CLIMATE SCENARIO NARRATIVES FOR THE FINANCIAL SERVICES SECTOR

Financial Services Council NZ

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FSC.

INTRODUCTION

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To care for our planet and our people, and to meet climate change goals, we must urgently address the climate agenda. The nation cannot do so without the full involvement of the financial sector. Every part of the economy has a role to play.

New Zealand's legislation and regulatory regimes are evolving to make sure that all industries are doing the right thing for the planet and our people. Over the last two years we've seen the passing of the Financial Sector (Climate-related Disclosures and Other Matters) Amendment Act 2021, the External Reporting Board developing standards and guidelines, Government emissions plans and significant international activity.

To help New Zealand's fund management, life insurance and health insurance sectors through this period of new regulation and reporting obligations, we engaged EY to assist with facilitating conversations and producing a report that can be used by organisations in their climate-related analysis and disclosure.

The report is designed to support the sector in the reporting of climate-related risks and opportunities under the framework developed by the External Reporting Board (XRB). It is the culmination of nine month's work by FSC members and others and reflects the passion of the industry to do the right thing and accelerate action to address the climate crisis.

We commend these common set of scenario narratives and approach, co-created with the aim to improve comparability and consistency of climate-related risk disclosures in the financial sector.

* Helen Clarkson, CEO of the Climate Group, which represents 260 regional governments and 500 multinational businesses, covering 1.75 billion people and 50% of the global economy.

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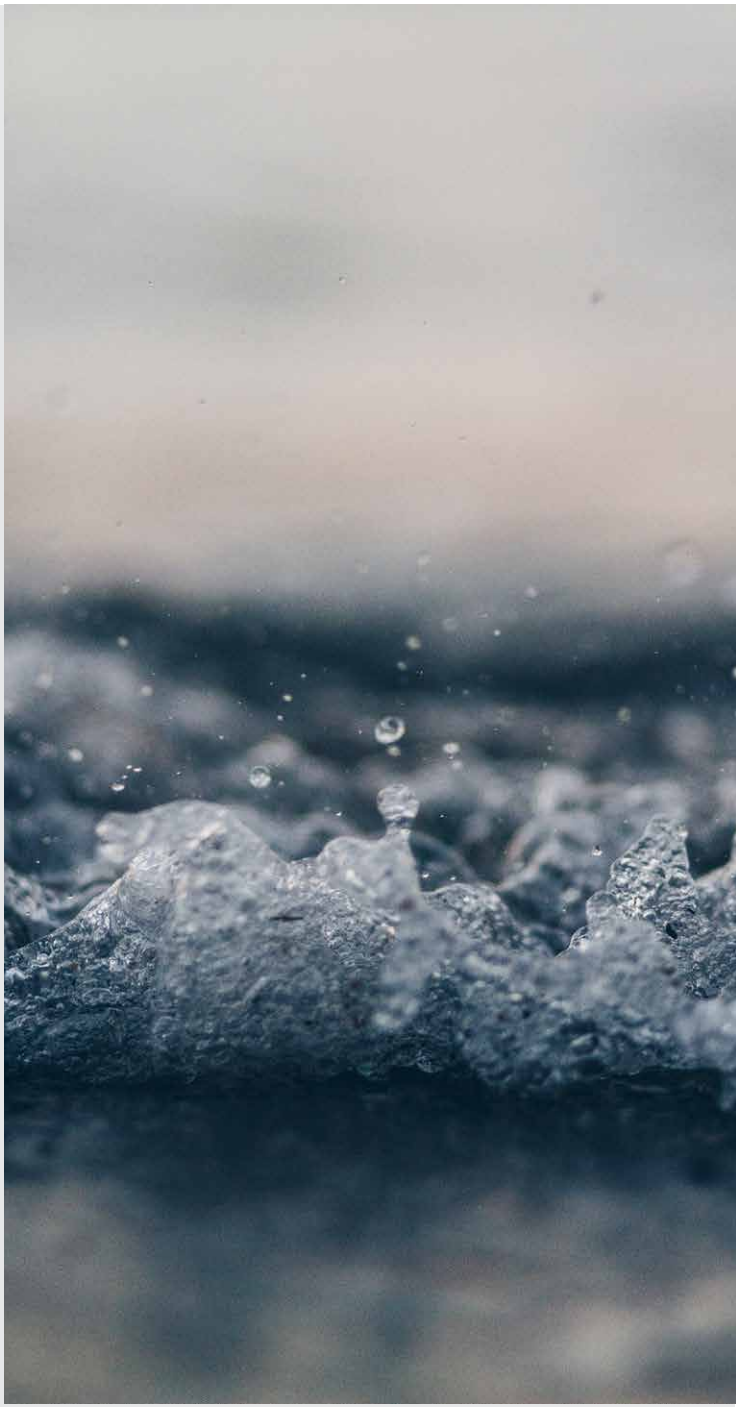
CONTENTS

ABBREVIATIONS

APS	Announced Pledges Scenario
BIG	Boutique Investment Group
CCC	Climate Change Commission
CDR	Carbon Dioxide Removal
CMIP	Coupled Model Intercomparison Project
ESG	Environment, Social, Governance
EU	European Union
EV	Electric Vehicle
FMA	Financial Markets Authority
FSC	Financial Services Council of New Zealand Incorporated
GDP	Gross Domestic Product
GHG	Greenhouse gas
GICS	Global Industry Classification Standard
IAMS	Integrated Assessment Models
IEA	International Energy Agency
IFA	Independent Financial Adviser
IPCC	Intergovernmental Panel on Climate Change
NDC	Nationally Determined Contributions
NGFS	Network for Greening the Financial System
NIWA	National Institute of Water and Atmospheric Research
NZ CSs	Aotearoa New Zealand Climate Standards
NZE	Net Zero Emissions
PED	Potential Evapotranspiration Deficit
RCP	Representative Concentration Pathway
SIDS	Small Island Developing States
SSP	Shared Socioeconomic Pathway
STEEP	Social, Technological, Economic, Environmental, and Political
STEPS	Stated Policies Scenario
TCFD	Taskforce on Climate-related Financial Disclosure
The Act	Financial Sector (Climate-related Disclosures and Other Matters) Amendment Act 2021
UK	United Kingdom
USA	United States of America
VaR	Value at risk
XRB	External Reporting Board



EXECUTIVE SUMMARY

PURPOSE OF THIS REPORT

This report is designed to support Financial Services Council ("FSC") and Boutique Investment Group ("BIG") members ("Users") for their reporting of climate-related risks and opportunities under the framework developed by the External Reporting Board ("XRB"). The XRB has developed the 'Aotearoa New Zealand Climate Standards' ("NZ CSs") in response to Parliament's decision in 2021 to pass the Financial Sector (Climate-related Disclosures and Other Matters) Amendment Act 2021 ("The Act"). Many fund managers, life insurers and health insurers are captured by the reporting mandate provided by The Act and will need to start publishing their disclosures over the next two years.

This report is aimed at supporting fund managers, life insurers and health insurers to better understand and assess climate-related risks and opportunities and understand the expectations of reporting against the Taskforce on Climate-related Financial Disclosure ("TCFD") recommendations and the NZ CSs. To support this, this report provides the following:

1. A common set of scenario narratives and horizons to be used in climate-related risk and opportunity assessments and disclosures
2. An approach to identify and assess portfolio-level climate-related risks, key product and operational climate-related risks for life and health insurers and high-level climate-related opportunities for life insurers, health insurers and fund managers.

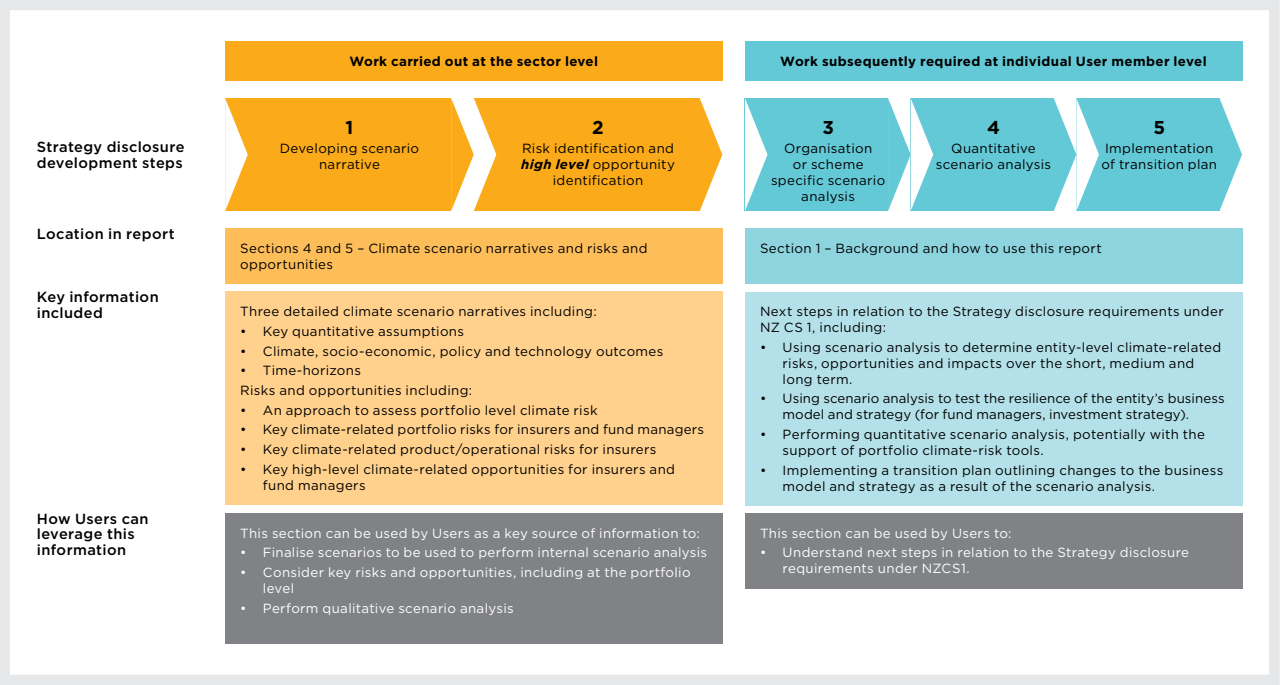


Figure 1: Key strategy disclosure development steps, and scope of sector collaboration for this report

These elements are designed to improve the comparability and consistency of climate-related risk disclosures in the life insurance, health insurance and fund management sectors.

Proposed next steps at the entity level are set out in Figure 1. The chevrons in orange represent the work that has been done collectively at the sector-level and the chevrons in blue represent the work that will need to be done by each individual organisation. The different ways Users can use the information contained in this report is highlighted in the blue boxes within Figure 1.

REPORT GUIDANCE

The key information in this report is presented in sections one to five and is supported by several appendices. Below is a summary of what each section of the report contains and how these can be used by insurers and fund managers as part of their scenario analysis process.

Section 1 – Background and how to use this report

Key information included in this section:

- Regulatory context that has led to the creation of this report
- Definition of scenario analysis and its importance
- Guidance on the integration of scenario analysis into the wider climate-related disclosure requirements

How insurers and fund managers could use this section:

- To provide context to internal stakeholders on the importance of climate-risk assessment and disclosures, and scenario analysis
- Additionally, this section could be used by Users to incorporate their scenario analysis activities into wider climate-related disclosure requirements

Section 2 – Methodology

Key information included in this section:

- Overview of process used to develop the scenario narratives, portfolio risk approach and high-level risks and opportunities

How insurers and fund managers could use this section:

- This section could be used by Users when describing the collaborative and iterative approach used in the creation of these scenario narratives, portfolio risk approach, and high-level risks and opportunities
- If the scenario narratives described in this report are used by a FSC or BIG member, this section can inform the methodology sections of their disclosures

Section 3 – Resources

Key information included in this section:

- Additional resources outside this report developed through the engagement process

How insurers and fund managers could use this section:

- As a key source of information for Users to perform their internal risk assessment and to support the record keeping requirements of the NZ CSs

Section 4 – Climate scenario narratives

Key information included in this section:

- Three detailed climate scenario narratives that follow the NZ CSs scenario requirements and consider the scenario analysis guidance set out in the XRB scenario analysis guidance. For each scenario narrative, this section provides:
  - Key quantitative assumptions that underpin the scenario narrative
  - Detailed narrative focusing on climate, socio-economic, policy and technology outcomes
- Time horizons to be used alongside the three scenario narratives to assess the variation in physical and transition risks

How insurers and fund managers could use this section:

- This section could be used as a source of information for Users to perform their internal scenario analysis, as detailed below:
  - Decide on key global and/or domestic scenarios and parameters to be used for each scenario narrative e.g., carbon price

Section 5 – Risks and opportunities

Key information included in this section:

- An approach to assess portfolio level climate-risk
  - Key climate-related portfolio risks for insurers and fund managers
  - Key climate-related product/operational risks for insurers
- Key high-level climate-related opportunities for insurers and fund managers

How insurers and fund managers could use this section:

This section could be used as a key source of information for Users to perform their internal risk assessment, as detailed below:

- Select the time horizons to be used to assess the entity's climate-related risks and opportunities
- Consider the key risks and high-level opportunities identified in their climate-related risks and opportunities assessment
- Determine their portfolio level risk

Appendices

Key information included in this section:

- Further detail on the scenario narratives
- A list of stakeholders engaged in developing the scenario narratives and risk database

How insurers and fund managers could use this section:

- This section could be used by entities to provide further context and data to their scenario analysis

PRESENTATION OF KEY ELEMENTS OF EACH SCENARIO NARRATIVE

In accordance with NZ CS 1, entities must describe the scenario analysis they have undertaken including a "description of how an entity has analysed, at a minimum, **a 1.5 degrees Celsius climate-related scenario, a 3 degrees Celsius or greater climate-related scenario, and a third climate related scenario"** (XRB, 2022a). The standard also specifies that entities "must include the **short-, medium-, and long-term time horizons** when describing its processes for identifying and assessing climate-related risks and opportunities, including specifying the duration of each of these time horizons." Three scenario narratives and three-time horizons were developed to meet the NZ CSs requirements and promote comparability of climate-related scenario analysis and risk disclosures across New Zealand's financial sector. Table 1 provides an overview of the datasets for each of the three scenario narratives selected by the Users. The categories for which datasets have been selected are those specified by the XRB in their document **Scenario analysis: Getting started at the sector level** (XRB, 2022b). Table 2 provides a summary of the time horizons chosen by the Users.

	SCENARIO DIMENSIONS		
CATEGORY[2]	**ORDERLY 1.5°C**	**TOO LITTLE TOO LATE >2°C**	**HOTHOUSE >3°C**
Global climate & socio-economic parameters	Intergovernmental Panel on Climate Change ("IPCC") Shared Socioeconomic Pathway ("SSP") 1-1.9	IPCC SSP2-4.5	IPCC SSP5-8.5
Global energy and emission pathway parameters	Network for Greening the Financial System ("NGFS") Net Zero 2050 International Energy Agency ("IEA") Net Zero Emissions by 2050 ("NZE")	NGFS Nationally Determined Contributions ("NDCs") IEA Announced Pledges Scenario ("APS")	NGFS Current Policies IEA Stated Policies Scenario ("STEPS")
New Zealand-specific climate parameters	National Institute of Water and Atmospheric Research ("NIWA") Representative Concentration Pathway ("RCP") 2.6	NIWA RCP4.5	NIWA RCP8.5
New Zealand-specific transition pathway parameters	Climate Change Commission ("CCC") 'Tailwinds'	CCC 'Headwinds'	CCC 'Current Policy Reference'
Rationale for selection	Most commonly used scenario by fund managers and insurers internationally. Aligned with scenarios already selected by FSC/ BIG members or their parent entities. Orderly was also selected for other NZ sectoral level climate scenario narratives. Meets XRBs requirement for a 1.5°C aligned scenario.	Although not a commonly used scenario by fund managers and insurers internationally, more realistic New Zealand scenario than the alternative, Disorderly scenario, with greater exposure to medium-high physical risk and transition risk. Third scenario selected for other NZ sectoral level climate scenario narratives and financial sector regulators.	Commonly used scenario by fund managers and insurers internationally. Aligned with scenarios already selected by FSC/ BIG members or their parent entities. Hothouse was also selected for other NZ sectoral level climate scenario narratives. Meets XRBs requirement for a >3°C aligned scenario.

Detailed information on these data sets can be found in Appendices A and B.

Table 1: Scenario dimensions and relevant international and domestic data sets selected by the Working Group in alignment with the XRB's guidance on sector-level scenario analysis (XRB, 2022b).

1 The categories selected are those specified by the XRB in their report **Scenario Analysis: Getting Started at the Sector Level.**

	SHORT TERM	MEDIUM TERM	LONG TERM
TIME HORIZON	**1-3 YEARS**	**5-10 YEARS**	**>30 YEARS**
YEAR RELATIVE TO 2022	**2025**	**2030**	**2050+**
Rationale for selection	Aligned with current regulator stress-testing time horizons and the timeframes over which the health insurance sector offers its products to customers.	Aligned with interim emissions reductions targets. Aligned with medium-term investment horizon such as those for individuals saving for marriage or KiwiSaver withdrawal for a first home. Will capture intermediary exposure to carbon price.	Aligned with international emissions reductions targets. Aligned with long-term investment horizons such as individuals saving for retirement or KiwiSaver withdrawal. Individual entities can extend time horizons if desired (likely physical impacts will increase in quantitative modelling over longer timeframes).

Table 2: Time horizons chosen by the Working Group

PRESENTATION OF KEY CLIMATE-RELATED RISKS AND OPPORTUNITIES AND AN APPROACH TO ASSESSING PORTFOLIO-LEVEL CLIMATE-RELATED RISKS*

Insurers and fund managers are exposed to climate-related risks and opportunities in two main ways – through their products and operations and through the portfolios of assets that they invest in. Generally, fund managers may be required by the NZ CSs to disclose in respect of the Registered Investment Scheme(s) under their management which meet the legislation's definition of 'Large', as opposed to disclosing the impacts of climate change on their own operations. Given this, key product and operational risks have only been identified for insurers through this work. Fund managers will generally not be required to disclose these risks, with the portfolio-level risk far exceeding the product or operational risk. An approach to enable members to identify climate-related risks at the portfolio level has been developed through this work and can be applied by both insurers and fund managers. Additionally, high-level opportunities have been identified for both insurers and fund-managers.

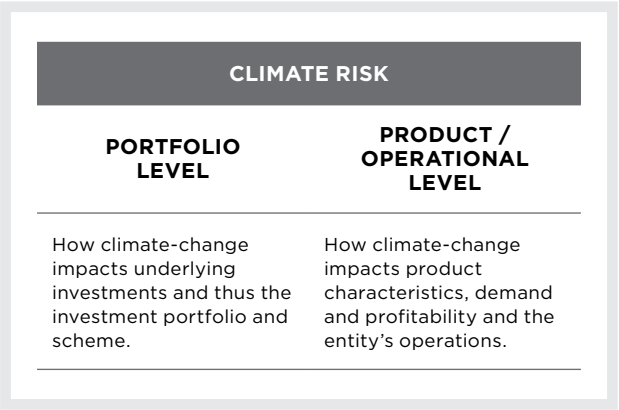


Figure 2: Insurer and fund manager climate-risk components

* This section, presentation of key climate-related risks and opportunities and an approach to assessing portfolio-level climate-related risks, does not constitute legal advice and you should not act upon any such information without seeking independent advice applicable to your organisation.

An approach to assess portfolio level climate risk

An approach was developed to enable Users to break their investment portfolios down into their component parts and therefore identify their portfolio-level climate-related risks. The disaggregation method determined three key attributes driving climate risk to the entities being invested in and therefore to the portfolio – sector, geography, and asset class. Key risks and their impacts were identified for each sector, geography, and asset class included in the analysis. Impacts to the portfolio as a result of these component parts were then identified. Figure 3 outlines the key climate-related risks, transmission channels and their impacts on the portfolio.

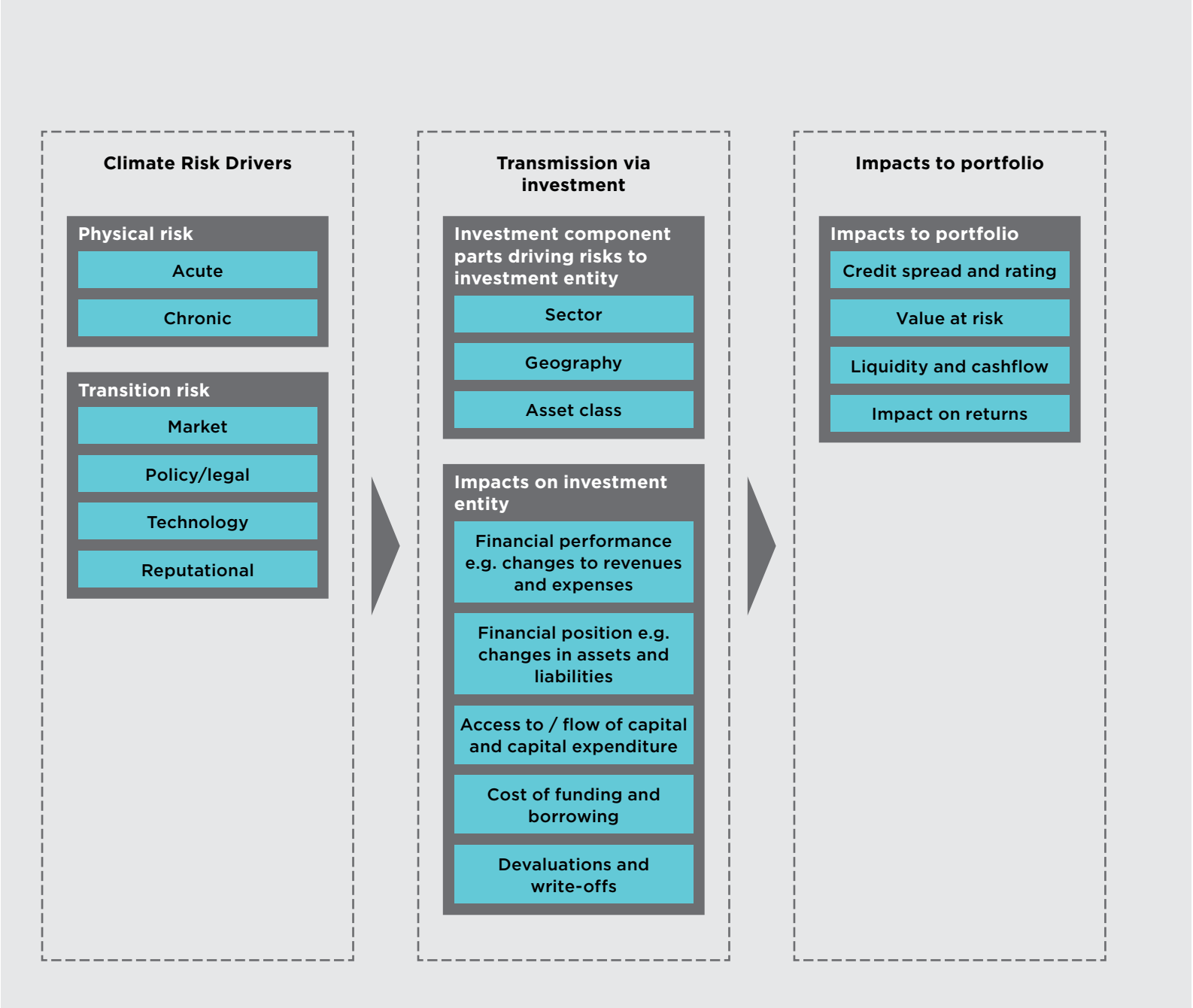


Figure 3: Key climate-related risks, transmission channels and their impacts on the portfolio

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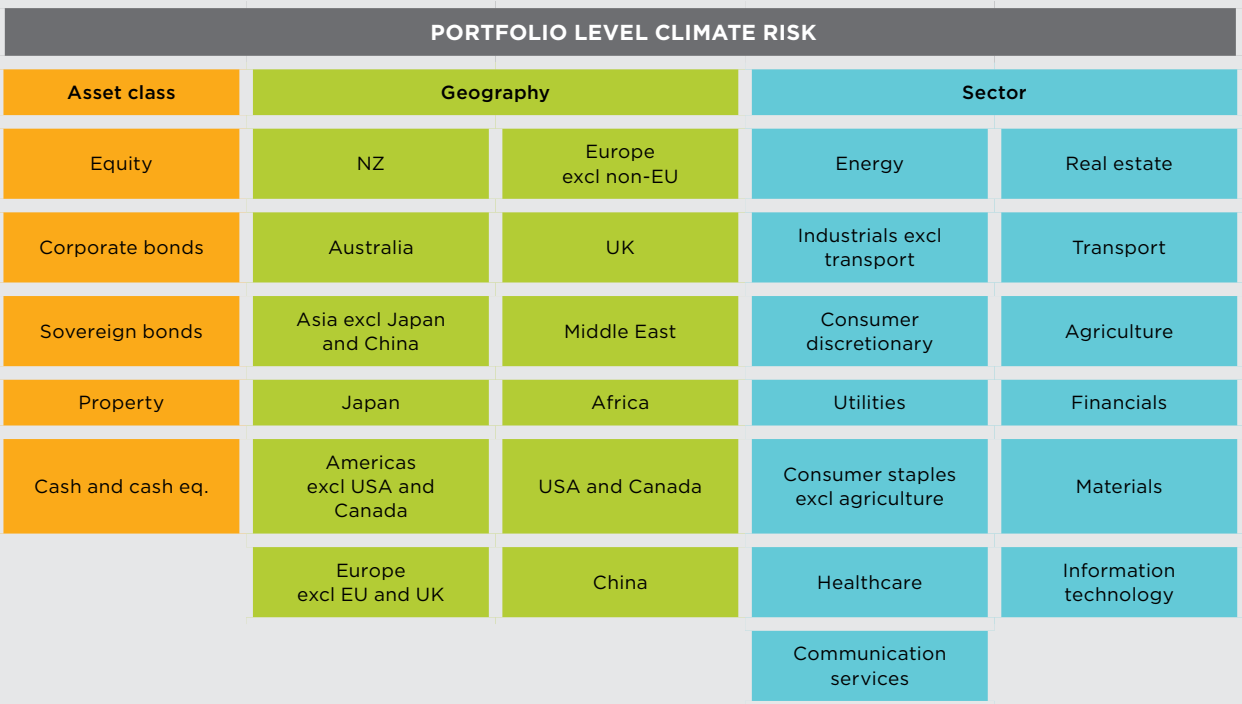


Figure 4: Portfolio-level climate risk attributes

Figure 4 provides a summary of the disaggregation method and the sectors, geographies and asset classes included.

To determine key portfolio-level climate risks, fund manager/insurer could first determine their key investment geographies, sectors, and asset classes. The impacts these will have at the portfolio-level to the fund manager / insurer can then be identified using the tables in the Climate-related risk database.

Key climate-related portfolio risks for insurers and fund managers

As per Figure 3, climate change will impact entity's which insurers and fund managers are invested in, for example, by decreasing their revenues, increasing their expenses, and decreasing the value of assets that they hold. This will impact insurers and fund managers portfolios – increasing credit spread, decreasing credit quality, increasing value at risk ("VaR"), reducing liquidity and cashflow and impacting on returns. These risks can be found in Section 5 – Risks and Opportunities.

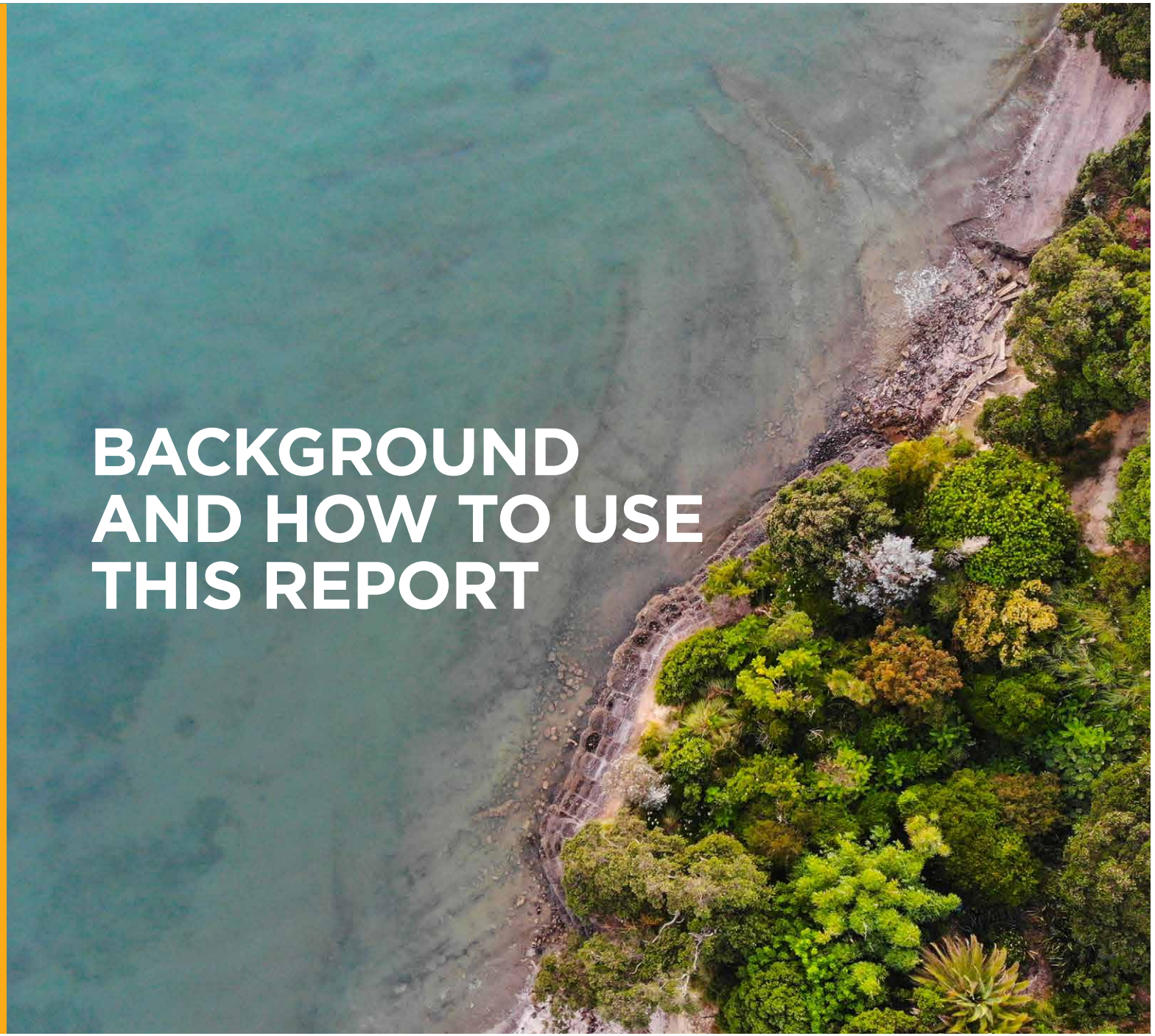
Key climate-related product/operational risks for insurers

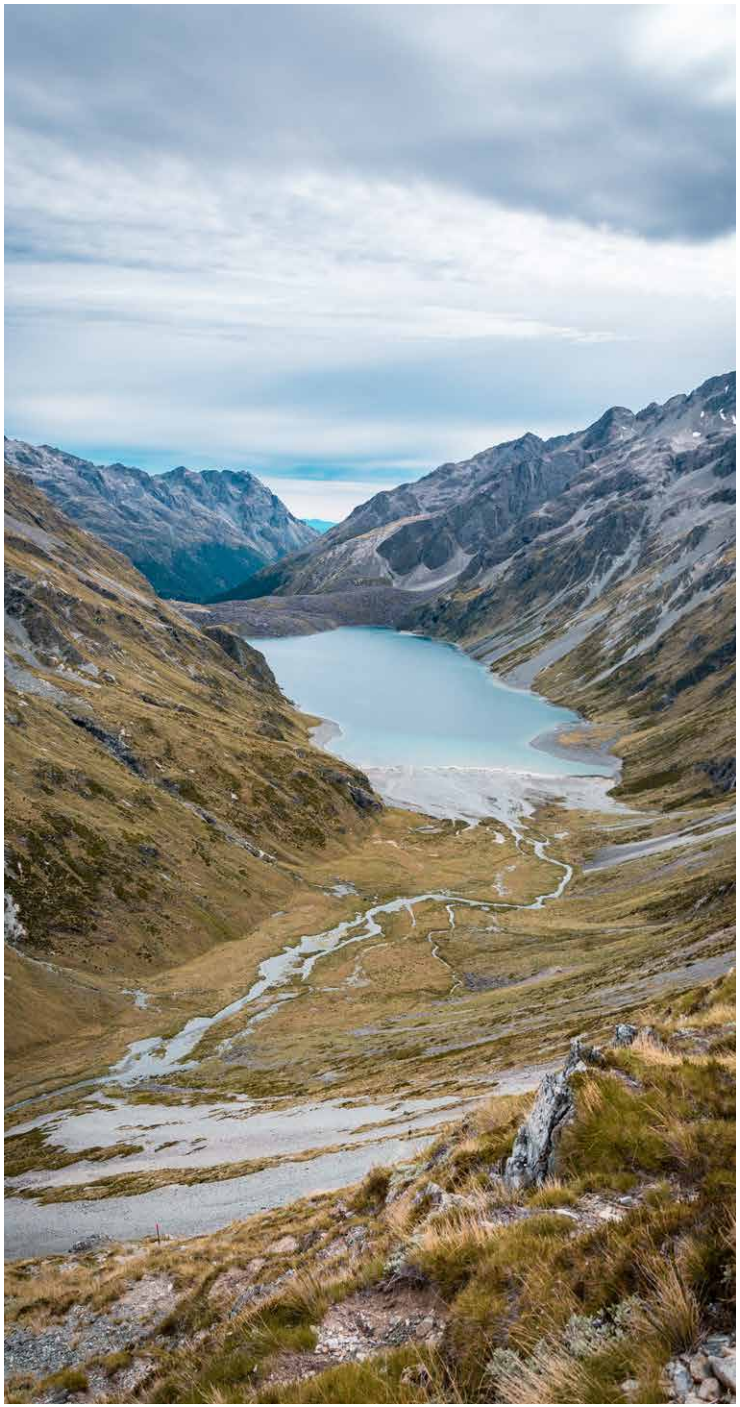
Life and health insurers are exposed to climate-risk through their products – for example climate-change impacts morbidity and mortality rates and therefore claim distribution, frequency, and value. We expect life and health insurers to experience potential increases in lapses and a reduced number of new customers. A list of the key risks identified through this work can be found in Section 5 – Risks and Opportunities.

Key high-level opportunities for insurers and fund managers

For insurers and fund managers that move quickly to understand potential impacts of climate change, there are climate-related opportunities. More detail on these opportunities can be found in Section 5 – Risks and Opportunities.

BACKGROUND AND HOW TO USE THIS REPORT





1.1 BACKGROUND

Published in 2017, the recommendations of the TCFD aimed to provide a common framework for entities to disclose how climate-related risks and opportunities are treated and assessed (TCFD, 2022a). In 2021, New Zealand passed The Act, becoming one of the first countries in the world to introduce mandatory climate-related risk disclosures for large financial organisations and large listed equity and debt issuers (New Zealand Government, 2021). The NZ CSs, developed by the XRB, are based on the TCFD recommendations, and provide a standard for which entities should be reporting these risks. Scenario analysis is included in both the TCFD recommendations and the NZ CSs as a means for entities to consider and better understand how they might perform under different climate future states. In June 2022, the XRB issued guidance for developing sectoral scenarios with the aim of improving comparability of climate-risk disclosures between entities in the same sector.

This report provides sector-specific climate scenario narratives and time horizons for the life insurance, health insurance and fund management sectors. It also identifies high-level climate-related risks and opportunities for the life insurance, health insurance and fund management sectors, to increase the understanding of physical and transition impacts that may materialise over time.

1.2 WHAT IS A CLIMATE SCENARIO?

The impacts of climate change are systemic, affecting not only climate outcomes, but social, economic, technological, and policy outcomes. These outcomes have complex relationships that will change depending on the level of action towards combatting climate change that is achieved.

Scenarios divert from the task of predicting the most likely future, and instead focus on creating hypothetical future climate states to allow entities to better understand potential climate-related impacts that might occur. Scenarios consist of assumptions which must have the following characteristics, as defined by the TCFD (TCFD, 2017):

- Be plausible (the events in the scenario should be possible and the narrative credible)
- Be distinctive (each scenario should focus on a different combination of the key factors)
- Be consistent (each scenario should have strong internal logic)
- Be relevant (each scenario, and the set of scenarios taken as a whole, should contribute specific insights into the future that relate to strategic and/or financial implications of climate-related risks and opportunities)
- Be challenging (scenarios should challenge conventional wisdom and simplistic assumptions about the future)

1.3 WHAT IS SCENARIO ANALYSIS AND HOW CAN THIS REPORT BE USED TO SUPPORT ENTITIES IN MEETING THEIR REQUIREMENTS UNDER THE STANDARDS?

The XRB (XRB, 2022e) defines scenario analysis as a process for systematically exploring the effects of a range of plausible future events under conditions of uncertainty. Engaging in climate scenario analysis will help an entity to better understand how climate-related risks and opportunities may impact their strategy over time.

NZ CS 1 (Paragraph 13) requires entities to describe the scenario analysis it has undertaken to help identify its climate-related risks and opportunities and better understand the resilience of its business model and strategy. Entities are required to analyse at a minimum, a 1.5°C scenario, a 3°C or greater scenario and a third climate-related scenario.

NZ CS 3 (Paragraph 51) describes in detail what is expected by an entity when disclosing the scenario analysis it has performed. The requirements and how the report addresses these are outlined in Table 3. We note that the requirements per Paragraph 51 b) relate to organisation or scheme specific scenario analysis and as such the report does not address these.

NZ CS 3 DISCLOSURE REQUIREMENT			HOW THIS REPORT ADDRESSES THE REQUIREMENT
a)	**An entity must disclose the climate-related scenarios it has used, including:**	i. A brief description of each scenario narrative	Brief descriptions of the relevant narratives can be found in the following sections: • **Orderly**: Section 4.1.1 • **Too Little Too Late**: Section 4.2.1 • **Hothouse**: Section 4.3.1
		ii. The time-horizons considered, including endpoints and whether the endpoints are determined by a year or a temperature target	Time-horizons including end points can be found in Table 2 (Executive Summary)
		iii. A description of the various emissions reduction pathways in each scenario and the assumptions underlying pathway development over time, including the scope of operations covered, policy and socioeconomic assumptions, macroeconomic trends, energy pathways, carbon sequestration from afforestation and nature-based solutions and technology assumptions including negative emissions technology	Emissions reduction pathways and assumptions underlying pathway development are outlined in the following Drivers of Change sections: • **Orderly**: Section 4.1.3 • **Too Little Too Late**: Section 4.2.3 • **Hothouse**: Section 4.3.3 The scope of operations covered will need to be addressed at the entity level
		iv. An explanation of why the entity believes the chosen scenarios are relevant and appropriate to assessing the resilience of the entity's business model and strategy to climate-related risks and opportunities	Rationale for selection of scenarios can be found in Table 1 (Executive Summary) and Table 4 (Body of the Report). This explains why at a sector level these scenarios have been selected. However, it does not address on an entity level why the chosen scenarios are appropriate to assessing the resilience of the entity's business model and strategy to climate-related risks and opportunities
		v. The sources of data used to construct each scenario	Data sources for the relevant scenarios can be found in the following sections: • **Orderly**: Section 4.1.2 • **Too Little Too Late**: Section 4.2.2 • **Hothouse**: Section 4.3.2
b)	**An entity must disclose how the scenario analysis process has been conducted, including:**	i. Whether scenario analysis is a standalone analysis or integrated within the entity's strategy processes	This needs to be determined at the entity level
		ii. The governance process used to oversee and manage the scenario analysis process, including the role of the governance body and management	This needs to be determined at the entity level
		iii. If modelling has been undertaken, a clear description of what modelling was undertaken and why the model was chosen as the appropriate model	Quantitative scenario analysis was not performed through this work
		iv. Which external partners and stakeholders are involved	This needs to be determined at the entity level

Table 3: NZ CS 3 disclosure requirements and how this report can support entities

1.4 NEXT STEPS

The scenarios described in Section 4 provide a consistent framework for insurers and fund managers to use as they progress in their assessment of the potential business implications of climate-related risks and opportunities. Climate scenario analysis considers plausible climate trajectories, acknowledging that there is uncertainty in future climate outcomes to allow entities to better understand potential climate-related risks and opportunities that might occur. Steps outlined in Figure 5 summarise the key next steps which insurers and fund managers would need to take to better understand their climate risks and opportunities and the impacts of these on their business model and strategy (among other things):

- **Organisation or scheme specific scenario analysis:** Using the scenarios developed through this work (with any further changes to adapt to entity level as deemed necessary), entities could determine their climate-related risks, opportunities and impacts over the short, medium, and long term and test the resilience of their business and investment strategy through a process of internal scenario analysis. This is likely to be qualitative in nature initially but could be expanded upon to be quantitative in future years.
- **Quantitative scenario analysis:** Where significant risks or opportunities are identified, further analysis to determine the financial impact (quantitative scenario analysis) may be required. Portfolio climate-risk tools could be used to support this work.
- **Implementation of transition plan:** The next step in this process is for fund managers and insurers to consider, develop and disclose a transition plan outlining any changes to the business model and strategy (among other things) as a result of learnings from the scenario analysis.

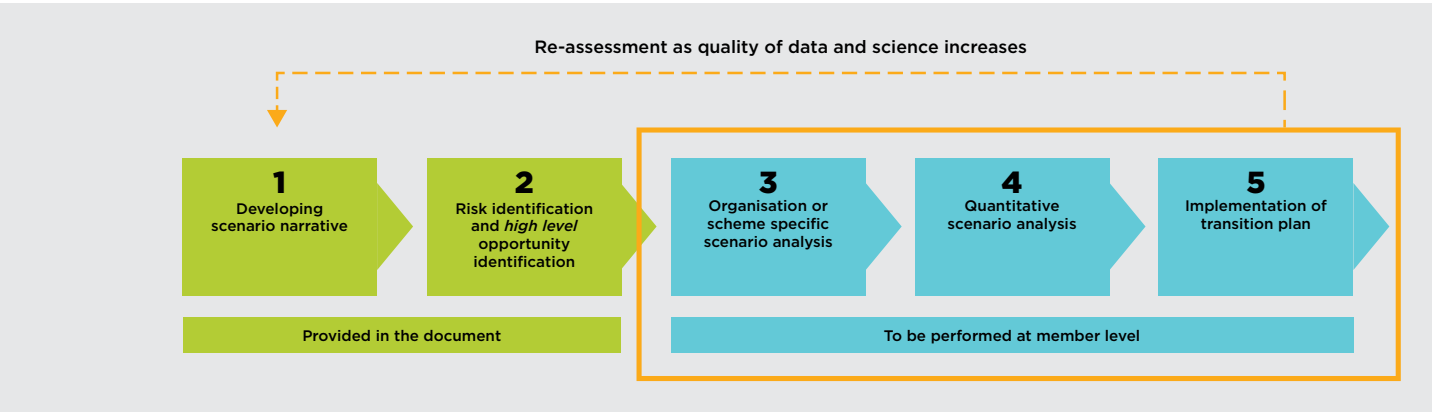
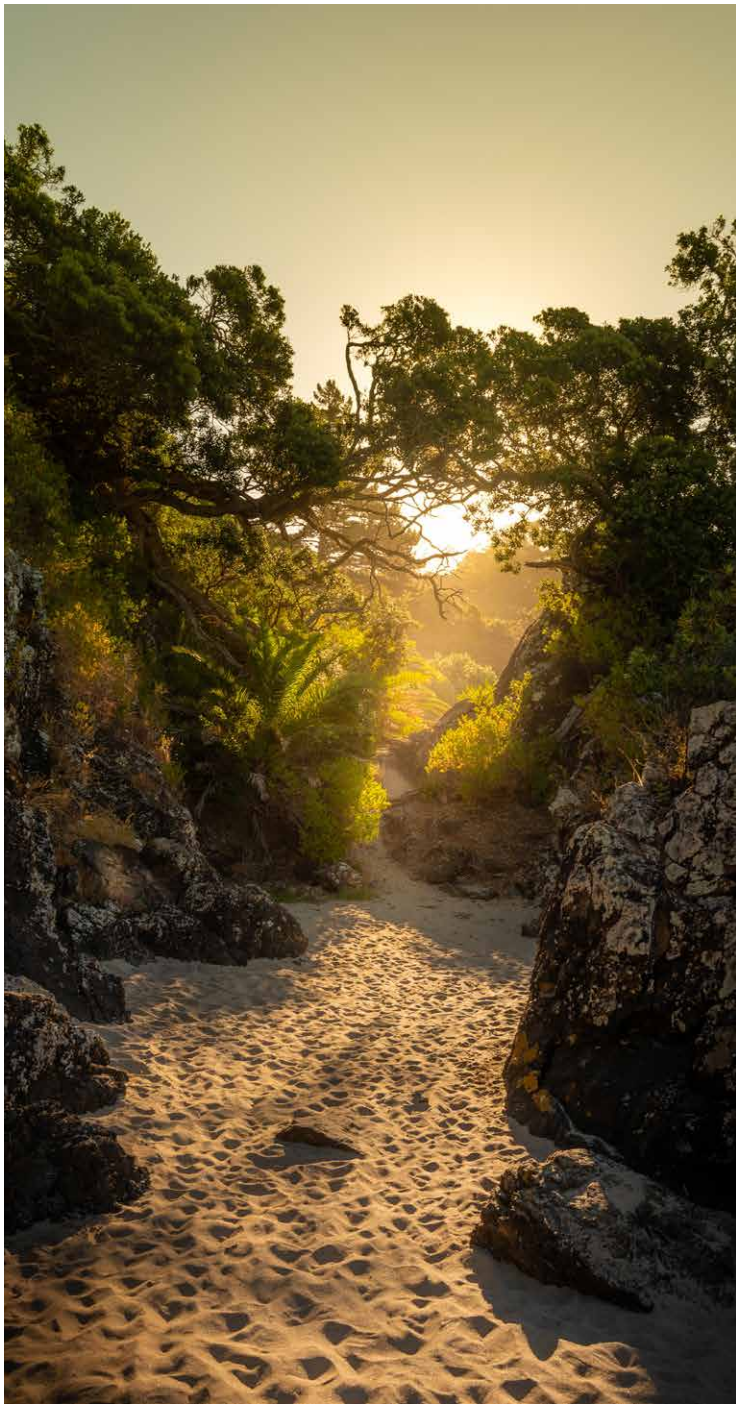


Figure 5: Key steps for strategy disclosure development, and scope of the sector work for the life insurance, health insurance and fund management sectors



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METHODOLOGY

METHODOLOGY

Figure 6 provides an overview of the timeline and key steps taken to develop the scenario narratives and determine high-level risks for the fund managers and insurers.

The following sections detail the approach adopted in developing scenario narratives, identifying high-level climate-related risks and opportunities and an approach to portfolio risks to life insurance, health insurance and fund management sectors.

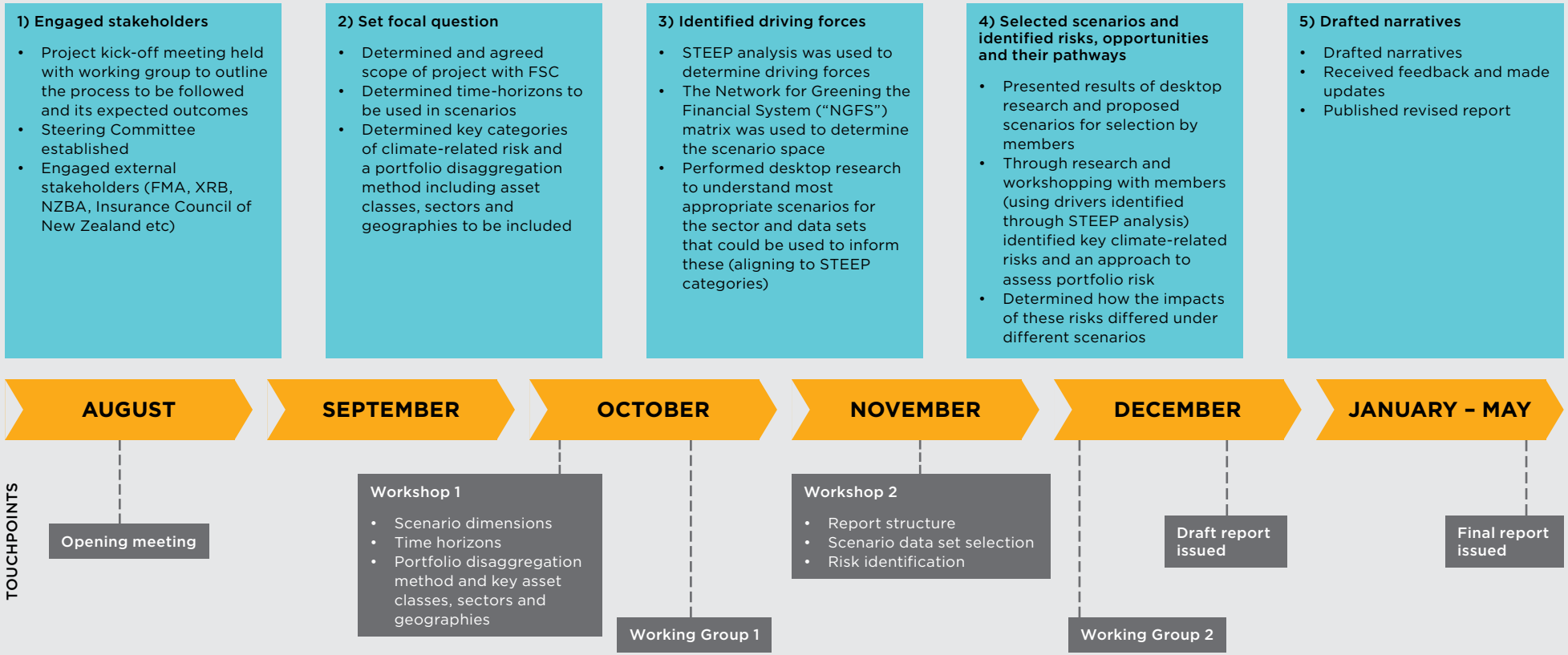


Figure 6: Timeline and key steps for development of scenario narratives, risks and opportunities for life insurance, health insurance and fund management sectors

2.1 DEVELOPMENT OF SCENARIO NARRATIVES AND DETERMINATION OF KEY CLIMATE-RELATED RISKS AND OPPORTUNITIES

An overview of the development process for the scenario narratives is set out below. Where possible, the XRB's sector scenario analysis guidance was followed.

1. Stakeholder engagement

- A project kick-off meeting was held with Users to outline the process to be followed through this engagement and its expected outcomes.
- The working method and governance structures were established as outlined below:
  - **Workshops** – Workshops were used to introduce topics, present results of desktop research and discuss options going forward. All Users were invited to attend these sessions.
  - **Working Groups** – Working Groups were used to gain consensus on key decisions. Discussions in the Workshops were used to inform further work and enable development of proposed approaches that were put to the group for voting. Decisions were ratified by the Chairs of FSC's Climate and Environmental, Social Governance ("ESG") Committee. As with the workshops, all Users were invited to attend these sessions and applicable regulators and industry group guests were invited to attend the beginning of these sessions.
  - **Steering Committee** – The Steering Committee was formed to determine the direction of the project and track project timelines, delivery outputs and stakeholder satisfaction. Steering Committee members were a subset of Working Group members, and included the Chairs of the FSC Climate and ESG Committee.
- External stakeholders (FMA, XRB, NZBA, Insurance Council of New Zealand etc) were engaged throughout the project.

A full list of stakeholders involved in this project can be found in Appendix C. Chatham House Rules and the Commerce Commission's anti-competitive behaviour rules were followed at all workshops, working groups and steering committee meetings.

2. Set focal question

- Determined and agreed the scope of the project with FSC and communicated this to the Working Group.
- Determined time-horizons to be used in scenarios by:
  - Performing desktop research to determine most appropriate time-horizons for the sector.
  - Presenting results of research and proposed time-horizons to the Working Group for selection.
- Determined key categories of climate-related risk and a portfolio disaggregation method including asset classes, sectors, and geographies to guide scenario development.

3. Identified driving forces

- STEEP analysis was used to determine driving forces under each of the following headings: Social, Technological, Environmental, Economic and Policy.
- The NGFS matrix was used to determine the scenario space.
- Desktop research was then undertaken to understand the most appropriate scenarios for the sector and data sets that could be used to inform these (aligning to STEEP categories).

4. Selected scenarios and identified risks, opportunities, and their pathways

- The results of desktop research and proposed scenarios were presented to the Working Group.
- Through research and workshops with members (using drivers identified through STEEP analysis), key climate-related risks and opportunities were identified along with an approach to assess portfolio risk.
- Impacts of these risks under different scenarios were then determined using driving forces identified.

5. Drafted narratives, quality check and review

- Drafted climate scenario narratives.
- Received feedback from stakeholder and made updates.
- Published revised report.

2.2 KEY LIMITATIONS

- **Volume of stakeholder engagement:** This project relied on the voluntary contribution of Users and other stakeholders. Opportunity was given to members throughout the project to input into the process and investment management and life and health insurer expertise was sought to assess whether the identified impacts where appropriate at the sectoral level. With more time and resource, additional stakeholder engagement could be conducted by individual insurers and fund managers to confirm the appropriateness

of the scenarios and climate-related risks and opportunities identified in this report.

- **Variances between global and domestic climate outcomes for similar scenario narratives:** This project maps out different global and domestic climate, socio-economic, policy and technology outcomes for each scenario narrative. An inherent limitation of this work exists as there are variances between global and domestic modelling approaches used to calculate the scenario parameters. There are also variances in the way New Zealand is predicted to react to climate change versus the rest of the world. This outcome is largely unavoidable when incorporating several independent scenarios together. In these situations, insurers and fund managers can consider which of these independent scenarios and assumptions are most relevant for their purpose and provide a rationale for this.
- **Variances between global and domestic maturity and data availability:** This project maps out different global and domestic climate, socio-economic, policy and technology outcomes for each scenario narrative. An inherent limitation of this is the relative immaturity of climate-related reporting in New Zealand and the lack of data available for New Zealand sustainability benchmarking.
- **Use of publicly available data:** The nature and content of any information provided in this report is limited by the scope and limitations of the source scenarios used to inform the scenario narratives. The data provided in this report has been inputted directly from the source scenarios and has not been re-developed in any way for fund managers and insurers.
- **Cause and effect analysis:** Given the large number of fund managers and insurers in New Zealand and how diverse these entities are, especially with respect to what they invest in, not all risks as a result of identified drivers of change have been explored in the scenarios developed as this would have made the scenarios extremely long, difficult to follow and therefore of limited use. Fund managers and insurers will be required to undertake scenario analysis at the entity or scheme level and through this process can further develop risks that are most relevant to their entities/schemes.
- **Considerations of the financial impact of physical climate impacts on gross domestic product ("GDP") figures:** At a high level, the impact of climate change on GDP under a hot house scenario is likely to generate a significant contraction in global GDP growth potential, particularly in the latter half of the century. Conversely, the curbing of emissions under an Orderly scenario has the potential to positively impact GDP figures going forward. Quantifying the impact of physical climate risk is a complex process, and figures declared to capture this should be used with the acceptance that a degree of uncertainty is unavoidably embedded within the produced values. Nonetheless, values attempting to partially capture physical risk have been produced by the NGFS and are used throughout this report to provide an indication of the impact of physical risk on GDP. Noting, only chronic risk is accounted for in this calculation, with the exclusion of impacts materialising from extreme weather events regarded as acute physical risk.
- **Uncertainties related to climate risk drivers:** The speed in which climate-related impacts are evolving are unprecedented and little reliance can be placed on historical experience to assess both magnitude and patterns. This gives rise to a higher level of uncertainty for fund managers and insurers when assessing the magnitude and timing of climate risk drivers. These drivers are also subject to tipping points that exacerbate uncertainty, particularly given geographic diversity of physical and transition impacts across New Zealand and the rest of the world.
- **Climate opportunities:** As agreed with the Steering Committee, climate opportunities are considered at a high-level due to scope and time constraints. More detailed opportunities can be provided at the entity level or in any updated version of this document.
- **Climate risks:** Risks have been identified in this report, but the significance of these risks have not been assessed given entities will be affected by these risks to different degrees depending on their portfolios and operations. One of the key next steps is for entities to consider how climate risks will impact their organisation, including consideration of portfolio and operational structure and product offering. High level risks have been identified in this report but time horizons have not been assigned to specific risks. When using this report, entities will need to consider how they assess identified risks in relation to their organisation, including consideration of time horizons.

3

RESOURCES

RESOURCES

Additional resources outside this report were developed to support fund managers and insurers to understand and report on their climate-related risks and opportunities in compliance with the NZ CSs. These include:

- **A Climate-related risk database:** This database outlines:
  - Product and operational climate-related risks and impacts for insurers.
  - High-level climate-related opportunities and impacts for insurers and fund managers.
  - Sector level climate-related risks for entities invested in.
  - Geography level climate-related risks for entities invested in.
  - Asset class impact resulting from investment entity climate-related risks.

This could be accessed by Users to inform their determination of climate related risks and opportunities over different time-horizons and the impacts, both current and anticipated, of these.

- **Record keeping:** Section 461V, Part 7A of the Financial Markets Conduct Act 2013 requires that every climate reporting entity under the legislation ensure that there are records that will support the climate reporting entity compliance with the climate-related disclosure framework. To support entities with their obligations, the FSC retains copies of all workshop packs, Steering Group minutes and Working Group minutes. Packs and minutes are only available to workshop and meeting attendees, in line with the FSC's confidentiality policy.

CLIMATE SCENARIO NARRATIVES

CLIMATE SCENARIO NARRATIVES

In accordance with NZ CS 1, entities must describe the scenario analysis they have undertaken including a "description of how an entity has analysed, at a minimum, **a 1.5 degrees Celsius climate-related scenario, a 3 degrees Celsius or greater climate-related scenario, and a third climate related scenario**." (XRB, 2022a). The standard also specifies that entities "must include the **short-, medium-, and long-term time horizons** when describing its processes for identifying and assessing climate-related risk, including specifying the duration of each of these time horizons." Three scenario narratives and three-time horizons were developed to meet requirements under the NZ CSs and promote alignment of climate-related scenario analysis and risk disclosures across New Zealand's financial sector. This section describes these.

Table 4 provides an overview of the datasets for each of the three scenario narratives selected by fund managers and insurers. The categories for which datasets have been selected are those specified by the XRB in their document **Scenario analysis: Getting started at the sector level** (XRB, 2022b). Detailed information on these datasets can be found in Appendices A and B.

Table 5 provides a summary of the time horizons selected by fund managers and insurers.

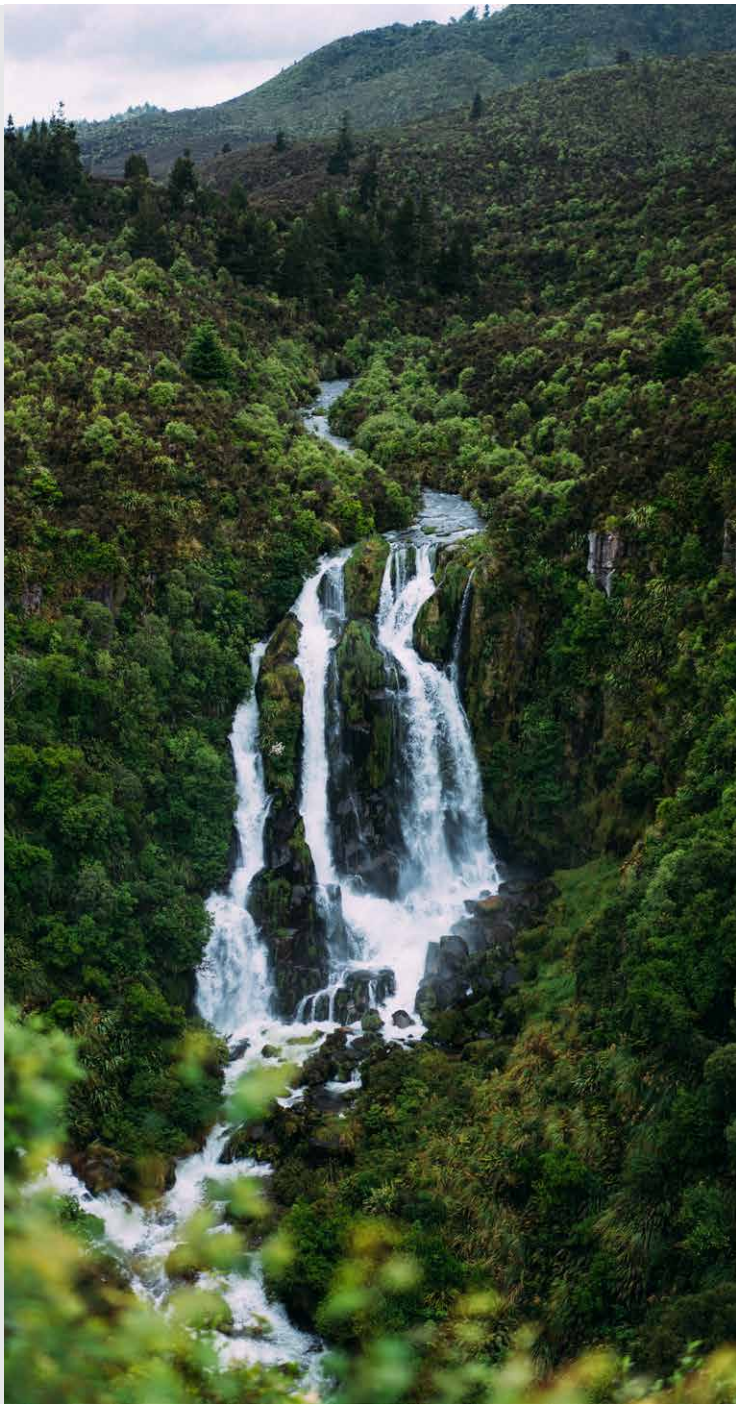
We note that scenarios are plausible, challenging descriptions of how the future **may** develop and as such, although definitive language has been used the scenarios are not predictive and should not be taken as such.

	SCENARIO DIMENSIONS		
CATEGORY	**ORDERLY 1.5°C**	**TOO LITTLE TOO LATE >2°C**	**HOTHOUSE >3°C**
Global climate & socio-economic parameters	IPCC SSP1-1.9	IPCC SSP2-4.5	IPCC SSP5-8.5
Global energy and emission pathway parameters	NGFS Net Zero 2050 IEA Net Zero Emissions by 2050	NGFS NDCs IEA APS	NGFS Current Policies IEA STEPS
New Zealand-specific climate parameters	NIWA RCP2.6	NIWA RCP4.5	NIWA RCP8.5
New Zealand-specific transition pathway parameters	CCC 'Tailwinds'	CCC 'Headwinds'	CCC 'Current Policy Reference'
Rationale for selection	Most commonly used scenario by fund managers and insurers internationally. Aligned with scenarios already selected by FSC/ BIG members or their parent entities. Orderly was also selected by the banking sector. Meets XRBs requirement for a 1.5°C aligned scenario.	Although not a commonly used scenario by fund managers and insurers internationally, more realistic New Zealand scenario than the alternative, Disorderly scenario with greater exposure to medium physical risk and transition risk. Third scenario selected by the banking sector and financial sector regulators.	Commonly used scenario by fund managers and insurers internationally. Aligned with scenarios already selected by FSC/ BIG members or their parent entities. Hothouse was also selected by the banking sector. Meets XRBs requirement for a >3°C aligned scenario.

Table 4: Scenario dimensions and relevant international and domestic data sets selected by the Working Group in alignment with the XRB's guidance on sector-level scenario analysis (XRB, 2022b)

	SHORT TERM	MEDIUM TERM	LONG TERM
TIME HORIZON	**1-3 YEARS**	**5-10 YEARS**	**>30 YEARS**
YEAR RELATIVE TO 2022	**2025**	**2030**	**2050+**
Rationale for selection	Aligned with current regulator stress-testing time horizons and the timeframes over which the health insurance sector offers its products to customers.	Aligned with interim emissions reductions targets. Aligned with medium-term investment horizon such as those for individuals saving for marriage or KiwiSaver withdrawal for a first home. Will capture intermediary exposure to carbon price.	Aligned with international emissions reductions targets. Aligned with long-term investment horizons such as individuals saving for retirement or KiwiSaver withdrawal. Individual entities can extend time horizons if desired (likely more impactful in quantitative modelling).

Table 5: Time horizons chosen by the Working Group



4.1 ORDERLY

4.1.1 Overview of scenario dimension

The Orderly scenario represents collective action towards a low carbon global economy. In this scenario, there are steady and constant societal changes related to technology, policy, and behaviour to support the transition to a lower emissions economy. This is matched by an increasing carbon price that reinforces low carbon behaviour change. The coordinated and timely action around the world to curb greenhouse gases prevents the worst predicted impacts of climate change, however, the long-term chronic impacts from historic greenhouse gas ("GHG") emissions still occur, although not severely. Overall, based on the literature review and stakeholder engagement, this scenario represents a medium level of transition risk and a low level of physical risk relative to the other scenarios. Table 6 provides key assumptions under the Orderly scenario.

ENVIRONMENTAL OUTCOMES	EMISSION PATHWAYS
Average temperature increase • Domestic: +0.7°C by 2100 (min 0.4, max 1.3) (NIWA) • Global: +1.4°C (min 1.0, max 1.8) by 2100 (SSP)	Net Emissions • Domestic: 47 $MtCO_2e$ by 2030, 3.8$MtCO_2e$ by 2050 (CCC) • Global: NGFS Net Zero by 2050 25.9 $BtCO_2e$ by 2030, -294.82 $MtCO_2e$ by 2050 using GCAM5.3+ (NGFS)[4]
ECONOMIC OUTCOMES	**SOCIAL OUTCOMES**
GDP (GDP % change due to chronic physical risk, acute impacts are excluded from this figure and would further negatively impact GDP) • Global: US$ 176 trillion (-1.2%) in 2030, US$ 289 trillion (2.0%) in 2050[5] (NGFS) • NZ: NZ$ 330 billion (-0.5%) in 2030, NZ$ 485 billion (-0.7%) in 2050[6] (NGFS)	Population • Global: 8 billion by 2030, 8.5 billion by 2050 (IPCC)
POLICY OUTCOMES	**TECHNOLOGY OUTCOMES**
Carbon Price • Domestic ETS: NZ$140 in 2030, NZ $250 in 2050 (CCC) • Global: US$124 in 2030, US$400 in 2050 (NGFS)	Percent of Renewable Electricity of Total Electricity Produced • Domestic: 94% by 2030, 100% by 2050 (CCC) • Global: 61% by 2030, 88% by 2050 (IEA) Percent of Renewable Energy of Total Energy Produced • Domestic: 55% by 2030, 90% by 2050 (CCC) • Global: 30% by 2030, 67% by 2050 (IEA)

Table 6: Scenario parameters under an Orderly scenario[3]

2 Refer to Appendix B for source data for these assumptions
3 NGFS has three different global projections available, with all having validity and robustness, GCAM5.3+ was selected for consistency. For information on differences, please see NGFS FAQ
4 Provided in % difference, **2017** PPP, US$
5 Provided in % difference, **2009** prices; NZ$

4.1.2 Datasets aligned with scenario dimension

Scenario narratives aligned with an Orderly transition are summarised in Table 7 below.

	SCENARIO	DESCRIPTION
ORDERLY	IPCC SSP1-1.9	SSP1 is the sustainability path scenario and represents the world shifting gradually, but persuasively, towards a more sustainable future, emphasising more inclusive development that respects perceived environmental boundaries. Increasing evidence of, and accounting for, the social, cultural, and economic costs of environmental degradation and inequality drive this shift. Emissions in this scenario decline rapidly achieving net zero by 2050 and limiting global warming to 1.5°C. The second half of the century is characterised by net negative CO_2e emissions, implying the use of carbon dioxide removals ("CDR").
	NGFS Net Zero 2050	Net Zero 2050 limits global warming to 1.5°C through stringent climate policies and innovation, reaching global net zero CO_2 emissions around 2050. This requires strong climate policy, technology advances and behavioural change. While CDR is used to accelerate even further decarbonisation, its use is minimised wherever possible.
	IEA NZE	NZE sets out a narrow but achievable pathway for the global energy sector to achieve net zero CO_2 emissions by 2050. It does not rely on emissions reductions from outside the energy sector to achieve its goals. This scenario relies heavily on solar and wind generation and less on carbon capture, utilisation and storage and requires strong behavioural change (uptake of lower emission technology) across all industries.
	NIWA RCP2.6	The NIWA scenarios leverage the IPCC's RCP modelling of varying levels of GHG concentrations on the earth's climate system. NIWA downscales the global models to study how these different atmospheric concentrations of GHGs might influence the New Zealand climate. As with RCP 2.6, NIWA RCP2.6 represents a world where carbon dioxide (CO_2e) emissions start declining in the 2020s and go to zero by 2100. Average temperature increases under the NIWA scenarios are relative to a 1986-2005 baseline, which differs from the IPCC baseline of 1850-1900. As such, the stated warming at various future points in time is lower in NIWA's scenarios than in the IPCC scenarios.
	CCC Tailwinds	The tailwinds scenario combines further technology and further behaviour change assumptions to provide a potential upper boundary for how far and how quickly emissions could be reduced based on current evidence and judgements. This scenario assumes both strong behaviour and technology change across all sectors.

Table 7: Overview of the Orderly scenario narratives

FSC.

4.1.3 Drivers of change

Emissions pathway

Globally, the Orderly scenario shows a steady steep decline in global emissions, as seen in the figure below. Overall, emissions reduce at an average of 3.4% per annum, with a 101% reduction in net emissions in 2050 compared to 2020 (NGFS, 2023). This reduction leads to net emissions being less than zero in 2050 (NGFS, 2023), as indicated by the emission pathway intersecting the x axis in the figure below.

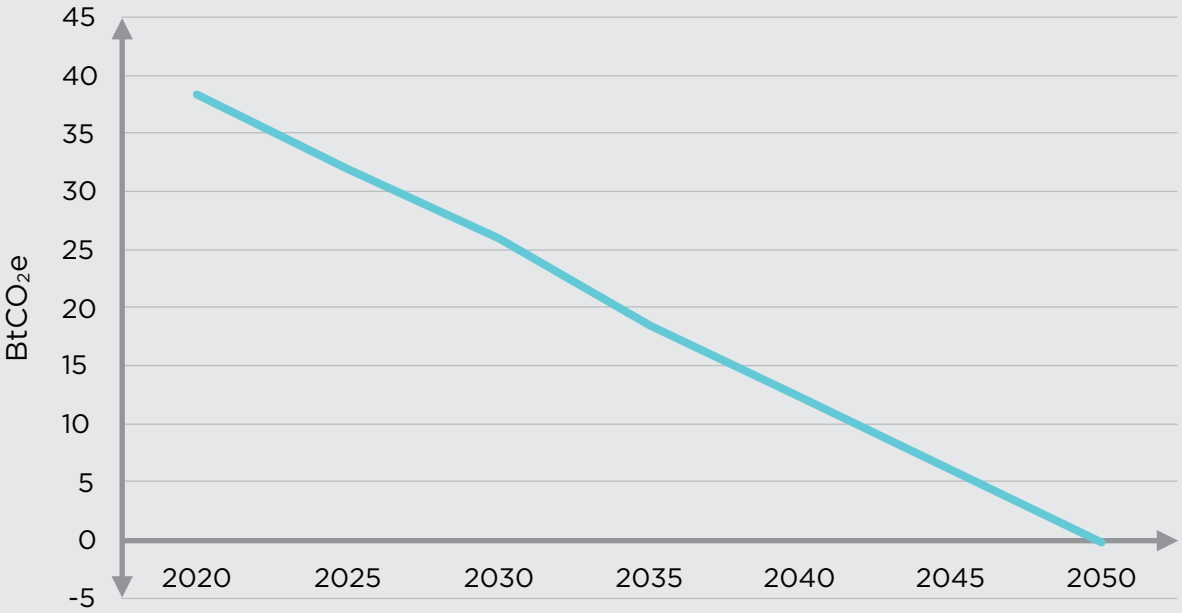


Figure 7: Orderly global emission pathway using NGFS data

Environmental

In this scenario, the curbing of global GHG emissions through effective policies and the transition to a low carbon economy has helped to curb the most significant physical impacts of climate change. New Zealand's average temperature increase reaches 0.7°C (min 0.4, max 1.3) by 2050, and remains constant out to 2100 (NIWA, 2023). Globally average temperature increases reach 1.4°C (min 1, max 1.8) by 2100 (IPCC, 2021b). Limiting the increase in global temperatures to 1.5°C relative to 1850-1900 levels has helped to minimise the increase in severity of extreme weather.

Policy

Progressive policy activity across the globe, such as the implementation of national and international emissions reduction requirements, mandatory climate-related reporting, emissions trading schemes, carbon taxes including border adjustments and an increase in legislation that bans emissions-intensive activities, along with increasing carbon prices act to incentivise decarbonisation. Carbon prices will reach NZ$250 per tonne of carbon in New Zealand and US$400 per tonne globally in 2050 (CCC, 2021b), (NGFS, 2023).

Social

Society at large expects and puts pressure on entities to decarbonise. This is driven by concerted behaviour change across the population including preference changes towards low emissions products or services throughout the supply chain, climate activism including through litigation and negative media attention oriented towards entities with a lack of appropriate action towards climate change and/or greenwashing allegations. Human quality of life continues to increase, resulting in an overall population growth slowdown in the medium term, with the global population reaching 8.5 billion (IPCC, 2021a).

Technological

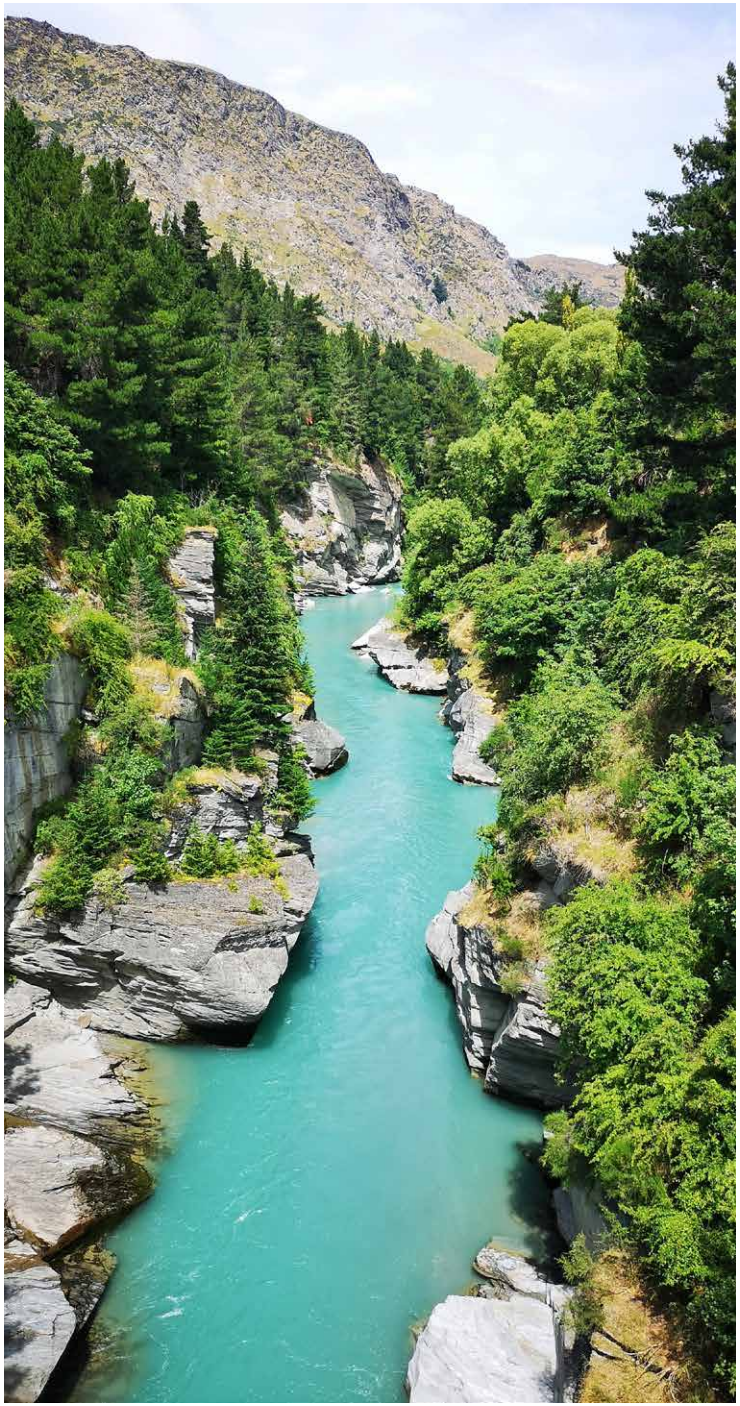
There is increased research and development into low emissions and emissions abatement technology and a rapid uptake of existing low-emissions and emission abatement technologies across all sectors. The transport sector sees widespread adoption of electric vehicles ("EVs"), with an average of 85% of all vehicles on the road running on electricity by 2050 (CCC, 2021a). Residual emissions remain in the heavy trucking and aviation sectors where emissions reductions are the most difficult to achieve.

Supporting the electrification of the transport fleet is the continued transition to a renewable electricity generation system which reaches 94% renewable by 2030 in New Zealand and 61% globally (CCC, 2022) (IEA, 2022a). Significant improvements in renewable storage technology allows for electricity production to reach 100% renewable and 88% renewable in New Zealand and globally respectively by 2050. The primary energy sector is not far behind the electricity sector, with 90% of all energy in New Zealand and 67% of all energy globally sourced from renewables by 2050 (CCC, 2022) (IEA, 2022a). Residual emissions remain from process heat application and industrial processes such as cement and steel making which are hard to abate.

The agriculture sector also undergoes major technology and behaviour changes to reduce biogenic methane, largely through widespread adoption of biogenic methane inhibitors, vaccines, and low emissions stock variants. Farmers successfully implement ambitious practice changes to become more emissions efficient. Approximately 90,000 hectares are converted from livestock agriculture to horticulture by 2050, nearly doubling the current area of horticulture. Methane reductions are also supported in the waste sector with a 73% organic waste recovery rate by 2050 alongside a major expansion of landfill gas capture globally.

Economic

Throughout this period, the global economy benefits from the stable transition to a low carbon economy, with the GDP reaching US$289 trillion by 2050 (NGFS, 2023). Likewise, the orderly transition in New Zealand, positively impacts the New Zealand economy, including the New Zealand agricultural and horticultural sectors, with the GDP reaching NZ$485 billion in 2050 (NGFS, 2023). All countries face internal challenges brought by transformational change to their economies, including job losses and skill shortages. However, these issues are managed effectively with the help of a stable climate, economy, and international relations.



4.1.4 Detailed scenario description

Under an Orderly scenario, the rate of physical risk remains relatively low, even in the long term, as there is a concerted effort to reduce emissions. Because of this transition, risks initially increase in the short and medium term before reducing as society shifts to a low carbon economy. The graph below describes the level of physical and transition risk for the Orderly scenario over the short-, medium-, and long-term.

Insurer outcomes

Under the Orderly scenario there will be increasing stakeholder expectations that life and health insurers emissions, including financed and insured (scope 3) emissions, are reduced proactively and that low-carbon products are offered. Those health and life insurers that do not have business strategies aligned with net-zero targets will experience customer impacts, for example increased lapse rates and reduced new policy sales. They will also find it difficult to attract and retain talent, impacting on the quality of services that they can provide and the efficient functioning of their businesses. Further, it will become difficult and more expensive to obtain reinsurance, and financing both from lenders and investors. Climate activists and media outlets will focus efforts on calling out those entities that are not taking action to reduce their emissions or those whose climate credentials lack integrity, further impacting on ability to retain and obtain customers, staff, reinsurance, investors, and lenders. Mandatory reporting under the New Zealand Climate Standards, will enable primary Users to determine the resilience of health and life insurers business models and strategies to climate-related risks impacting on their choices to invest in, lend to, do business with or purchase from these entities.

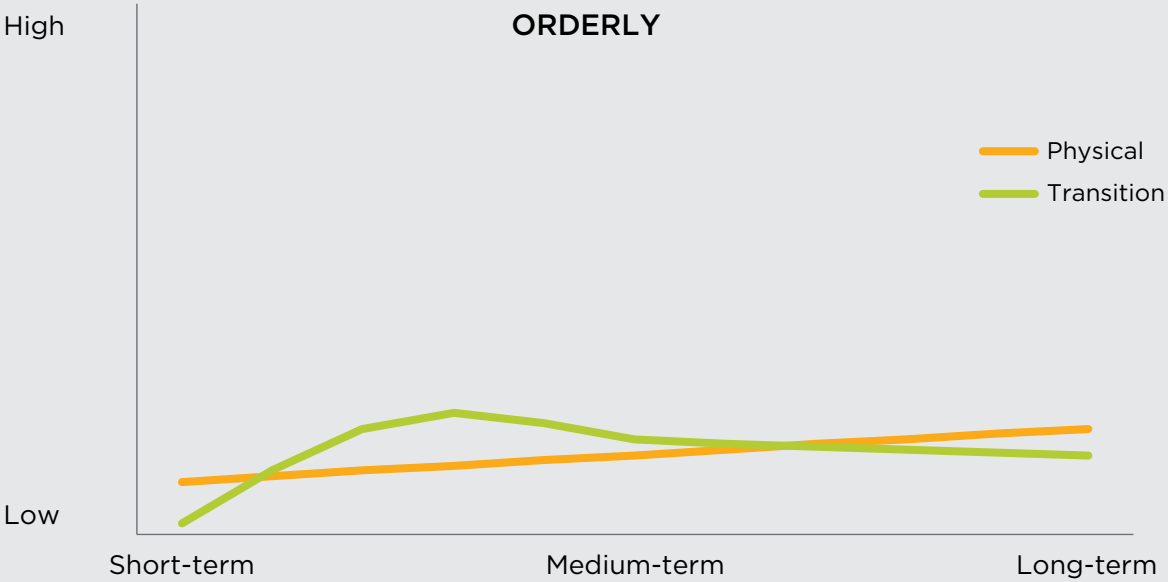


Figure 8: Physical and transition risks out to 2050+, for Orderly scenario[7]

Initially under the Orderly scenario, the cost to transition will have wide reaching impacts on the economy and individuals, impacting upon the finances of customers and potential customers and therefore their ability or willingness to pay for insurance products. Those life and health insurers that act to better assume risks and remain competitive on price will maintain customers and increase new policy writing, whilst those that do not will have deteriorating lapse rates and a reduction in new customers in the short term. Once the economy begins to stabilise in the medium term, customer lifestyle changes towards low emissions living, such as the adoption of plant-based diets and transport mode shifts, will impact positively upon health outcomes in the long term and act to change claim patterns. Those life and health insurers who can understand how claims and therefore profitability of products are changing will be able to change their products, pricing and underwriting to better

6 Physical and transition risk determinations over the short-, medium-, and long term are based on the general themes in the NIWA and CCC scenarios, literature reviews and stakeholder feedback. Each entity should assess the appropriateness of the risk determination to their analysis.

reflect customer needs and the cost to service their policies increasing affordability and acting to attract more customers. This could be driven through the development and/or adoption of technology to analyse claims and profitability of products.

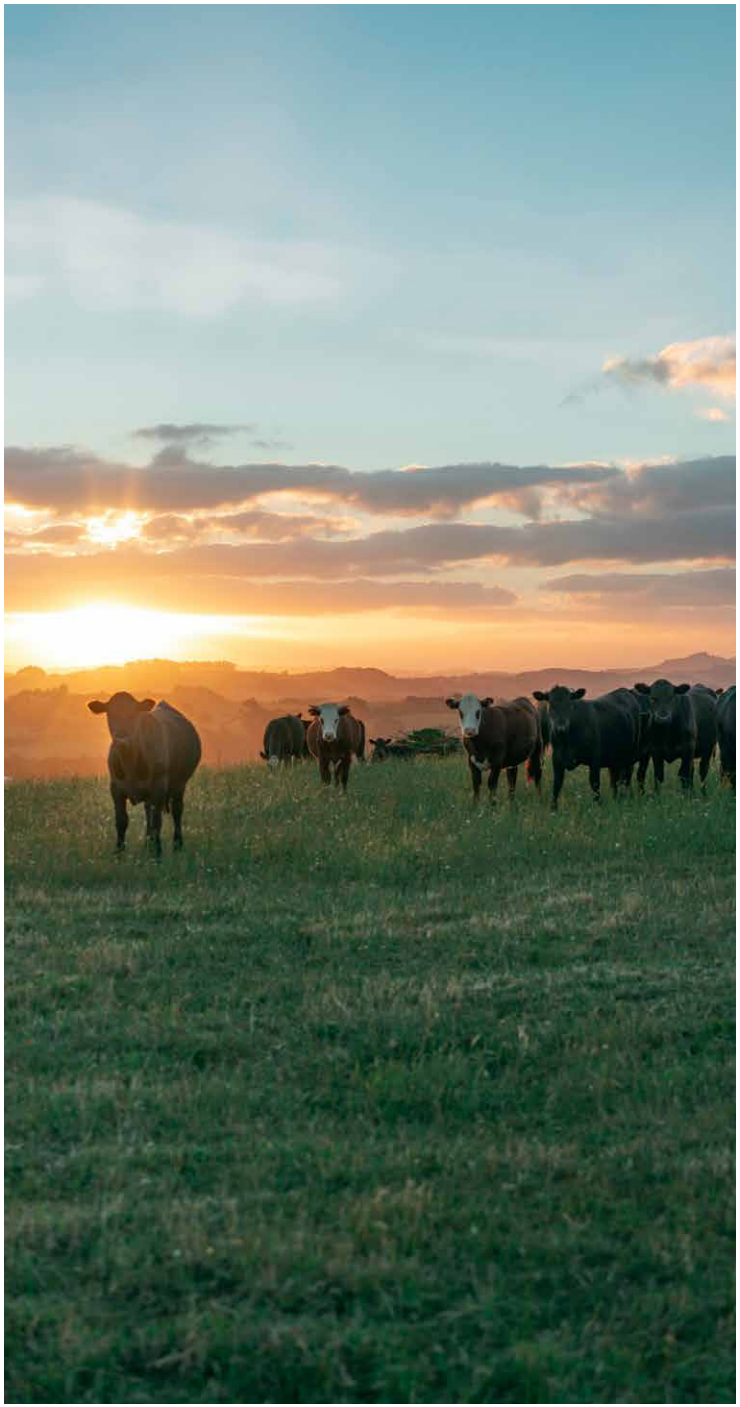
Societal and policy changes along with technological advancements (as outlined in the driving force section) under the Orderly scenario will result in minimal increases in New Zealand's average temperature, with it reaching 0.7°C by 2050 and remaining constant out to 2100. Precipitation will change minimally with minimal increases in the west of the South Island and minimal decreases in the north and east of the North Island. As a result, mortality and morbidity rates in New Zealand will remain unchanged by environmental impacts. Local and global impacts on horticulture and agriculture and thus food production and New Zealanders nutrition will be minimised with average temperature increases being 1.4 °C by 2100 further acting to maintain mortality and morbidity rates as they are. Climate anxiety is reduced as emissions levels fall, average temperatures are kept within live-able ranges and extreme weather events reduce in occurrence. Therefore, there will be minimal impacts to life and health insurers on claim distribution and the average cost of claims, reducing adverse impacts on liabilities, cashflow, the profitability of some products and solvency.

Investment outcomes

Under the Orderly scenario, emissions intensive sectors and entities globally will have increased costs as a result of an increased emissions price (NZ$250 and US$400 by 2050, in New Zealand and globally respectively) and increased climate regulatory requirements such as mandatory reporting (CCC, 2021b), (NGFS, 2023). Societal changes as well as increased regulatory reporting including the reporting of financed emissions will lead to investors and lenders withdrawing financing and funding from emissions intensive sectors and entities, preferring to provide financing or funding to entities and sectors supportive of decarbonisation instead. Low-emissions technology developments, especially in the energy and transport sector, will impact on the viability of businesses operating in these sectors that do not have low-emissions products and/or business models with customers preferring the low-emissions versions. Emissions intensive sectors and entities struggle to attract new investors and lenders both due to stakeholder preference changes and the decrease in profitability of these entities because of regulation, leading to last ditch attempts to decarbonise to maintain the viability of their businesses.

The reduction in GHG emissions globally has helped to minimise the most significant physical impacts of climate change, however there are still minor impacts on sectors and entities reliant on the natural environment for their outputs or service delivery. At a geography level, there are economic impacts in the short-term to entities in economies that historically relied on emissions intensive sectors and that have been slow to transition. There are also economic impacts to these governments as worsening economic conditions reduce government revenue and expenditure is required to keep pace with the transition being made by the rest of the world, for example through electrification of transport infrastructure. This will act to devalue government bonds in these countries.

Table 8 provides an overview of the impact of underlying physical risks to different sectors, whilst Table 9 provides an overview of the impact of underlying transition risks to different sectors under an Orderly scenario.



Sector	Disruption to ability to provide services or product (at a cost consumers can afford)	Stranded assets	Disruption to supply chain	Disruption to business operations	Reduced demand for services/products	Increased demand for services/products
Agriculture	Likely	Likely	Not likely	Not likely	Not likely	Not likely
Communication Services Sector	Likely	Not likely	Not likely	Likely	Not likely	Not likely
Consumer Discretionary Sector excl. Transport	Likely	Likely	Likely	Likely	Likely	Not likely
Consumer Staples Sector excl. Agriculture	Likely	Likely	Likely	Likely	Not likely	Not likely
Energy Sector	Likely	Likely	Likely	Likely	Not likely	Not likely
Financial Sector	Not likely	Likely	Not likely	Likely	Not likely	Not likely
Health Care Sector	Likely	Likely	Not likely	Not likely	Not likely	Likely
Industrials Sector excl. Transport	Not likely	Likely	Likely	Likely	Not likely	Not likely
Transport	Likely	Not likely	Likely	Likely	Not likely	Not likely
Information Technology Sector	Likely	Likely	Likely	Likely	Not likely	Not likely
Materials Sector	Not likely	Likely	Likely	Likely	Not likely	Not likely
Real Estate Sector	Not likely	Likely	Likely	Likely	Not likely	Not likely
Utilities Sector	Likely	Likely	Likely	Not likely	Not likely	Likely

Very likely to be present under the relevant scenario

Likely to be present under the relevant scenario

Not likely to be present under the relevant scenario

Table 8: Physical risks to sector under an Orderly scenario

Sector	Stranded assets	Stakeholder preference change	Regulatory / policy impacts	Litigation risk	Emissions pricing impacts	Technology availability	Ability for customers to afford services/products
Agriculture	Likely	Very likely	Very likely	Very likely	Likely	Likely	Not likely
Communication Services Sector	Not likely	Likely	Likely	Likely	Likely	Not likely	Likely
Consumer Discretionary Sector excl. Transport	Not likely	Likely	Likely	Likely	Likely	Not likely	Very likely
Consumer Staples Sector excl. Agriculture	Not likely	Likely	Likely	Likely	Likely	Not likely	Likely
Energy Sector	Very likely	Very likely	Very likely	Very likely	Very likely	Not likely	Not likely
Financial Sector	Not likely	Likely	Likely	Likely	Likely	Likely	Not likely
Health Care Sector	Not likely	Likely	Likely	Likely	Likely	Not likely	Likely
Industrials Sector excl. Transport	Not likely	Very likely	Likely	Likely	Very likely	Likely	Not likely
Transport	Likely	Very likely	Very likely	Likely	Very likely	Likely	Likely
Information Technology Sector	Not likely	Likely	Likely	Likely	Likely	Not likely	Not likely
Materials Sector	Not likely	Very likely	Likely	Likely	Very likely	Likely	Not likely
Real Estate Sector	Not likely	Likely	Likely	Likely	Likely	Not likely	Likely
Utilities Sector	Very likely	Very likely	Very likely	Very likely	Very likely	Very likely	Likely

Very likely to be present under the relevant scenario

Likely to be present under the relevant scenario

Not likely to be present under the relevant scenario

Table 9: Transition risks to sector under an Orderly scenario

Table 10 provides an overview of the impact of underlying physical risks to different geographies, whilst Table 11 provides an overview of the impact of underlying transition risks to different geographies under an Orderly scenario.

Geography	Wildfire	Water Stress & Drought	Sea Level Rise	Increase in Mean temperature	Flood
Africa	●	●	●	●	●
America excl. USA and Canada	●	●	●	●	●
Asia excl. China and Japan	●	●	●	●	●
Australia	●	●	●	●	●
China	●	●	●	●	●
EU	●	●	●	●	●
Europe excl. EU and UK	●	●	●	●	●
Japan	●	●	●	●	●
Middle East	●	●	●	●	●
New Zealand	●	●	●	●	●
UK	●	●	●	●	●
USA and Canada	●	●	●	●	●

Table 10: Physical risks to geography under an Orderly scenario

● Very likely to be present under the relevant scenario
● Likely to be present under the relevant scenario
● Not likely to be present under the relevant scenario

Geography	Reliance on emissions intensive sectors	Poor climate policies and commitments and limited stakeholder preference change	Progressive climate policies and commitments and a large amount of stakeholder preference change
Africa	●	●	●
America excl. USA and Canada	●	●	●
Asia excl. China and Japan	●	●	●
Australia	●	●	●
China	●	●	●
EU	●	●	●
Europe excl. EU and UK	●	●	●
Japan	●	●	●
Middle East	●	●	●
New Zealand	●	●	●
UK	●	●	●
USA and Canada	●	●	●

Table 11: Transition risks to geography under an Orderly scenario

4.2 TOO LITTLE TOO LATE

4.2.1 Overview of scenario dimension

The Too Little Too Late scenario represents a misaligned and delayed transition a low carbon economy between different parts of the world. In this scenario, some countries are early movers on the transition to a low emissions economy, introducing policy that brings about net zero emissions by 2050. In other parts of the world, however, there is very little action towards a low emissions future with fossil fuelled development continuing throughout much of the remaining first half of the century. From mid-century, global efforts to address climate change begin to align and exceed those by the early movers. Large increases in carbon price will drive a rapid improvement in low emissions technology efficacy and uptake. This shift is partly driven by the increasing evidence and awareness of the social, economic, and environmental degradation caused by a continued increase in fossil fuelled development. Despite making a concerted effort to reduce emissions and move to a low emissions economy at mid-century, the changes come too late to prevent wide ranging acute and chronic physical climate impacts. Overall, based on the literature review and stakeholder engagement, this scenario represents a high level of transition risk compared to the other scenarios and a medium level of physical risk compared to the other scenarios.

The table summarises the various scenario parameters under the Too Little Too Late scenario narrative.

ENVIRONMENTAL OUTCOMES	EMISSION PATHWAYS
Average temperature increase • Domestic: +1.4°C (min 0.7, max 2.2) by 2100[9] (NIWA) • Global: +2.7°C (min 2.1, max 3.5) by 2100[10] (IPCC)	Net Emissions • Domestic: 57 $MtCO_2e$ by 2030, 22$MtCO_2e$ by 2050 (CCC) • Global: NGFS National Determined Contributions (NDCs) 35.1 $BtCO_2e$ by 2030, 26.7 $BtCO_2e$ by 2050 using GCAM5.3+ (NGFS)[11]
ECONOMIC OUTCOMES	**SOCIAL OUTCOMES**
GDP (GDP % change due to chronic physical risk, acute impacts are excluded from this figure and would further negatively impact GDP) • Global: US$ 175 trillion (-1.6%) in 2030, US$ 274 trillion (-5.1%) in 2050[12] (NGFS) • NZ: NZ$ 329 billion (-0.7%) in 2030, NZ$ 477 billion (-2.3%) in 2050[13] (NGFS)	Population • Global: 8.3 billion by 2030, 9.2 billion by 2050 (IPCC)
POLICY OUTCOMES	**TECHNOLOGY OUTCOMES**
Carbon Price • Domestic: NZ$140 in 2030, NZ$250 in 2050 (CCC) • Global: US$34 in 2030, US$50 in 2050 (NGFS)	Percent of Renewable Electricity of Total Electricity Produced • Domestic: 94% by 2030, 98% by 2050 (CCC) • Global: 46% by 2030, 71% by 2050 (IEA) Percent of Renewable Energy of Total Energy Produced • Domestic: 50% by 2030, 80% by 2050 (CCC) • Global: 19% by 2030, 37% by 2050 (IEA)

Table 12: Scenario parameters under a Too Little Too Late scenario[8]

7 Refer to Appendix B for source data for these assumptions
8 Relative to 1986-2005
9 Relative to 1850-1900
10 NGFS has three different global projections available, with all having validity and robustness, GCAM5.3+ was selected for consistency. For information on differences, please see NGFS FAQ
11 Provided in % difference, 2017 PPP, US$
12 Provided in % difference, 2009 prices; NZ$

4.2.2 Datasets aligned with scenario dimension

Scenario narratives aligned with a Too Little Too Late scenario are summarised in Table 13.

TOO LITTLE TOO LATE

SCENARIO	DESCRIPTION
IPCC SSP2-4.5	SSP2-4.5 is the middle of the road scenario and represents a moderate approach to transitioning towards a low carbon future. With a disjointed global approach, policies shift over time to become increasingly oriented toward national and regional issues, at the expense of broader-based development. Strong environmental degradation is experienced in some areas due to a low international priority for addressing environmental concerns. Lack of international cooperation increases challenges to mitigation. The use of CDR is limited to its direct application to the exhaust streams of point-source facilities such as power plants or factories.
NGFS NDC	NDC scenario projects 2.6°Caverage global temperature rise relative to pre-industrial levels, associated with moderate to high physical risk exposure. This scenario is also characterised by a slower uptake in technology in the first half of the century, accompanied by less transition risk on a global scale in the medium term.[14]
IEA APS	The APS scenario assumes that all recent major national announcements of emission targets from 2030 onwards are achieved (regardless of whether these have been anchored in implementing legislation or updated NDCs). This includes the commitment made by the New Zealand Zero Carbon amendment to the Climate Change Response Act setting a net zero emission target for all GHG except biogenic methane by 2050.
NIWA RCP4.5	The NIWA scenarios leverage the IPCC's RCP modelling of varying levels of GHG concentrations on the earth's climate system. NIWA downscales the global models in order to study how these different atmospheric concentrations of GHGs might influence the New Zealand climate. As with RCP 4.5, NIWA RCP4.5 represents a world where carbon dioxide (CO_2e) emissions start declining by approximately 2045 to reach roughly half of the levels of 2050 by 2100. Average temperature increases under the NIWA scenarios are relative to a 1986-2005 baseline which differs from the IPCC baseline of 1850-1900. As such, the stated warming at various future points in time are lower in NIWA's scenarios than they are in the IPCC scenarios.
CCC 'Headwinds'	In this scenario there are higher barriers to uptake of both technology and behaviour changes across key measures. It assumes conservative improvements in technology relative to the Current Policy Reference case. It assumes a modest change from existing behaviour trends among people and businesses.

Table 13: Datasets aligned with Too Little Too Late scenario

13 This scenario was only used for GDP projections for the first half of the century, therefore assumptions for this scenario in the latter half of the century have been ignored.

4.2.3 Drivers of change

Emissions pathway

Globally, the Too Little Too Late scenario shows a steady decline in global emissions, as seen in the figure below. Overall, emissions reduce at an average of 1.0% per annum, with a 31% reduction in net emissions in 2050 compared to 2020 (NGFS, 2023). This reduction leads to a net emission of 26.7 $BtCO_2e$ in 2050 (NGFS, 2023), significantly higher than zero.

Environmental

Although global emissions begin to reduce from mid-century, the delay in abatement efforts has resulted in the materialisation of a number of physical climate risks. By 2050, temperatures around New Zealand have increased by an average of 0.8°C (min 0.4, max 1.3) and continue to increase to an average of 1.4°C (min 0.7, max 2.2) by 2100 (NIWA, 2023). Globally average temperature increases reach 2.7°C (min 2.1, max 3.5) by 2100 (IPCC, 2021b).

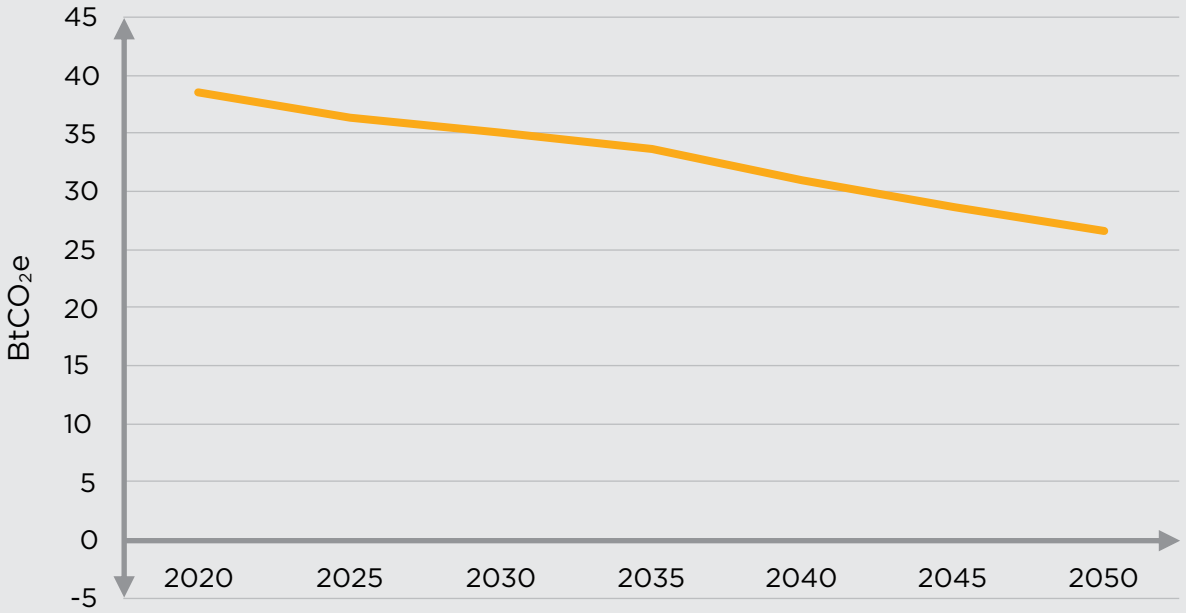


Figure 9: Too Little Too Late global emission pathway using NGFS data

In New Zealand the increased energy contained within the atmosphere by this temperature increase is helping to drive greater extreme weather events especially in the latter half of the century. By 2050, the number of hot days (defined as those reaching over 25°C) in Northland, Bay of Plenty, Hawke's Bay and Canterbury have increased by an average of 54%. By 2100 this has increased to 96% (NIWA, 2023). At the same time, the level of precipitation in the same regions are decreasing, reaching a 10% reduction by 2100 (NIWA, 2023). In combination, these changes are driving up drought levels in Northland, and around the East Coast of New Zealand. While certain regions in New Zealand face increased drought conditions, other regions are seeing increased average precipitation. By 2100, the West Coast of the South Island is experiencing 20% more precipitation during the winter months bringing increased risk of floods to the area (NIWA, 2023). The intensity of precipitation around the lower South Island is also increasing, driving up the risk of heavy downpours that can create flash flooding. By the medium and long term, New Zealand experiences a median increase in sea level of 0.24 and 0.55m, respectively (NIWA, 2023).

Globally, under the Too Little Too Late scenario, greater climate fluctuations are predicted globally compared to the Orderly scenario (IPCC, 2021a). However, there are regions that are worse impacted than others. Stronger temperature increases are reported over the northern hemisphere than the southern hemisphere (Nazarenko, 2022). With regions at high latitudes, including the Arctic and northern regions of North America, Europe, and Asia having the most significant temperature increase, with warming expected to be twice the global average (3-4°C by 2050) (Nazarenko, 2022),.

Prolonged reduction in precipitation is seen in parts of northern and central Europe, eastern Africa, and southern Australia increasing risk of drought (IPCC, 2021a). While parts of South Asia and East Asia have increased precipitation by 2050, with greater frequency and intensity of flooding occurring compared to the past (IPCC, 2021a). Sub-Saharan Africa has areas of both lower and higher precipitation increasing risk of both flood and drought, further exacerbating challenges associated with agriculture and food security in the region (IPCC, 2021a).

Sea level rise of 0.20m by 2050, and 0.56m by 2100 will affect coastal regions (NASA, 2023). Small Island Developing States ("SIDS"), including low-lying islands in the Pacific, Caribbean, and Indian Ocean, are expected to be severely impacted by the predicted sea level rise (IPCC, 2021c). In addition, coastal areas worldwide are projected to face increased risk from storm surges, flooding, and sea level rise. This results in loss of land, damage to infrastructure, displacement of populations, impacts on coastal ecosystems and impacts to trade routes (NASA, 2023).

Policy

The EU, Japan, China, the UK, the USA, Canada, and New Zealand make early climate policy implementations, for example national and international emissions reduction requirements, mandatory climate-related reporting, emissions trading schemes, carbon taxes including border adjustments and legislation that bans emissions-intensive activities, and increase carbon prices, which act to incentivise decarbonisation. In 2030 the carbon price in New Zealand will reach NZ$140 per tonne of carbon, whilst globally it will reach US$34 (CCC, 2022) (NGFS, 2023). In other parts of the world, however, for example the Middle East, Asia (excluding Japan and China), Australia and central and south America, there is very little policy action incentivising a low emissions future. From mid-century, climate policy and price begin to align and accelerate globally. This shift is partly driven by the increasing evidence and awareness of the social, economic, and environmental degradation caused by a continued increase in fossil fuelled development. By 2050 carbon prices will increase to NZ$250 per tonne of carbon in New Zealand and US$50 globally (CCC, 2022) (NGFS, 2023).

Adaptation plans are put in place in developed nations and act to reduce the physical impacts of climate change. Regions with limited resources, infrastructure, and adaptive capacity will face greater challenges in mitigating the physical effects of climate change and consequently, experience greater negative impacts.

Social

Behaviour changes and social pressure in Europe, the USA, Canada, Australia, and New Zealand drives decarbonisation in these countries in the short-term, however, outside of these countries' behaviour change does not begin until the medium term. Lower GDP growth together with higher population estimates, transition costs and physical climate impacts will increase inequities, as the world's more marginalised nations are exposed to higher rates of poverty, political and economic instability, and physical climate impacts. Prioritisation by developed nations on covering internal transition costs and an increase in displaced people seeking to migrate to safer living conditions will increase geopolitical tensions as will increased challenges in agriculture, food security and water availability as a result of greater volatility in precipitation combined with increased risk of drought and flood (IPCC, 2021a).

Technological

There are delays in the development of low emissions and emissions abatement technology restricting early climate moving nations progress on decarbonisation until closer to the medium term, when global efforts to decarbonise begin to align with early movers.

With renewable electricity technologies already well developed, New Zealand achieves a 94% renewable electricity rate in the short term due to the continued expansion of New Zealand's renewable electricity network, especially through wind, solar and geothermal (CCC, 2021a). This is well ahead of the global 46% renewable electricity rate in 2030 (IEA, 2022). The expansion of New Zealand's renewable electricity continues in the medium term. However, a lack of viable renewable energy storage technology and the failure to invest in the pumped hydro scheme at Lake Onslow prevents a 100% renewable electricity generation rate. Some natural gas usage remains in the system to provide base load electricity which results in 98% renewable electricity rate by 2050 (CCC, 2021b). Globally by 2050 renewable electricity rates have increased to 71% through gradual conversion. Unlike electricity, the uptake of renewable primary energy in New Zealand is limited in the short term as New Zealand faces challenges in decarbonising process heat systems due to a lack of investment into low emissions alternatives. In the medium term, renewable primary energy in New Zealand increases significantly, reaching 80% (CCC, 2021b). Much of this increase is driven by the rise in renewable electricity and the conversion of low-process heat boilers to biomass and electricity. Again, New Zealand is well ahead of the global renewable energy rates of 19% in 2030 and 37% in 2050 (IEA, 2022).

In the transport sector, emissions reductions happen slowly, with only 6% of the fleet electrified in the short term. By the medium term, the rate of fleet electrification reaches 76% (CCC, 2021b). As EV sales reach critical mass and steadily take over the international vehicle fleet nearer to the medium term. Residual emissions are largely the result of aviation emissions, which see little to no reduction, even by the medium term.

Economic

The high transition risks combined with medium physical risks under a Too Little Too Late scenario will lead to significant financial impacts such as job-loss of 900,000 annually by 2070 and declines in global economic growth in the medium term, with GDP reaching US$274 trillion by 2050, a reduction of approximately US$9 trillion compared to an Orderly scenario (Deloitte, 2022), (NGFS, 2022a). On the other hand, global population growth exceeds that of an Orderly scenario, with a global population of 9.2 billion people resulting in a lower standard of living for many across the globe as a smaller GDP is shared amongst a greater population by 2100 (IPCC, 2021b).

4.2.4 Detailed scenario description

Under a Too Little Too Late scenario, the rate of physical risk climbs steadily out to the long term. Transition risk increases rapidly in the short-term, plateauing in the medium term as net zero targets are reached. Transition risk exposure then increases again in the long term due to increased global action and the emergence of new technologies facilitating decarbonisation. Figure 10 below shows the overall physical and transition risk level for the Too Little Too Late scenario over the short-, medium-, and long-term.

Insurer outcomes

High transition risk combined with medium physical risk under a Too Little Too Late scenario will lead to significant financial impacts for New Zealand consumers such as job-loss and increased property costs as a result of physical impacts such as sea-level rise and extreme weather events over the short, medium, and long-term. This will impact upon the financial position of health and life insurance customers and potential customers and therefore their ability or willingness to pay for insurance products. Those life and health insurers that act to better assume risks and remain competitive on price will maintain customers and increase new policy writing, whilst those that do not will have deteriorating lapse rates and a reduction in new customers in the short term.

Although societal and policy changes are made in New Zealand and by early mover nations, the delayed action by the rest of the world including with respect to technological advancements (as outlined in the driving force section) under the Too Little Too Late scenario will result in temperatures around New Zealand increasing by an average of 0.8°C (min 0.4, max 1.3) in 2050 and continuing to increase to an average of 1.4°C (min 0.7, max 2.2) by 2100. By 2050, the number of hot days (defined as those reaching over 25°C) in Northland, Bay of Plenty, Hawke's Bay and Canterbury have increased by an average of 54%. By 2100 this has increased to 96% (NIWA, 2023). At the same time, the level of precipitation in the same regions are decreasing, reaching a 10% reduction by 2100 (NIWA, 2023). In combination, these changes are driving up drought levels in Northland, and around the East Coast of New Zealand. As a result, there is increased exposure to heat stress in these areas increasing the incidence of cardiovascular and respiratory illnesses as well as skin cancer. While certain regions in New Zealand face increased drought conditions, other regions are seeing increased average precipitation. By 2100, the West Coast of the South Island is experiencing 20% more precipitation during the winter months bringing

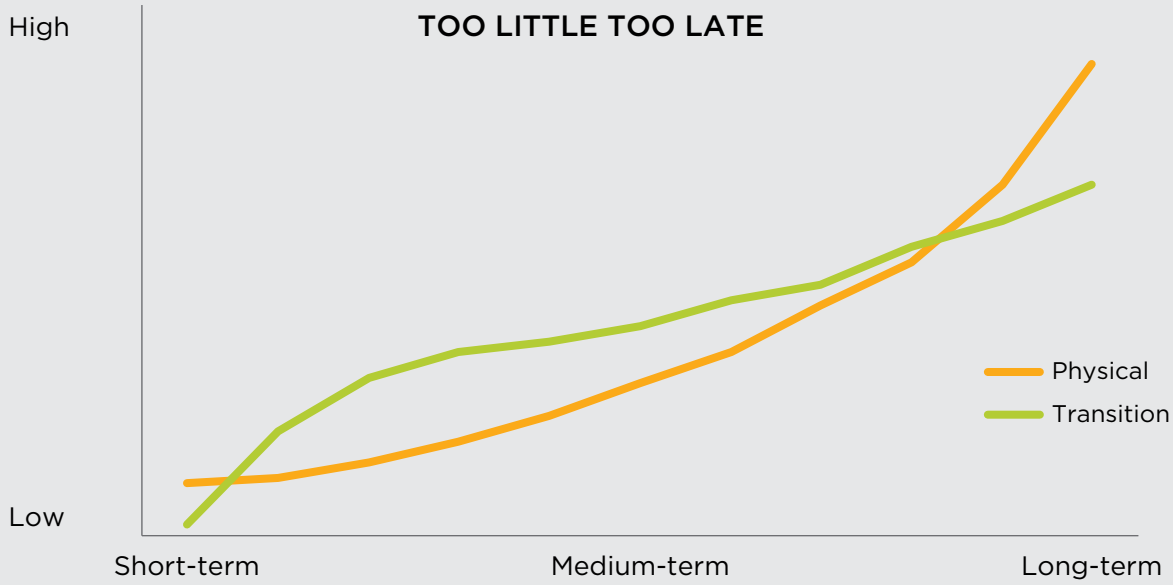


Figure 10: Physical and transition risks out to 2050+, for Too Little Too Late scenario[15]

14 Physical and transition risk determinations over the short-, medium-, and long term are based on the general themes in the NIWA and CCC scenarios, literature reviews and stakeholder feedback. Each entity should assess the appropriateness of the risk determination to their analysis.

increased risk of floods to the area (NIWA, 2023). The intensity of precipitation around the lower South Island is also increasing, driving up the risk of heavy downpours that can create flash flooding. As a result of the warmer and wetter climate in these areas, there is an increase in the viability of vector-borne diseases being able to spread disease, increasing the number and incidence of extreme infectious diseases. The New Zealand horticulture and agriculture sectors are impacted both by the physical changes to the climate and the transition impacts of increased cost of carbon, limited emissions reduction technologies and increased popularity of plant-based diets. There is a reduction in livestock farming area from 9Mha in 2019 to 8.7Mha in the medium term (CCC, 2021a; Stats NZ, 2021). Most of this land use change is absorbed by exotic forestry planting as farmers see greater viability from planting their farms than raising livestock. Horticulture sees a small amount of growth as low emissions plant proteins continue to increase in popularity both locally and globally. Globally the horticulture and agriculture sectors experience similar physical and transition impacts as in New Zealand. Overall, this impacts on food production levels and the nutrition of New Zealanders. Climate anxiety increases as global emissions continue to increase in the immediate and short term, average temperatures continue to increase, and extreme weather events increase in occurrence which impacts upon mental health within the New Zealand population. Financial impacts on New Zealanders because of physical climate impacts such as sea-level rise and extreme weather events and transition impacts, such as job-loss and increased property costs also impact upon the wellbeing of New Zealanders. Overall, mortality and morbidity rates will increase and change, morbidity from the short term and mortality from the medium to long term. Therefore, there will be impacts to life and health insurers on claim distribution and the average cost of claims. Where these changes are unexpected product, pricing and underwriting will have been inadequate at the time of policy sale resulting in adverse effects on liabilities, cashflow, profitability of products and overall solvency of the organization. Those health and life insurers that have invested in research and technology to understand how climate-risks will impact claims and factored this into their processes will be less effected. There will also be an increase in expenditure to develop ways to deal with sudden surges in claims and to minimise reputational impacts if claims are not settled in a timely manner due to the surges. Further, there will be an increase in costs to service customers where their vulnerability has increased because of climate impacts. The increased frequency and size of claims will require that health and life insurers increase premiums by more than customers are willing to pay resulting in increased policy lapses and lower acquisition of new customers. On the flip side, the public health system is being overwhelmed by climate impacts on health of the population, resulting in long wait times for patients and in some cases inability to access care. This acts to increase the value consumers place on health insurance and increases the number of new policy sales.

At an operational level, the increase in extreme weather events under the Too Little Too Late scenario will result in disruption. These events will cause damage to physical assets including offices, equipment, utilities, and other assets or enabling infrastructure, impacting on life and health insurers abilities to operate. Further, employees will be impacted by these events and as a result will not be able to work due to personal impacts or access issues resulting in reduced employee productivity. Together

these will act to create a capacity risk, whereby the insurer is unable to service claims in a timely manner impacting upon customer satisfaction. There will be increased expenses too – for example to remediate any issues as a result of disruption to operations or to contribute towards repair costs for leased buildings and any potential increases in insurance premiums. Independent Financial Advisers ("IFAs") will also be affected by extreme weather events impacting upon policy sales. In the long term it will result in the need to develop alternative distribution channels as IFAs are driven out of business and sales reductions are too large. Reinsurers, the majority of which are located in countries taking progressive action on climate-change are impacted by the increased frequency and severity of physical climate impacts. This makes it more difficult and expensive for New Zealand based life and health insurers to access reinsurance. Life and health insurers that do not have business strategies aligned with net-zero targets will find it even more difficult, with an increasing focus on financed and insured (scope 3 emissions) by reinsurers.

Investment outcomes

There are varied physical and transition climate impacts globally due to the misaligned and delayed transition under the Too Little Too Late scenario.

In the EU, Japan, China, the UK, the USA, Canada and New Zealand, costs increase for emissions intensive entities because of an increased emissions price and increased climate regulatory requirements (CCC, 2021b) (IEA, 2022a). Changes in stakeholder expectations that entities be proactive in reducing their emissions and in addressing their climate-risks drive customer, investor, supplier, and employee decisions as to the entities they choose to buy from, invest in, do business with and work for. Those entities without emission reduction plans or climate-risk management plans will experience reduced sales and revenue, increased difficulty and cost when raising funds, decreased employee attraction and retention and supply chain impacts. Outside of these countries there are less impacts on high-emissions sectors and entities, however exporters from these geographies will experience the same impacts including through carbon taxes.

The delay in emission reductions results in the materialisation of significant physical climate risks that impact different sectors and geographies by varying amounts. Agricultural output and renewable energy generation will be impacted by extreme weather events and gradual weather changes such as temperature and precipitation levels, decreasing revenue and increasing costs. There will also be increases in fossil fuel use as a result, for example more fertiliser to support crop growth and the need to use coal or gas to generate energy further acting to increase emissions and physical climate change impacts. The communication, utilities, information technology and transport sectors will be disrupted by extreme weather events impacting upon their abilities to provide services to customers and therefore on customer satisfaction and revenue. There will also be increased operational expenditure to cover repair costs and potential increases in insurance premiums.

The high transition risks combined with medium physical risks under a Too Little Too Late scenario will lead to significant financial impacts globally and therefore reduce discretionary spending and therefore the demand for discretionary products and services such as those provided by the consumer discretionary sector. In the health sector there will be increased demand due to the health impacts associated with increased physical climate impacts and reduced economic stability.

At a geography level, Asia (excluding China and Japan) and the Middle East are most impacted by the physical effects of climate change both due to the magnitude and frequency of climate perils but also due to the lack of adaptation planning and therefore resilience to these effects. In Asia this manifests as increased frequency and magnitude of floods which damage property and infrastructure and increases the spread of disease and reduces the fertility of soil. In the Middle East the most material climate peril is water stress and drought which limits access to clean drinking water, crop's ability to grow and irrigation supply. Remediation costs and disruption because of these perils will be excessive and there will be increased challenges with food security, water availability and housing shortages leading to political unrest and migration to countries less impacted. Together, these impacts will have wide-ranging effects on these governments and economies. Government expenditure will increase both to manage the social impacts as well as repair and maintain infrastructure and entities operating in these geographies will face increased costs, reduced revenue and thus reduced profits.

Table 14 provides an overview of the impact of underlying physical risks to different sectors, whilst Table 15 provides an overview of the impact of underlying transition risks to different sectors under a Too Little Too Late scenario.

Sector	Disruption to ability to provide services or product (at a cost consumers can afford)	Stranded assets	Disruption to supply chain	Disruption to business operations	Reduced demand for services/products	Increased demand for services/products
Agriculture	Very likely	Likely	Not likely	Not likely	Not likely	Not likely
Communication Services Sector	Very likely	Not likely	Not likely	Likely	Not likely	Not likely
Consumer Discretionary Sector excl. Transport	Likely	Likely	Likely	Likely	Very likely	Not likely
Consumer Staples Sector excl. Agriculture	Very likely	Likely	Likely	Likely	Not likely	Not likely
Energy Sector	Very likely	Likely	Likely	Very likely	Not likely	Not likely
Financial Sector	Likely	Likely	Not likely	Likely	Very likely	Not likely
Health Care Sector	Very likely	Likely	Not likely	Not likely	Not likely	Very likely
Industrials Sector excl. Transport	Not likely	Likely	Likely	Likely	Not likely	Not likely
Transport	Very likely	Not likely	Likely	Very likely	Not likely	Not likely
Information Technology Sector	Very likely	Likely	Likely	Likely	Not likely	Not likely
Materials Sector	Not likely	Likely	Likely	Likely	Not likely	Not likely
Real Estate Sector	Not likely	Likely	Likely	Likely	Not likely	Not likely
Utilities Sector	Very likely	Likely	Likely	Not likely	Not likely	Likely

Very likely to be present under the relevant scenario

Likely to be present under the relevant scenario

Not likely to be present under the relevant scenario

Table 14: Physical risks to sector under a Too Little Too Late scenario

Sector	Stranded assets	Stakeholder preference change	Regulatory / policy impacts	Litigation risk	Emissions pricing impacts	Technology availability	Ability for customers to afford services/products
Agriculture	Likely	Very likely	Very likely	Very likely	Very likely	Very likely	Not likely
Communication Services Sector	Not likely	Likely	Likely	Likely	Very likely	Not likely	Likely
Consumer Discretionary Sector excl. Transport	Not likely	Very likely	Likely	Likely	Very likely	Not likely	Very likely
Consumer Staples Sector excl. Agriculture	Not likely	Very likely	Likely	Likely	Very likely	Not likely	Likely
Energy Sector	Very likely	Very likely	Very likely	Very likely	Very likely	Not likely	Not likely
Financial Sector	Not likely	Likely	Likely	Likely	Very likely	Likely	Very likely
Health Care Sector	Not likely	Likely	Likely	Likely	Very likely	Not likely	Likely
Industrials Sector excl. Transport	Not likely	Very likely	Very likely	Likely	Very likely	Likely	Not likely
Transport	Likely	Very likely	Very likely	Likely	Very likely	Likely	Likely
Information Technology Sector	Not likely	Likely	Likely	Likely	Very likely	Not likely	Not likely
Materials Sector	Not likely	Very likely	Very likely	Likely	Very likely	Likely	Not likely
Real Estate Sector	Not likely	Likely	Likely	Likely	Very likely	Not likely	Very likely
Utilities Sector	Very likely	Very likely	Very likely	Very likely	Very likely	Very likely	Likely

Very likely to be present under the relevant scenario

Likely to be present under the relevant scenario

Not likely to be present under the relevant scenario

Table 15: Transition risks to sector under a Too Little Too Late scenario

Table 16 provides an overview of the impact of underlying physical risks to different geographies, whilst Table 17 provides an overview of the impact of underlying transition risks to different geographies under a Too Little Too Late scenario.

Geography	Wildfire	Water Stress & Drought	Sea Level Rise	Increase in Mean temperature	Flood
Africa	🟠	🟢	🟠	🟠	🟢
America excl. USA and Canada	🟠	🟠	🟠	🟠	🟠
Asia excl. China and Japan	🟠	🟠	🟢	🟢	🟢
Australia	🟢	🟢	🟠	🟠	🟠
China	🟠	🟠	🟠	🟢	🟢
EU	🟠	🟢	🟢	🟢	🟠
Europe excl. EU and UK	🟠	🟠	🟠	🟠	🟠
Japan	🟠	🟠	🟢	🟠	🟠
Middle East	🟢	🟢	🟠	🟢	🟠
New Zealand	🟠	🟠	🟠	🟠	🟠
UK	🟠	🟢	🟠	🟠	🟢
USA and Canada	🟢	🟠	🟠	🟢	🟠

Table 16: Physical risks to geography under a Too Little Too Late scenario

🟢 Very likely to be present under the relevant scenario

🟠 Likely to be present under the relevant scenario

🔵 Not likely to be present under the relevant scenario

Geography	Reliance on emissions intensive sectors	Poor climate policies and commitments and limited stakeholder preference change	Progressive climate policies and commitments and a large amount of stakeholder preference change
Africa	🟢	🟢	🔵
America excl. USA and Canada	🟢	🟢	🔵
Asia excl. China and Japan	🟢	🟢	🔵
Australia	🟢	🟢	🔵
China	🟢	🟠	🟠
EU	🟠	🔵	🟢
Europe excl. EU and UK	🟠	🟢	🔵
Japan	🟠	🟠	🟠
Middle East	🟢	🟢	🔵
New Zealand	🟠	🔵	🟢
UK	🟠	🔵	🟢
USA and Canada	🟠	🔵	🟢

Table 17: Transition risks to geography under a Too Little Too Late scenario

4.3 HOTHOUSE

4.3.1 Overview of scenario dimension

This scenario represents minimal action towards a low carbon global transition. Despite increasing levels of social, economic, and environmental degradation, there is little shift in social and political traction towards a low emissions future. As a result, there is little behaviour change and a lack of low carbon emissions technology development. This leads to a continued and increasing level of fossil fuel use, strong globalisation, increasing consumption and materialism. The impact of these activities continues to drive emissions higher throughout the remaining 21st century leading to significant materialisation of acute and chronic physical risks. In the first half of the 21st century this physical risk sees increasing severity of extreme weather which is accompanied by rising sea levels in the latter half of the 21st century. This threatens coastal developments worldwide, placing pressure on global relations. Overall, this scenario represents a low transition risk and a high level of physical risk when compared to the other scenarios.

The following table summarises the various scenario parameters under this Hothouse scenario narrative.

ENVIRONMENTAL OUTCOMES	EMISSION PATHWAYS
Average temperature increase • Domestic: +3.0°C (min 2.0, max 4.6) by 2100 (NIWA) • Global: +4.4°C (min 3.3, max 5.7) by 2100 (IPCC)	Net Emissions • Domestic: 62MtCO_2e by 2030, 35MtCO_2e by 2050 (CCC) • Global: NGFS Current Policies (Hothouse) • 38.6 BtCO_2e by 2030, 34.3 BtCO_2e by 2050 using GCAM5.3+ (NGFS)[17]
ECONOMIC OUTCOMES	**SOCIAL OUTCOMES**
GDP (GDP % change due to chronic physical risk, acute impacts are excluded from this figure and would further negatively impact GDP) • Global: US$ 175 trillion (-1.6%) in 2030, US$ 273 trillion (-5.7%) in 2050[18] (NGFS) • NZ: NZ$ 329 billion (-0.7%) in 2030, NZ$ 475 billion (-2.6%) in 2050[19] (NGFS)	Population • Global: 8.2 billion by 2030, 8.6 billion by 2050 (IPCC)
POLICY OUTCOMES	**TECHNOLOGY OUTCOMES**
Carbon Price • Domestic: NZ$35 in 2035, NZ$35 in 2050 (CCC) • Global: US$6 in 2030, US$6 in 2050 (NGFS)	Percent of Renewable Electricity of Total Electricity Produced • Domestic: 93% by 2030, 94% by 2050 (CCC) • Global: 42% by 2030, 60% by 2050 (IEA) Percent of Renewable Energy of Total Energy Produced • Domestic: 48% by 2030, 61% by 2050 (CCC) • Global: 16% by 2030, 26% by 2050 (IEA)

Table 18: Scenario parameters under a Hothouse scenario[16]

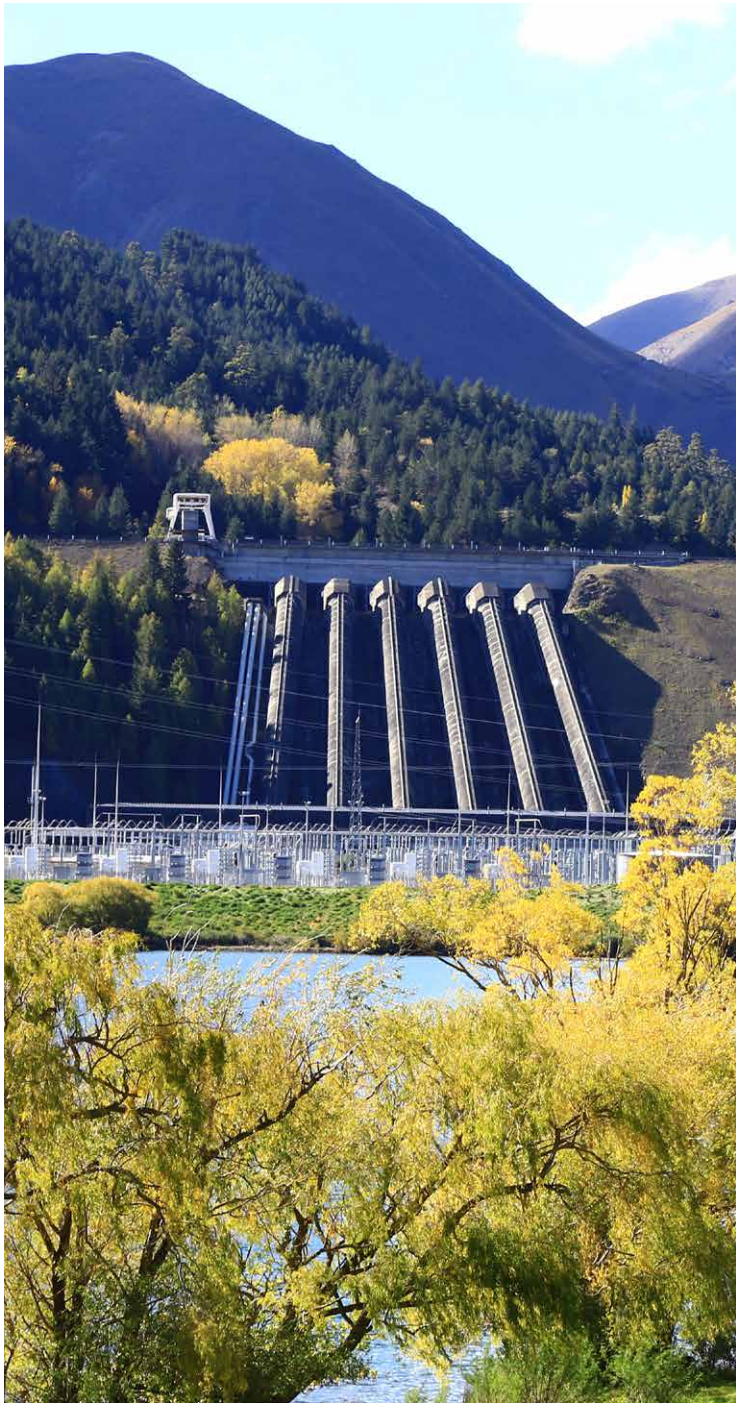
15 Refer to Appendix B for source data for these assumptions
16 NGFS has three different global projections available, with all having validity and robustness, GCAM5.3+ was selected for consistency. For information on differences, please see NGFS FAQ
17 Provided in % difference, 2017 PPP, US$
18 Provided in % difference, 2009 prices; NZ$

4.3.2 Datasets aligned with scenario dimension

Scenario narratives aligned with a Hothouse scenario are summarised in Table 19 below.

	SCENARIO	DESCRIPTION
HOTHOUSE	IPCC SSP5-8.5	SSP5-8.5 is the fossil fuelled development path scenario. This scenario sees a focus on immediate economic growth, with strong GDP growth, increase in materialism, meat consumption and minimal environmental policy. In response, the emissions are forecast to be the highest, with greatest climate variability across all climate variables expected. The lack of focus on emissions reductions means CDR sees little to no deployment across the globe.
	NGFS 'Current Policies'	Current Policies assumes that only currently implemented policies are preserved, leading to high physical risks. Slow technology uptake and low CDR activity.
	IEA STEPS	STEPS reflects current policy settings based on a sector-by-sector assessment of the specific policies that are in place, as well as those that have been announced by governments around the world.
	NIWA RCP8.5	The NIWA scenarios leverage the IPCC's RCP modelling of varying levels of GHG concentrations on the earth's climate system. NIWA downscales the global models in order to study how these different atmospheric concentrations of GHGs might influence the New Zealand climate. As with RCP 8.5, NIWA RCP 8.5 represents a world where carbon dioxide (CO_2e) emissions continue to rise throughout the 21st century. RCP 8.5 is the worst-case climate change scenario and assumes a world that continues to be fuelled by fossil fuel energy. Average temperature increases under the NIWA scenarios are relative to a 1986-2005 baseline, which differs from the IPCC baseline of 1850-1900. As such, the stated warming at various future points in time are lower in NIWA's scenarios than they are in the IPCC scenarios.
	CCC 'Current policy reference'	An estimation of NZ's emission profile if we carry on our current trajectory from a behavioural, technology, and policy perspective.

Table 19: Overview of the Orderly scenario narratives



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4.3.3 Drivers of change

Emissions pathway

The Hothouse scenario shows minimal change in global emissions, as seen in the figure below, with a slight increase projected between 2020-2025, and then gradually decreasing. Overall, emissions reduce at an average of 0.4% per annum, leading to a 11% reduction in net emissions in 2050 compared to 2020. This reduction leads to net emissions being 34.3BtCO_2e in 2050, well short of net zero (NGFS, 2023).

Environmental

The lack of action towards climate change allows for GHG emissions to continue to rise unabated through the remainder of the century, leading to severe physical risk. A leading driver of this physical risk is the increase in global average temperature, which reaches 2.4°C in the medium term, climbing to 4.4°C by 2100 (IPCC, 2021a). In New Zealand temperatures have increased, on average, by 1.0°C (min 0.5, max 1.7) by 2050 and 3.0°C (min 2.0, max 4.6) by 2100 (NIWA, 2023).

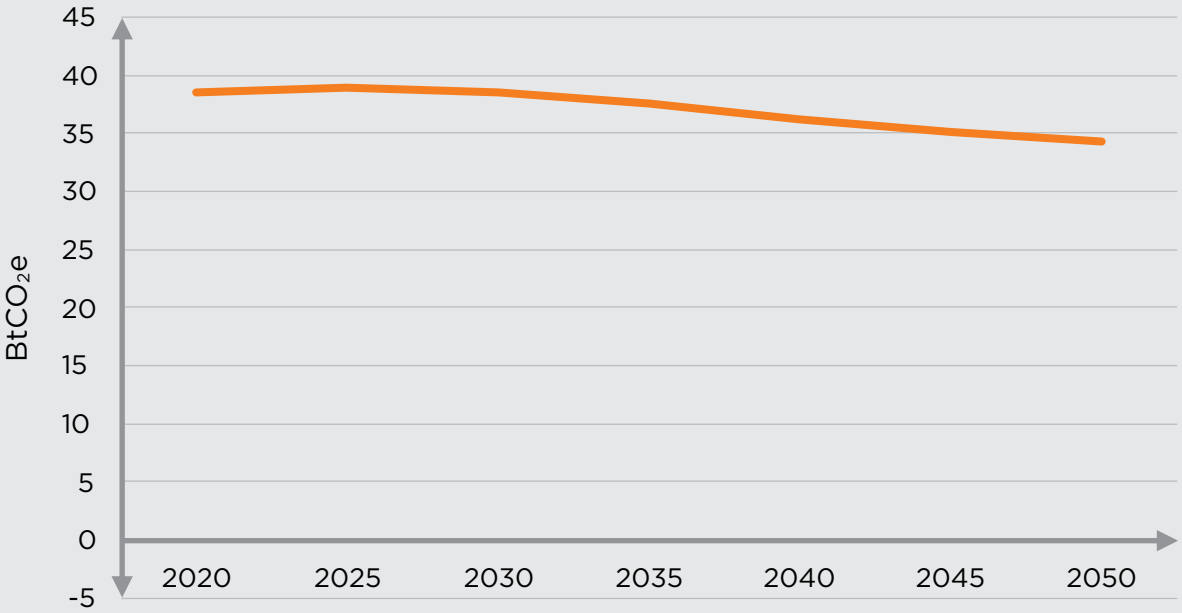


Figure 11: Hothouse global emission pathway using NGFS data

The variability of climate changes across the country increases over time. In the long term, New Zealand sees large precipitation changes, such as on the West Coast in the winter season, where area-average increases of up to 40% are experienced (MfE, 2018). The long term also brings an overall increase in drought intensity that manifests in several ways. The north and east of the North Island experience an increase in dry days and lower rainfall levels (MfE, 2018). This coincides with an average increase of 50mm in the July-June potential evapotranspiration deficit ("PED"), with the biggest changes arising in the northern and eastern North Island and areas to the east of the South Island's main (MfE, 2018). In addition to drought, the level of snowfall reduces, with the number of snow days decreasing by at least 30 days in the long term, reducing the overall snowpack that supplies several lakes and rivers in the South Island (MfE, 2018). As with other physical risks, the high level of emissions has increased the overall impact of sea level rise around the country. The median sea level rise around New Zealand reaches 0.28m in the medium term, increasing to 0.79m in the long term (MfE, 2017). In the medium term, the high frequency of extreme weather events sees coastal areas regularly faced with storm damage.

Globally, under the Hot House World scenario, greater climate fluctuations are predicted compared to both Orderly and Too Little Too Late scenarios (IPCC, 2021a). Global average temperature is increased by 2050 with regions at high latitudes, including the Arctic and northern regions of North America, Europe, and Asia having the most significant temperature increase, with warming forecast to be three times the global average (3-5°C by 2050) (Nazarenko, 2022). Regions that are already prone to water stress, such as parts of the Mediterranean,

the Middle East, southwestern United States, and parts of Africa and Asia, see increased frequency and intensity of both droughts and floods, with Sub-Saharan Africa projected to have a 40% increase in wetness (IPCC, 2021a). Sea level rise of 0.23m by 2050, and 0.77m by 2100 will impact coastal regions (NASA, 2023). SIDS will be severely impacted by the projected sea level rise (IPCC, 2021a). In addition, coastal areas worldwide will face increased risk from storm surges, flooding, and sea level rise. This will result in loss of land, damage to infrastructure, displacement of populations, impacts coastal ecosystems and impact trade routes.

Policy

Early adopters of progressive climate policy, the EU, the UK, the USA, Canada and New Zealand, reverse, revoke or otherwise roll back climate policies. Japan, China, and Australia push pause on further development and implementation of climate policies currently under development. The Paris Agreement fails as NDCs are not met and nations begin to withdraw. By 2050 the carbon price in New Zealand is NZ $35 per tonne of carbon, whilst globally it is even lower at US $6 per tonne of carbon (CCC, 2021a) (NGFS, 2023). Investment in adaptation is minimal.

Social

There is limited behaviour change or social pressure to drive decarbonisation globally. The focus on global growth by any means necessary drives higher rates of economic inequality, increasing political instability and geopolitical tensions around the world. There is an increase in displaced people seeking to migrate to safer living conditions.

In New Zealand over the medium term, the frequency of extreme weather events and rising sea-levels causes economic impacts and disruptions, reducing quality of life. Hydro lake levels reach critically low levels, threatening the reliability of electricity supply to households. Sea-level rise and increased flooding events make coastal properties and those properties in flood plains uninsurable in the short term, and over the long term there is widespread retreat from these areas and homes as they become uninhabitable. This leaves these property owners with significant financial losses. Cities and towns located in areas effected by sea-level rise and extreme weather events see a significant loss of population as people move away from affected areas and towards elevated, inland areas perceived as lower risk. This causes a substantial loss of value for all properties in the areas experiencing population loss, while the areas people are moving to see a significant increase in property values and a housing shortage. Additionally, impacts to the transport network effects the construction and property sector, causing issues with the supply of raw materials to building sites and delaying the construction of new housing, especially in high-demand areas. As a result, building costs rise steadily in the medium term, making it even more challenging to adapt to the housing challenges created by climate change.

Technological

There is an overall lack of technological change to support emissions reduction. By 2050, fossil fuels continue to be the dominant source of primary energy, even after accounting for current technology trends (IPCC, 2021a). This is reflected in renewable energy levels, which only reach 61% in New Zealand

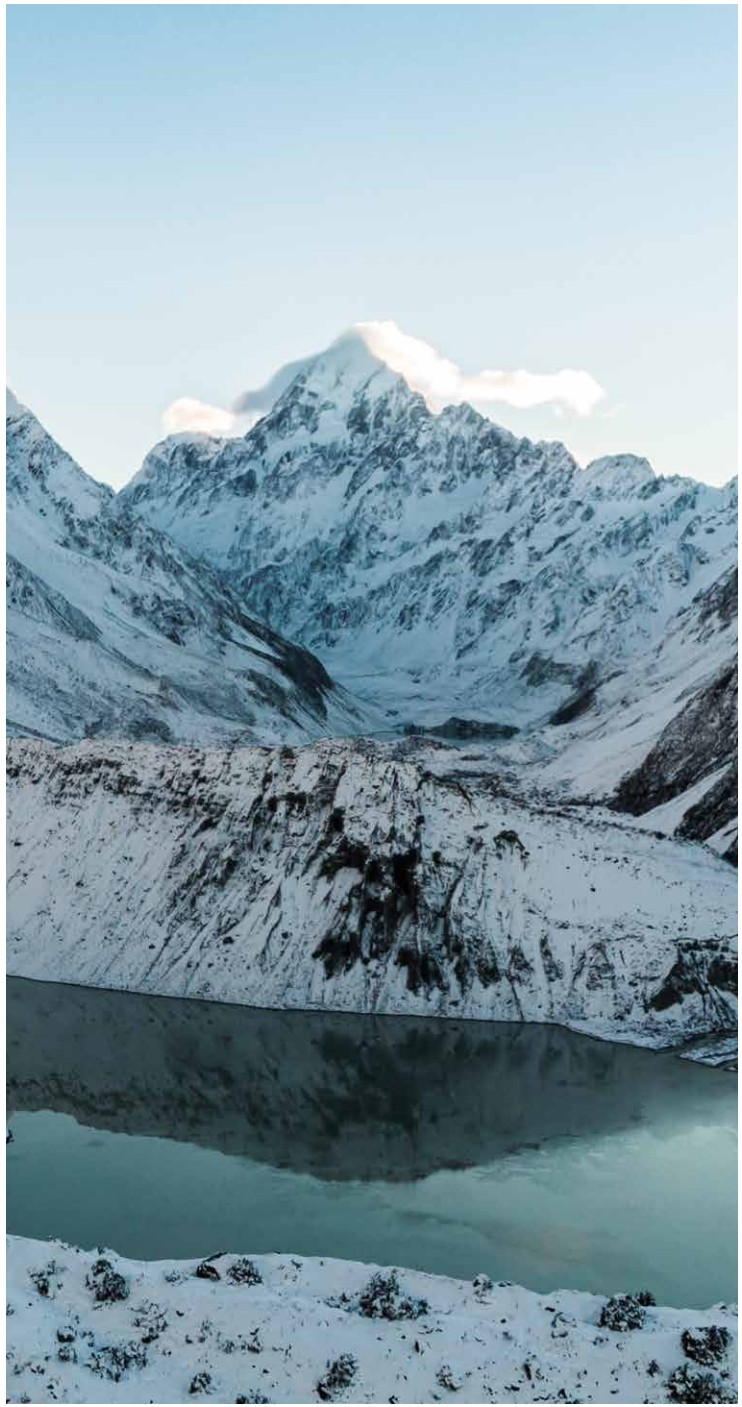
and 26% globally by 2050 (CCC, 2021a; IEA, 2022) (IEA, 2021a). Renewable electricity sourcing in New Zealand, while high by global standards (93%), has only increased by 1% between 2030 and 2050 to reach 94% (CCC, 2021a; IEA, 2022) (IEA, 2021a). Although fossil fuels continue to dominate in the world's energy mix, the level of transport electrification in New Zealand continues to rise out to 2050, with 69% of the national road transport fleet electrified (CCC, 2021a).

Economic

Unabated productivity by emissions intensive industries spur income accumulation within emissions intensive sectors, however surmounting costs from increasingly pervasive chronic physical climate change impacts negatively affect GDP at national and global scales. US$273 trillion is expected by the medium term under this scenario, capturing a decrease of 6% due to chronic physical risk, a difference of US$ 11 trillion when compared to an Orderly scenario (NGFS, 2023)[19]. Acute physical risk events will result in widespread displacement, reduced productivity due to temporary closures of workplaces and income losses from damage to assets. Alongside a reduction in GDP, global population growth exceeds that of the Orderly scenario, with a total of 8.2 billion people in the medium term (IPCC, 2021a).

Agriculture continues to grow using industrial agriculture fuelled mostly by fossil fuel-based fertiliser and machinery. Over the short and medium term, New Zealand's meat and milk solids exports increase from 3 billion kilograms in the short term to 3.1 billion kilograms in the medium term (CCC, 2021a). In the long term, however, the ability for continued growth in the agriculture becomes increasingly difficult due to the impacts of extreme weather around New Zealand. Alternative proteins increase in popularity in the medium and long term, largely due to their lower costs to produce and the ability to improve food security for nations with limited agricultural land (Te Puna Whakaaronui, 2022). A lack of policy support and behavioural change sees alternative protein manufacturing remain a niche industry in New Zealand.

Transport and shipping around the country are also impacted, with flooding and storms damaging transport infrastructure, and restricting the ability for goods to move around the country. This has a flow-on effect on the construction and property sector, causing issues with the supply of raw materials to building sites.



19 Note that this estimate only captures the impacts of chronic physical risks and does not include financial impacts because of acute physical risks.

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4.3.4 Detailed scenario description

Under a Hothouse scenario, the rate of physical risk increases exponentially out to the long term as global emissions continue to rise throughout the century (NGFS, 2023). The lack of action to abate these emissions sees transition risk remain low, even in the long term.

Insurer outcomes

With insufficient global efforts to limit climate change, New Zealand experiences average temperature increases of 1.0°C (min 0.5, max 1.7) by 2050 and 3.0°C (min 2.0, max 4.6) by 2100 (NIWA, 2023). In the long term, New Zealand sees large precipitation changes, such as on the West Coast in the winter season, where area-average increases of up to 40% are experienced (MfE, 2018).The long term also brings an overall increase in drought intensity that manifests in several ways. The north and east of the North Island experience an increase in dry days and lower rainfall levels (MfE, 2018). This coincides with an average increase of 50mm in the July-June PED, with the biggest changes arising in the northern and eastern North Island and areas to the east of the South Island's main divide (MfE, 2018). As a result, there is increased exposure to heat stress in these areas increasing the incidence of cardiovascular and respiratory illnesses as well as skin cancer. There is also an increase in the viability of vector-borne diseases being able to spread disease as the climate becomes warmer and wetter in some areas, increasing the number and incidence of extreme infectious diseases. With a lack of adaptation action and limited technology to mitigate the impact of increased extreme weather events globally, the agricultural sector sees significant

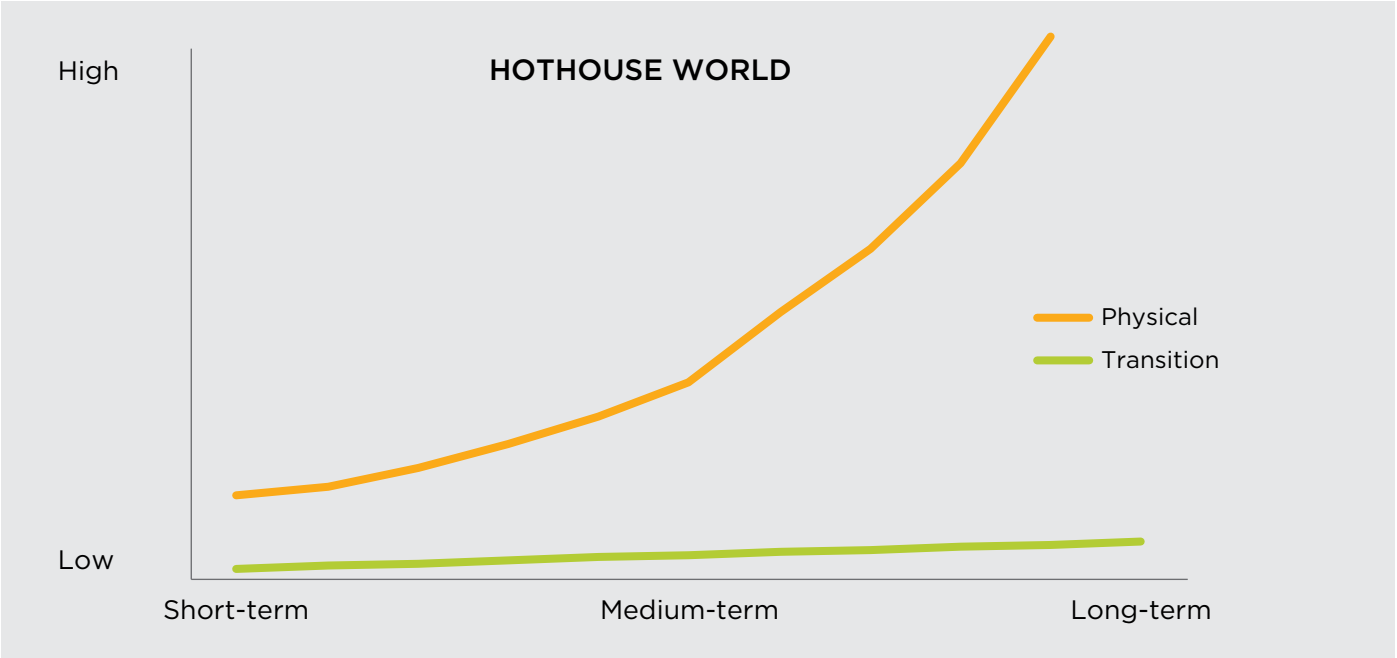


Figure 12: Physical and transition risk out to 2050+ under a, for Hothouse scenario[21]

losses in productivity impacting on food availability and increasing nutritional deficiencies within the New Zealand population. Financial impacts on New Zealanders because of physical climate risk, impacts upon the wellbeing of New Zealanders. Climate anxiety increases as global emissions, average temperatures and extreme weather events all increase in occurrence which impacts upon mental health within the New Zealand population. Health insurers will thus see an inflation in claims which will impact cashflow and the profitability of some products and create challenging moral decisions where climate makes it unprofitable to provide insurance to particular customers, especially where they are vulnerable. Life insurers will see a change in claim distribution as a result of acute physical climate events impacting on cashflow and liquidity and increasing the required capital holding leading to a need to raise premiums or activate other capital management measures. Insurers will need to understand how claims are changing, and to find ways to better assume risks if they are to continue to operate a viable business. Those health and life insurers who spend money early on to conduct research and adopt technology to support this analysis will have advantages over those that do not.

The increased frequency of extreme weather events and rising sea-levels cause economic impacts and disruptions to households. Sea-level rise and increased

20 Physical and transition risk determinations over the short-, medium-, and long-term are based on the general themes in the NIWA and CCC scenarios, literature reviews and stakeholder feedback. Each entity should assess the appropriateness of the risk determination to their analysis.

flooding events make coastal properties and those properties in flood plains uninsurable in the short term, and over the long term there is widespread retreat from these areas and homes as they become uninhabitable. This leaves these property owners with significant financial losses. This will impact upon the financial position of health and life insurance customers and potential customers and therefore their ability or willingness to pay for insurance products. Conversely, the public health system is overwhelmed by climate impacts on health of the population, resulting in long wait times for patients and in some cases inability to access care. This increases the value consumers place on health insurance and will increase the number of new policy sales. Those life and health insurers that act to better assume risks and remain competitive on price will maintain customers and increase new policy writing, whilst those that do not will have deteriorating lapse rates and a reduction in new customers in the short term.

At an operational level, the increase in extreme weather events under the Hot House World scenario will result in disruption to health and life insurers. These events will cause damage to physical assets including offices, equipment, utilities, and other assets or enabling infrastructure, impacting on life and health insurers abilities to operate. Further, employees will be impacted by these events and as a result will not be able to work due to personal impacts or access issues resulting in reduced employee productivity. Together these will act to create a capacity risk, whereby the insurer is unable to service claims in a timely manner impacting upon customer satisfaction. There will be increased expenses too – for example to remediate any issues because of disruption to operations or to contribute towards repair costs for leased buildings and any potential increases in insurance premiums. IFAs will also be affected by extreme weather events impacting upon policy sales. In the long term it will result in the need to develop alternative distribution channels as IFAs are driven out of business and sales reductions are too large. Reinsurers are impacted by the increased frequency and severity of physical climate impacts. This makes it more difficult and expensive for New Zealand based life and health insurers to access reinsurance and therefore transfer risk and provide insurance in a profitable way.

Investment outcomes

Under a Hothouse scenario, it is sectors reliant on specific environmental conditions and those that will have production or service delivery affected because of physical climate impacts that will be most impacted. Specifically, there will be significant impacts on stock and crop quality and yield in the agricultural sector because of the increased frequency of extreme weather events and gradual weather changes such as temperature and precipitation and the impact this will have on stock/crop health, property, plant, and equipment required to run facilities, water and feed access, pest proliferation and infrastructure required

for both downstream and upstream supply chain access. There will also be material impacts to the utilities sector with a risk to potable water supplies (due to changes in rainfall, temperature, drought, extreme weather events and sea-level rise), production of energy (drought impacting hydro) and delivery of other services associated with the sector such as wastewater treatment. Transport infrastructure and services will be affected too. Entities in most sectors will have increased costs, for example repair and remediation costs, reduced productivity and output and thus reduced revenue and profitability, with the listed sectors those that will be most impacted. This will increase the VaR and decrease the value of equities and increase the probability of default, devalue the bond, and decrease the credit quality of corporate bonds. Property assets are also impacted by physical climate risks under this scenario, with increased repairs and maintenance costs, insurance costs and decreasing value of these assets including write-offs and early retirement if in areas significantly impacted, for example on the coast or in a flood plain.

All geographies are affected by physical climate impacts, and these are exacerbated by the lack of investment in adaptation infrastructure made by governments globally over the short and medium term under this scenario. Given the disruption and cost associated with physical climate impacts, financial impacts are felt across all economies, impacting on individuals, businesses, and governments. Food and water shortages and declining health and financial outcomes will drive political unrest and act to further destabilise economies. Individuals will have reduced income impacting upon the performance of sectors such as the consumer discretionary sector and resulting in difficult questions and impacts on margin for sectors providing necessities such as the consumer staples sector, health care sector, communication services sector and utilities sector, where costs increase but the ability for consumers to pay for these is reduced. Governments, which as well as having significant repair and remediation costs associated with physical climate impacts and reduced tax income due to the financial flow on effects, come under increasing pressure to provide financial support to individuals and to support businesses especially those that provide essential services such as communication or utilities, putting them under further strain. In the health sector there will be increased demand due to the health impacts associated with increased physical climate perils and reduced economic stability. Support from governments will be required to enable public health services to continue to serve the needs of a growing and sickening population. As a result, government bonds become riskier, with increased VaR, reduced credit ratings and an increased probability of default.

High-emitting sectors will have increased demand too with increased cooling requirements as a result of increased temperature and therefore energy requirements, an increased need for coal and gas energy because of weather changes impacting upon renewable energy generation and an increased need for fertiliser use to enable food production. Given there is limited by way of climate policy in place, entities in high-emissions sectors will have increased revenue and similar levels of cost to other entities. This will drive increased value of equities and corporate bonds in these sectors.

Table 20 provides an overview of the impact of underlying physical risks to different sectors, whilst Table 21 provides an overview of the impact of underlying transition risks to different sectors under a Hothouse scenario.

Sector	Disruption to ability to provide services or product (at a cost consumers can afford)	Stranded assets	Disruption to supply chain	Disruption to business operations	Reduced demand for services/products	Increased demand for services/products
Agriculture	🟢	🟠	🔵	🔵	🔵	🔵
Communication Services Sector	🟢	🟠	🔵	🟢	🔵	🔵
Consumer Discretionary Sector excl. Transport	🟠	🟠	🟠	🟠	🟢	🔵
Consumer Staples Sector excl. Agriculture	🟢	🟠	🟢	🟠	🔵	🔵
Energy Sector	🟢	🟠	🟠	🟢	🔵	🟠
Financial Sector	🟠	🟠	🔵	🟠	🟢	🔵
Health Care Sector	🟢	🟠	🟠	🔵	🔵	🟢
Industrials Sector excl. Transport	🔵	🟠	🟠	🟢	🔵	🔵
Transport	🟢	🔵	🟠	🟢	🔵	🔵
Information Technology Sector	🟢	🟠	🟠	🟠	🔵	🔵
Materials Sector	🔵	🟠	🟠	🟢	🔵	🔵
Real Estate Sector	🔵	🟢	🟠	🟠	🔵	🔵
Utilities Sector	🟢	🟢	🟠	🔵	🔵	🟠

🟢 Very likely to be present under the relevant scenario

🟠 Likely to be present under the relevant scenario

🔵 Not likely to be present under the relevant scenario

Table 20: Physical risks to sector under a Hothouse scenario

Sector	Stranded assets	Stakeholder preference change	Regulatory / policy impacts	Litigation risk	Emissions pricing impacts	Technology availability	Ability for customers to afford services/products
Agriculture	Likely	Likely	Likely	Likely	Likely	Likely	Not likely
Communication Services Sector	Not likely	Likely	Likely	Likely	Likely	Not likely	Likely
Consumer Discretionary Sector excl. Transport	Not likely	Likely	Likely	Likely	Likely	Not likely	Likely
Consumer Staples Sector excl. Agriculture	Not likely	Likely	Likely	Likely	Likely	Not likely	Likely
Energy Sector	Likely	Likely	Likely	Likely	Likely	Not likely	Not likely
Financial Sector	Not likely	Likely	Likely	Likely	Likely	Likely	Likely
Health Care Sector	Not likely	Likely	Likely	Likely	Likely	Not likely	Likely
Industrials Sector excl. Transport	Not likely	Likely	Likely	Likely	Likely	Likely	Not likely
Transport	Likely	Likely	Likely	Likely	Likely	Likely	Likely
Information Technology Sector	Not likely	Likely	Likely	Likely	Likely	Not likely	Not likely
Materials Sector	Not likely	Likely	Likely	Likely	Likely	Likely	Not likely
Real Estate Sector	Not likely	Likely	Likely	Likely	Likely	Not likely	Likely
Utilities Sector	Likely	Likely	Likely	Likely	Likely	Likely	Likely

Very likely to be present under the relevant scenario

Likely to be present under the relevant scenario

Not likely to be present under the relevant scenario

Table 21: Transition risks to sector under a Hothouse scenario

Table 22 provides an overview of the impact of underlying physical risks to different geographies, whilst Table 23 provides an overview of the impact of underlying transition risks to different geographies under a Hothouse scenario.

Geography	Wildfire	Water Stress & Drought	Sea Level Rise	Increase in Mean temperature	Flood
Africa	Likely	Very likely	Likely	Very likely	Very likely
America excl. USA and Canada	Likely	Very likely	Very likely	Very likely	Very likely
Asia excl. China and Japan	Likely	Very likely	Very likely	Very likely	Very likely
Australia	Very likely	Very likely	Very likely	Very likely	Very likely
China	Likely	Very likely	Likely	Very likely	Very likely
EU	Very likely	Very likely	Very likely	Very likely	Likely
Europe excl. EU and UK	Very likely	Very likely	Very likely	Very likely	Likely
Japan	Likely	Likely	Very likely	Very likely	Likely
Middle East	Very likely	Very likely	Very likely	Very likely	Likely
New Zealand	Likely	Very likely	Very likely	Very likely	Very likely
UK	Likely	Very likely	Very likely	Very likely	Very likely
USA and Canada	Very likely	Very likely	Likely	Very likely	Likely

Table 22: Physical risks to geography under a Hothouse scenario

Very likely to be present under the relevant scenario

Likely to be present under the relevant scenario

Not likely to be present under the relevant scenario

Geography	Reliance on emissions intensive sectors	Poor climate policies and commitments and limited stakeholder preference change	Progressive climate policies and commitments and a large amount of stakeholder preference change
Africa	Likely	Likely	Not likely
America excl. USA and Canada	Likely	Likely	Not likely
Asia excl. China and Japan	Likely	Likely	Not likely
Australia	Likely	Likely	Not likely
China	Likely	Likely	Likely
EU	Likely	Not likely	Likely
Europe excl. EU and UK	Likely	Likely	Not likely
Japan	Likely	Likely	Likely
Middle East	Likely	Likely	Not likely
New Zealand	Likely	Not likely	Likely
UK	Likely	Not likely	Likely
USA and Canada	Likely	Not likely	Likely

Table 23: Transition risks to geography under a Hothouse scenario

5

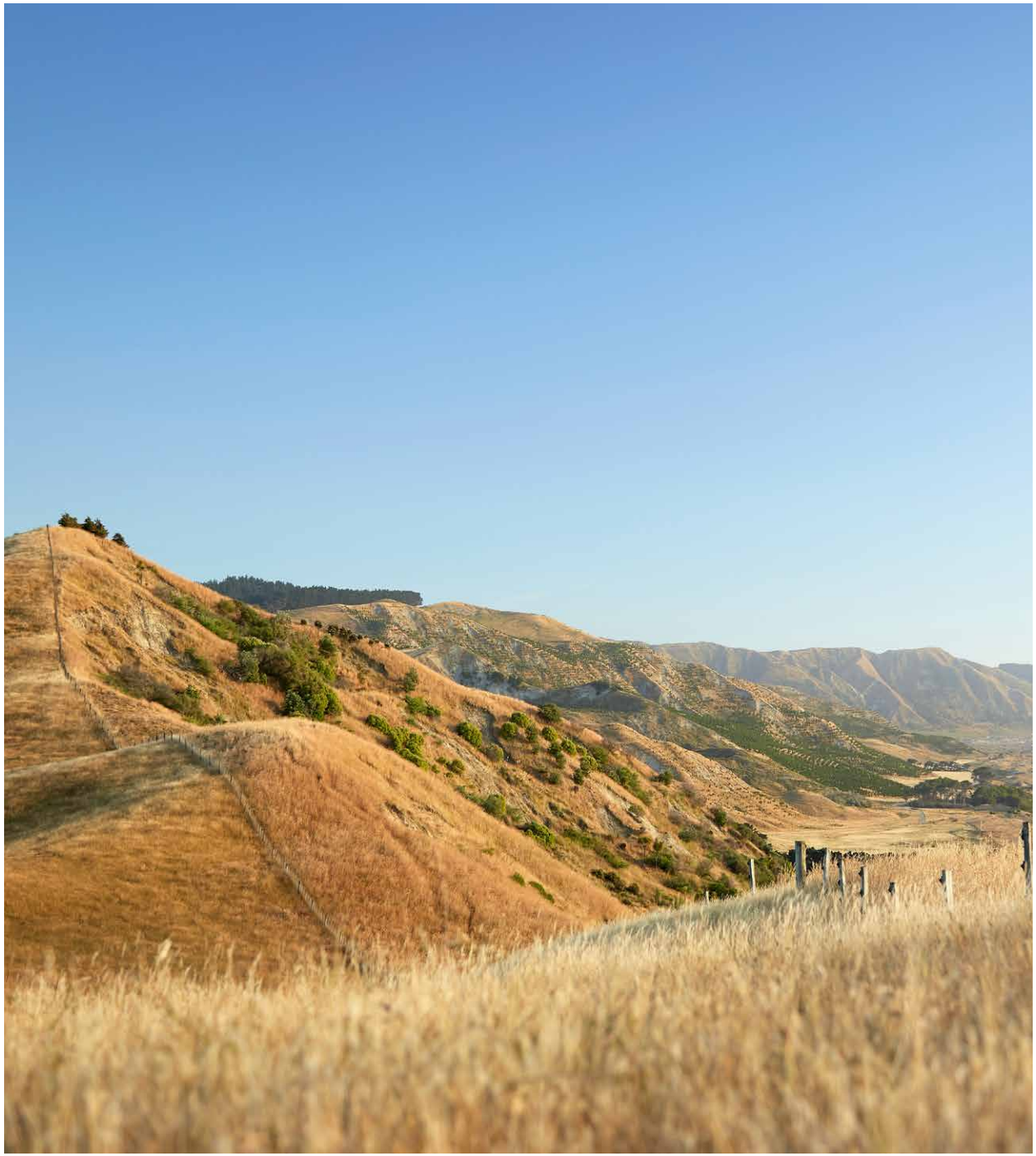
RISKS AND OPPORTUNITIES

RISKS AND OPPORTUNITIES

Insurers and fund managers are exposed to climate-related risk in two key ways – through their products and operations and through the portfolios that they invest in. Generally, fund managers will be required by the NZ CSs to disclose in respect of the Registered Investment Scheme(s) under their management which meet the legislation's definition of 'Large', as opposed to disclosing the impacts of climate change on their own operations. Given this, key product and operational risks have only been identified for insurers through this work as fund managers will generally not be required to disclose these risks, with the portfolio-level risk far exceeding the product or operational risk. An approach to enable fund managers and insurers to identify climate-related risks at the portfolio level has been developed through this work and can be applied by both insurers and fund managers. Additionally high-level opportunities have been identified for both insurers and fund-managers, per Section 5.3 the decision to keep these high-level was made due to competition issues. Figure 13 provides a summary of the key components of climate-related risk for fund managers and insurers.

CLIMATE RISK	
PORTFOLIO LEVEL	**PRODUCT / OPERATIONAL LEVEL**
How climate-change impacts underlying investments and thus the investment portfolio and scheme.	How climate-change impacts product characteristics, demand and profitability and the entities operations.

Figure 13: Insurer and fund manager climate-risk components



5.1 AN APPROACH TO ASSESS PORTFOLIO LEVEL CLIMATE RISK

An approach was developed to support fund managers and insurers to break their investment portfolios down into their component parts and therefore identify their portfolio-level climate-related risks. The disaggregation method determined three key attributes driving climate risk to entities invested in and therefore the portfolio – sector, geography, and asset class. Key risks and their impacts on the entities invested in were identified for each sector, geography and asset class determined to be relevant. Impacts to the portfolio as a result of these were then identified. Figure 14 outlines the key climate-related risks, transmission channels and their impacts on the portfolio.

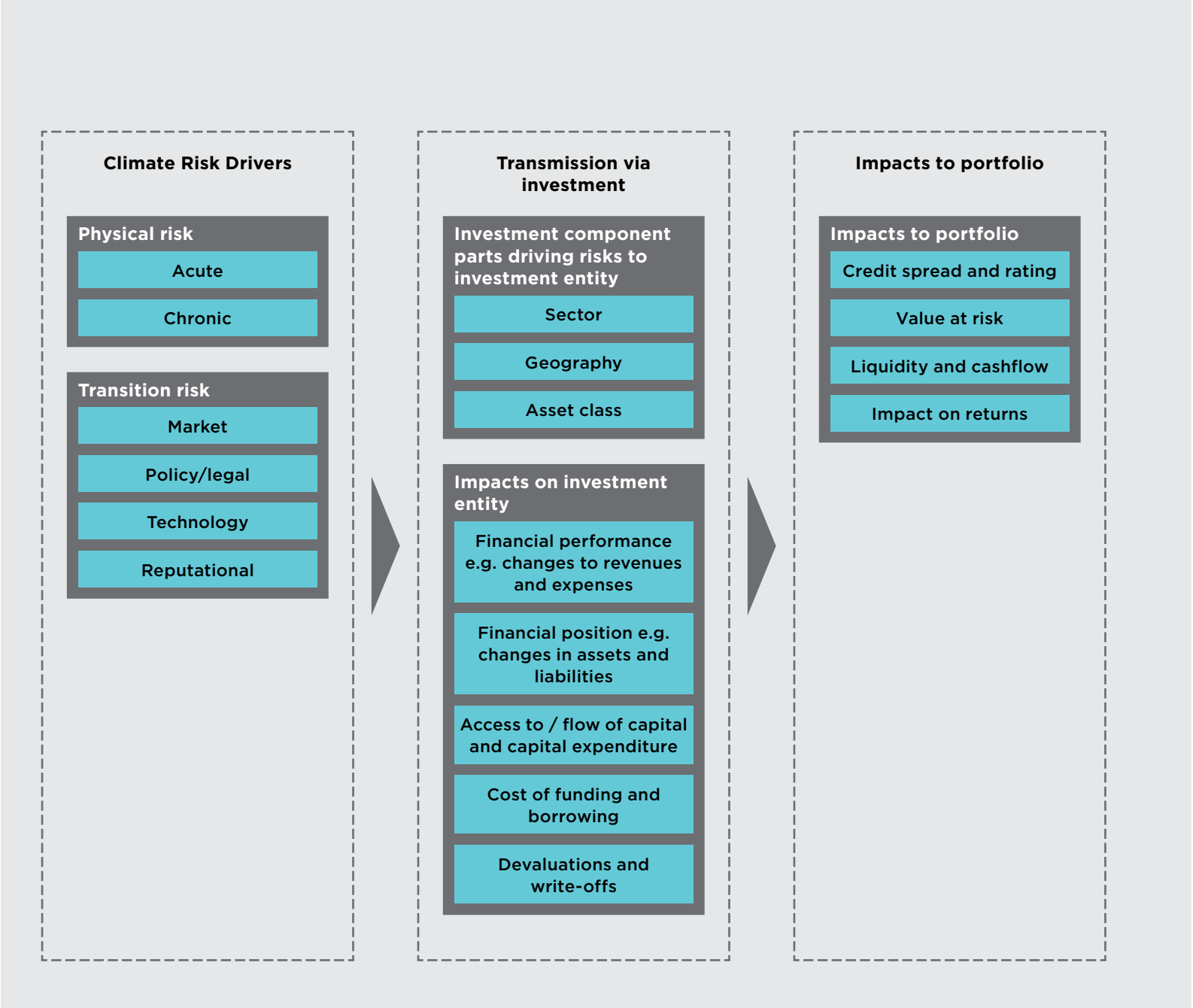


Figure 14: Key climate-related risks, transmission channels and their impacts on the portfolio

The eleven Global Industry Classification Standard ("GICS") sectors were used as a starting point to determine sectors for inclusion. Two modifications were made to enable focus on sectors most exposed to climate-related risks – Agriculture has been included as its own sector and removed from Consumer Staples and Transport has been included as its own sector and removed from the Industrials sector. The asset classes prescribed by the KiwiSaver (Periodic Disclosure) Regulations 2013 Act were used as a starting point to determine asset classes for inclusion with minor modifications – removing geography from asset class, splitting fixed interest investments into sovereign and corporate bonds, and merging listed and unlisted property into one asset class – property. The geographies were determined by analysing reporting by fund managers of investment geographies and through workshopping with members. Figure 15 provides a summary of the disaggregation method and the sectors, geographies and asset classes included.

To determine key portfolio-level climate risks, fund managers and insurers could first determine their key investment geographies, sectors, and asset classes. The key geography, sector and asset class risks and the impact these will have at the portfolio-level and to the fund manager / insurer can then be identified using the risk database workbook provided to members.

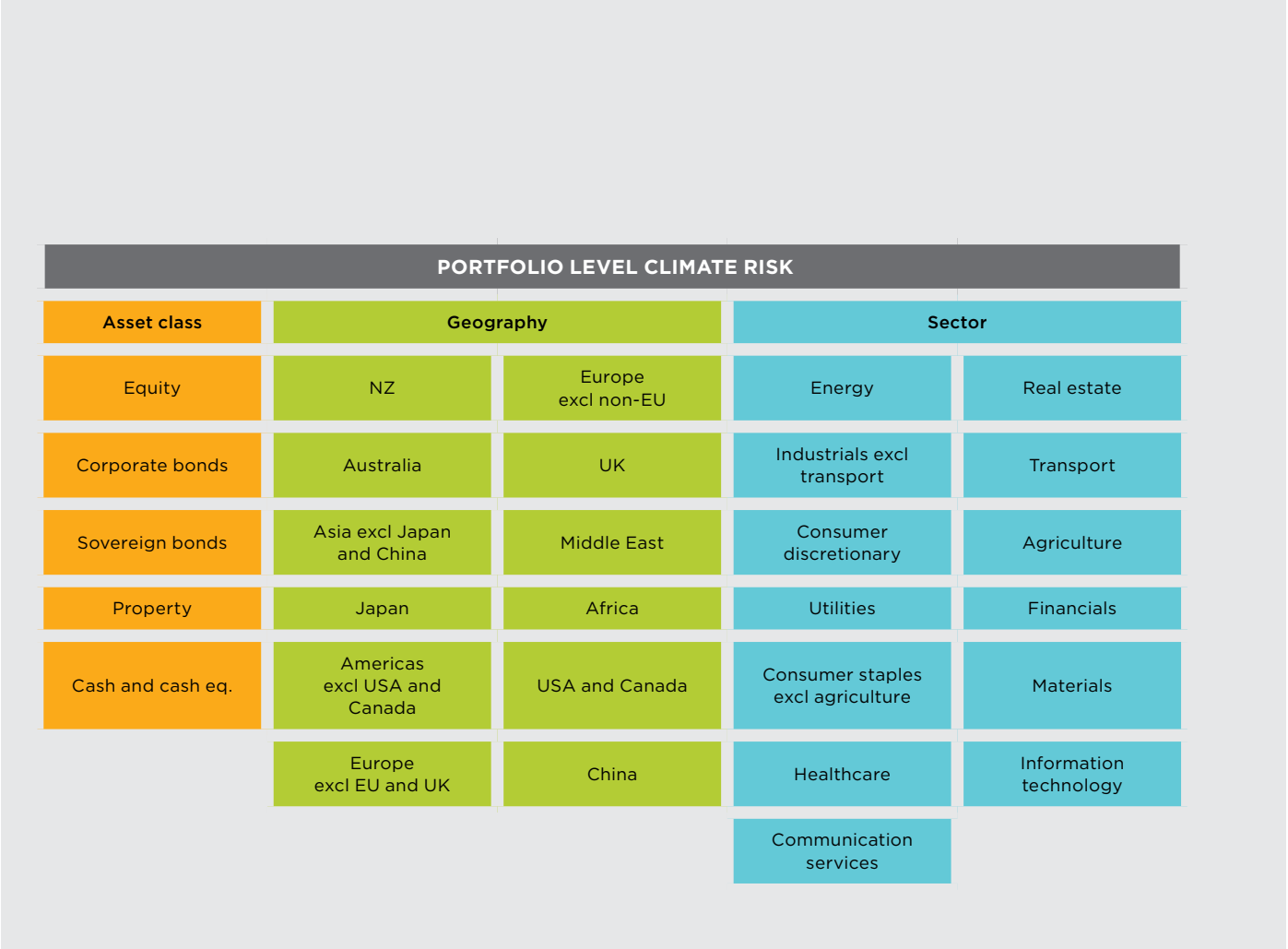


Figure 15: Portfolio-level climate risk attributes

5.2 KEY CLIMATE-RELATED PORTFOLIO RISKS FOR INSURERS AND FUND MANAGERS

Key risks for sectors and geographies can be found in Tables 24 and 25 below whilst the portfolio impacts of these risks by asset class and their impacts on investment entities can be found in Table 26.

	Wildfire	Water stress and drought	Sea level rise	Flood	Increase in mean temperature	Physical risk impacting government	Slow transition	International markets shift away from emissions intensive sectors	Poor climate policies and commitments	Large amount of policy intervention	Transition risk impacting government	Migration driven by physical climate perils	Political unrest driven by physical climate perils
Africa	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
America excl. USA and Canada	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Asia excl. China and Japan	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Australia	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
China[22]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
EU	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		
Europe excl. EU and UK	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
Japan[22]	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		
Middle East	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
New Zealand	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		
UK	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		
USA and Canada	✓	✓	✓		✓	✓	✓	✓		✓	✓		

Table 25: Key physical and transition risk by geography

21 We note that both poor climate policies and commitments and large amount of policy intervention have been included as risks for China and Japan. This is because it is hard to predict which way their policy will go and therefore, they could be exposed to either of these risks.

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SECTOR	CLIMATE DRIVER		
	PHYSICAL RISK	TRANSITION RISK	BOTH A PHYSICAL AND TRANSITION RISK
Agriculture	• Impacts on stock and crop quality and yield	• Stakeholder preferences (including customer, investor, and employee). • Regulatory/ policy impacts • Increased carbon price • Litigation risk • Adoption/ implementation	• Stranded assets (farms, manufacturing plants)
Communication Services Sector	• Disruption to services (telecom, internet, and data centres) • Disruption to business operations (media and entertainment)	• Stakeholder preferences (including customer, investor, and employee) • Regulatory/ policy impacts • Increased carbon price • Litigation risk • Adoption/ implementation	• Economic impacts on customers
Consumer Discretionary Sector excl. transport	• Stranded assets (hotels, restaurants, leisure facilities, retail facilities) • Disruption to manufacturing operations and supply chain • Disruption to business operations and ability to service customers (hotels, restaurants, leisure facilities, retail facilities)	• Stakeholder preferences (including customer, investor, and employee) • Regulatory/ policy impacts • Increased carbon price • Litigation risk • Adoption/ implementation	• Economic impacts on customers
Consumer Staples Sector excl. agriculture	• Disruption to business operations and ability to service customers (retail facilities) • Disruption to manufacturing operations and supply chain • Stranded assets (retail facilities, manufacturing facilities)	• Stakeholder preferences (including customer, investor, and employee) • Regulatory/ policy impacts • Increased carbon price • Litigation risk • Adoption/ implementation	• Economic impacts on customers
Energy Sector	• Disruption to coal mine operations including supply chain • Disruption to oil and gas operations including supply chain • Environmental damage	• Stakeholder preferences (including customer, investor, and employee) • Regulatory/ policy impacts • Increased carbon price • Litigation risk • Adoption/ implementation	• Stranded assets (mines, rigs, refineries)
Financial Sector	• Disruption to business operations • Stranded assets (branch facilities, offices)	• Stakeholder preferences (including customer, investor, and employee) • Regulatory/ policy impacts • Increased carbon price • Litigation risk • Adoption/ implementation	• Economic impacts on customers

Table 24: Key physical and transition risk by sector

	PHYSICAL RISK	TRANSITION RISK	BOTH A PHYSICAL AND TRANSITION RISK
Health Care Sector	• Disruption to provision of care • Stranded assets (medical facilities, manufacturing facilities) • Impacts on demand for care	• Stakeholder preferences (including customer, investor, and employee) • Regulatory/ policy impacts • Increased carbon price • Litigation risk • Adoption/ implementation	• Economic impacts on customers
Industrials Sector excl. transport	• Disruption to manufacturing operations and supply chain • Disruption to business operations (commercial and professional services) • Stranded assets (manufacturing plants, offices)	• Stakeholder preferences (including customer, investor, and employee) • Regulatory/ policy impacts • Increased carbon price • Litigation risk • Adoption/ implementation	
Information Technology Sector	• Disruption to services (software and information technology) • Stranded assets (manufacturing plants, information system infrastructure) • Disruption to manufacturing operations and supply chain	• Stakeholder preferences (including customer, investor, and employee) • Regulatory/ policy impacts • Increased carbon price • Litigation risk • Adoption/ implementation	
Materials Sector	• Disruption to manufacturing operations and supply chain • Stranded assets (manufacturing plants)	• Stakeholder preferences (including customer, investor, and employee) • Regulatory/ policy impacts • Increased carbon price • Litigation risk • Adoption/ implementation	
Real Estate Sector	• Stranded assets • Disruption to business operations (real estate operation) • Increased energy requirement to maintain optimal temperatures in managed real estate • Disruption to construction operations including supply chain (real estate development)	• Stakeholder preferences (including customer, investor, and employee) • Regulatory/ policy impacts • Increased carbon price • Litigation risk • Adoption/ implementation	
Transport	• Disruption to manufacturing operations and supply chain • Damage to transport infrastructure • Disruption to transport services	• Stakeholder preferences (including customer, investor, and employee) • Regulatory/ policy impacts • Increased carbon price • Litigation risk • Adoption/ implementation	• Economic impacts on customers
Utilities Sector	• Impacts on production of energy • Impacts on transmission of energy • Impacts on demand for energy • Impacts on availability and quality of potable water • Impacts to wastewater and stormwater systems • Impacts on demand for water	• Stakeholder preferences (including customer, investor, and employee) • Regulatory/ policy impacts • Increased carbon price • Litigation risk • Adoption/ implementation	• Economic impacts on customers • Stranded assets (power plants, water facilities)

ASSET CLASS	IMPACT TO PORTFOLIO			
	Credit spread and rating	VaR	Liquidity and cashflow	Impact on returns
Sovereign Bonds	• Devaluation of the current Government bonds held in the portfolio • Increased yield of future bonds if purchased after yield increased • Decreased credit quality of portfolio	• Increased VaR.	• Increased probability of default could impact portfolio's expected cash reserve/cash flow and liquidity and likely increase the required capital holding leading to a need to raise premiums or activate other capital management measures • Increased difficulty to sell bonds (and at a reduced price) • Inflationary pressures can increase claim pay-out price, while long term fixed incomes may have lower yields increasing risk of asset/ liability mismatch	• Devaluation of portfolio's current bonds • Increased yield of future bonds if purchased after yield increased • Penalised yield
Equities	N/A	• Increased VaR.	• Decrease in dividends could impact portfolio's expected cash reserve/cash flow and impact fund distributions to investors. • Increased difficulty to sell shares (and at a reduced price) especially for high emitters	• Decrease in portfolio book worth • Decrease in fund unit prices due to underlying equities decreasing in value • Reduced earnings growth and share price over time
Cash and cash equivalents	N/A	• Increased VaR	• Increased cash flow volatility and liquidity issues at the entity level could impact portfolio's expected cash reserve/cash flow and liquidity and likely increase the required capital holding leading to a need to raise premiums or activate other capital management measures • Inflationary pressures can increase claim pay-out price, while interest income may have lower yields increasing risk of asset/ liability mismatch	• Inflation acts to devalue current cash assets • Increased likelihood of interest not being paid impacting on returns
Corporate bonds	• Devaluation of issuer's current bonds could cause credit spreads to widen further • Decreased credit quality of portfolio	• Increased VaR.	• Increased probability of default could impact portfolio's expected cash reserve/cash flow • Increased difficulty to sell bonds (and at a reduced price)	• Devaluation of portfolio's current bonds. • Increased yield of future bonds if purchased after yield increased • Credit spread deterioration
Property	N/A	• Increased VaR.	• Decrease in dividends could impact organisation's expected cash reserve/cash flow • Increased difficulty to sell property related investments (and at a reduced price)	• Decrease in portfolio book worth

Table 26: Summary of key portfolio impacts as a result of climate change

5.3 KEY CLIMATE-RELATED PRODUCT/OPERATIONAL RISKS FOR INSURERS

Life and health insurers are exposed to climate-risk through their products – for example climate-change impacts morbidity and mortality rates and therefore claim distribution, frequency, and value. Key product and operational risks for these insurers are detailed in Table 27 below. Each member entity could identify the likelihood and consequence of the risks and potential impacts outlined below specific to their operations, products, and investment portfolios. Controls could then be identified to determine the residual risk level.

Table 27: Key product and operational risks for life and health insurers

CATEGORY	SUB-CATEGORY	CLIMATE DRIVER	RISK	IMPACT INDICATORS AND FINANCIAL IMPACT TO INSURERS
Physical	All	Impacts on health of customers	• Prolonged exposure to warming environment could cause increased morbidity e.g., cardiovascular, and respiratory illnesses, increased incidence of skin cancer, increased exposure to heat stress, impacting on the number and costs of claims • Agricultural impacts adversely affect diet and nutrition, impacting on customer health and number and cost of claims. • Rise of climate anxiety impacting on mental health and the number of claims • Increase in the number of extreme infectious diseases and pandemics impacting on health and claims • Second-order impacts, such as potential declines in economic growth, population migration, geopolitical conflict, etc may also impact on the health of customers and thus number of claims	• Inflation of claims impacting cashflow and the profitability of some products • Increase in expenditure to service customers where customer vulnerability has increased e.g., mental health or due to increase in claims • Increase in expenditure to develop ways to price climate risks into premiums and potentially develop new products • Reputational/conduct risk if some premiums for specific occupations increase significantly or render the person uninsurable e.g., outdoor work at higher risk of skin cancer, heat stress and respiratory disease due to physical climate impacts
Physical	All	Impacts on mortality	• Number of deaths due to certain unexpected physical climate events impacts on the timing and number of claims. • Health conditions (see risk above) as a result of climate change impacts on mortality and timing of claims	• Change in claim distribution impacting on cashflow and liquidity and likely increase the required capital holding leading to a need to raise premiums or activate other capital management measures • Increase in expenditure to develop ways to price climate risks into premiums and potentially develop new products
Physical	All	Impacts on finances of customers / potential customers	• Second order effects of climate-change such as job-loss, potential declines in economic growth, population migration, geopolitical conflict etc may affect financial position and vulnerability of customers/potential customers and their ability or willingness to pay for insurance products	• Increase in customer policy lapses and reduced number of new customers decreasing revenue • Reputational and conduct risk where the insurance sector not seen as supporting customers/making insurance accessible in worsened market conditions • Increase in expenditure to develop ways to better assume risks and lower prices

CATEGORY	SUB-CATEGORY	CLIMATE DRIVER	RISK	IMPACT INDICATORS AND FINANCIAL IMPACT TO INSURERS
Physical	All	Disruption to business operations	• Increase in extreme weather events causing damage to physical assets including offices, equipment, utilities, and other assets or enabling infrastructure (data centres) causing disruption to operations • Increase in extreme weather events impacting on employee's ability to work or access customers for claims management causing disruption to operations • Impacts to health of employees through heat stress, rise in infectious diseases, poorer water quality and injury in extreme weather events impacting on ability to work	• Decrease in revenue due to disruption to operations including sick leave and lower employee productivity • Decreased customer satisfaction, leading to increased lapses impacting revenue • Increase in operational expenditure to cover repair costs and any potential increase in insurance premium • Increased expenditure to remediate any issues as a result of disruption to operations i.e., claims processing • Increased expenditure on air conditioning (demand, exacerbated by increased carbon price)
Physical	All	Value/supply chain impacted by physical events impacting customer experience	• Climate change disrupts suppliers (including data centres) and ability to get products required to operate • Reliance on face-to-face or branch distribution channels e.g., by IFA partners could be disrupted by physical impacts and reduce the viability of their business • Hospitals and healthcare providers physical assets are impaired or damaged resulting in operational impacts leading to long wait times for service and decreasing customer satisfaction	• Decreased customer satisfaction, leading to increased lapses impacting revenue • Decreased ability to access new customers due to distribution partners being unable to engage with potential customers
Physical	All	Portfolio performance	• If portfolio management has not factored in physical climate risk, assets may not be as liquid as anticipated (e.g., bonds), may be devalued (e.g., cash through inflation) and the probability of default may increase • Additionally if physical climate risk has not been factored into estimating mortality rates, then the matching of maturity of assets against claims may be impaired • Dividends and credit ratings also impacted	• Increased probability of default and decreased liquidity and value of assets could impact organisation's expected cash reserve/cash flow and liquidity and likely increase the required capital holding leading to a need to raise premiums or activate other capital management measures • Inflationary pressures e.g., due to disrupted supply chains can increase claim pay-out price, while long term fixed incomes may have lower yields increasing risk of asset/liability mismatch and therefore likely increasing the required capital holding leading to a need to raise premiums or activate other capital management measures • Changes in claim timing and value likely increase the required capital holding leading to a need to raise premiums or activate other capital management measures (where this has not been factored into investment decisions) • Decreased credit quality of portfolio
Physical	All	Ability to access and cost of reinsurance	• Reinsurers effected by increase in frequency and severity of physical climate impacts making it more difficult or expensive to access reinsurance	• Increase in expenditure as reinsurance premiums increase • Increase in expenditure to develop ways to assume risks where these cannot be reinsured

CATEGORY	SUB-CATEGORY	CLIMATE DRIVER	RISK	IMPACT INDICATORS AND FINANCIAL IMPACT TO INSURERS
Transition	Market	Customer/ investor/ distributor / employee preference	• Increasing stakeholder expectation of insurer to be proactive in reducing their emissions, including within their portfolios e.g., in alignment with net-zero strategies, and in addressing their climate-related risks	• Increase in lapses and decrease in new customers decreasing revenue • Increase in expenditure to decarbonise and amend portfolio make up • Increase in difficulty and cost of raising capital • Increase in difficulty to reach new customers through distribution channels e.g., IFA • Decrease in employee attraction and retention where entity not seen to be prioritising this • Increase in recruitment costs • Impacts on quality of service where top talent cannot be retained
Transition	Reputation	Negative media	• Perceived or actual lack of appropriate action towards climate change and/or perceived or actual greenwashing with allegations directed towards entity with widespread media coverage	• Increase in customer policy lapses and decrease in new customers decreasing revenue • Loss of investor confidence increasing difficulty and cost of raising funds • Increase in expenditure to address negative press
Transition	Reputation	Customer / supplier / distributor selection	• Reputational damage by association if corporate customers and/or suppliers and/or distributors, are high emitters or are accused of green washing	• Increase in customer policy lapses and decrease in new customers decreasing revenue • Increase in expenditure to address negative press
Transition	Technology	Adoption / availability	• Technological solutions to help insurers analyse climate risks from an insurance loss perspective are not adopted, not available or not fit for purpose e.g., are not NZ specific • Inadequate investment in technology to assess climate risk in portfolio investments	• Increase in financial losses as unable to properly analyse climate risk and therefore do not hold an adequate amount of capital or price insurance premiums appropriately • Impacts to portfolio performance
Transition	Market	Falling behind competitors	• Risk of falling behind competitors in decarbonising and addressing climate risk	• Decrease in revenue due to loss of market share • Increase in capital expenditure and operational costs as insurers try to catch up to competitors
Transition	Market	Competition risk	• Risk that introducing sustainable products comes at the expense of price and competitiveness	• Reputational and conduct risk where insurer not seen as supporting customers/making insurance accessible in worsened market conditions
Transition	Market	Employee skills	• Employees do not have the skills required to incorporate climate risk in pricing and/or underwriting	• Increase in expenditure to upskill employees/acquire new personnel to incorporate climate risk in pricing
Transition	Market	Ability to service customers	• Second order effects of climate-change such as increased operating expenditure and reporting requirements impact suppliers and partners and therefore ability to and experience of service to customers (including distribution) • The viability of IFA business models are reduced if selling becomes difficult due to economic impacts of climate change on customers reducing ability of insurers to reach customers (vicious cycle) • Increased cost of carbon impacts ability or cost of visiting customers re claims	• Increased operational cost to service customers • Increase in customer policy lapses and decrease in new customers decreasing revenue

CATEGORY	SUB-CATEGORY	CLIMATE DRIVER	RISK	IMPACT INDICATORS AND FINANCIAL IMPACT TO INSURERS
Transition	Market	Customer behaviour change	• Lifestyle changes impact health outcomes and claim patterns e.g., Plant-based diets, transport mode shifts, working from home (mental health)	• Increased operational expenditure to understand how claims are changing • Impacts (either negative or positive) on claims and therefore profitability of products
Transition	Policy and legal	Climate disclosure	• Increasing disclosure requirements, including obligations to align with XRB disclosures and potential Group/parent expectations • Potential for fines or sanctions from regulators if not found to be complying with regulation or legislation	• Impact on reputation and therefore revenue if disclosures are not aligned with customer expectation • Increase in operational costs to meet reporting/disclosure requirements • Increase in operational expenditure to cover the financial losses imposed through the penalties
Transition	Policy and legal	Other climate-related policies and regulation	• Increasing climate-related policies and regulation including building standards, requirements for fleet conversion and adoption of low carbon technology	• Increase in operational costs to comply with policies and regulation • Penalties for non-compliance
Transition	All	Impacts on finances of customers/ potential customers	• Second order effects of climate-change such as job-loss, potential declines in economic growth, population migration, geopolitical conflict etc may affect financial position and vulnerability of customers/potential customers and their ability or willingness to pay for insurance products	• Increase in customer policy lapses and reduced number of new customers decreasing revenue • Reputational and conduct risk where the insurance sector not seen as supporting customers/making insurance accessible in worsened market conditions • Increase in expenditure to develop ways to better assume risks and lower prices
Transition	All	Portfolio performance	• If portfolio management has not factored in transition climate risk, assets may not be as liquid as anticipated (e.g., bonds), may be devalued (e.g., cash through inflation) and the probability of default may increase • Additionally if physical climate risk has not been factored into estimating mortality rates, then the matching of maturity of assets against claims may be impaired • Dividends and credit ratings also impacted	• Increased probability of default and decreased liquidity and value of assets could impact organisation's expected cash reserve/cash flow and liquidity and likely increase the required capital holding leading to a need to raise premiums or activate other capital management measures • Inflationary pressures e.g., due to disrupted supply chains can increase claim pay-out price, while long term fixed incomes may have lower yields increasing risk of asset/liability mismatch and likely increase the required capital holding leading to a need to raise premiums or activate other capital management measures • Changes in claim timing and value likely increase the required capital holding leading to a need to raise premiums or activate other capital management measures, (where this has not been factored into investment decisions) • Decreased credit quality of portfolio

5.4 KEY HIGH-LEVEL OPPORTUNITIES FOR INSURERS AND FUND MANAGERS

For insurers and fund managers that move quickly to understand potential impacts of climate change, there are climate-related opportunities. A high-level list of climate-related opportunities is outlined in Table 28 on page 72. We note that the opportunities have been kept high-level due to competition issues and that more detailed opportunities will be provided in any amended versions of this document.

CATEGORY	SUB-CATEGORY	CLIMATE DRIVER	OPPORTUNITY	IMPACT INDICATORS AND FINANCIAL IMPACT TO FUND MANAGER/ INSURER
Physical and transition	Technology	Integrate climate-risks and opportunities into investment decisions	• Opportunity for portfolio managers to align investments with the transition to a low carbon economy and to increase investments resilience to the physical effects of climate change	• Increase in portfolio returns as investments achieve high profitability • Increase in customers and reduced withdrawal due to increased reputation (low carbon investments) • Increased ability to identify emerging investment opportunities enabling access to emerging climate markets. This leads to a diversification of funds
Transition	Reputation	Lead in the climate change space	• Opportunity to lead on climate change, for example by improving operational efficiency and reducing emissions to net-zero, providing low-emission investment/insurance products and/or products with low climate risk and producing high quality climate-related risk disclosures	• Improved portfolio returns (as above) • Increased attraction and retention of customers especially the younger market, increasing revenue • Increased attraction and retention of staff decreasing operational expenditure and increasing quality of services • Increased attraction and retention of investors increasing equity • Reduced operational costs due to improved energy efficiency
Insurers only				
Transition	Technology	Integrate climate change health impacts into products	• Opportunity to provide products and services related to good health and disease prevention in anticipation of climate change impacts on health	• Increase in new customers as insurer is seen to be helping customers make positive changes for their health • Potential decrease in claim pay-outs due to better health outcomes for customers • Potential for increased data collection through new products to help assist underwriting and pricing increasing accuracy
Physical	Market	Market growth as a result of increased value of health/ life insurance to individuals	• Potential growth to market as value of insurance to customers increases due to climate anxiety, higher incidence of health events associated with physical climate impacts and reduced access to care as the public health system struggles to keep up with demand	• Increased attraction and retention of customers increasing revenue • Potential to increase prices as value to customers grows
Physical and transition	Technology	Understand climate risks from an insurance loss perspective	• Opportunity to price climate-change into premiums to reduce financial losses as a result of incorrect forecast of risk	• Competitive advantage by developing risk models that factor in forecast climate-change impacts on claims
Transition	Reputation	Incentivising partners to reduce emissions	• Actively incentivising low-emission products or low-emission behaviour changes, especially in the health-care sector (i.e., supporting purchases of more energy efficient equipment/ supporting reduction of waste). This can increase the reputation of the insurer and act to reduce scope 3 emissions	• Increase in new customers as insurer is seen to be helping health sector take a positive step for environmental impacts • Potential increase in relationship between health care provider and insurer, flowing on to greater customer satisfaction and in turn, increased retention
Transition	Market	Access to new market and consumers	• Climate change and perception of sustainability is already starting to influence consumers purchasing decisions. There is an opportunity for insurers to tap into this market by being proactive and actioning change to make their businesses sustainable	• Increased attraction and retention of customers especially the younger market, increasing revenue • Increased diversity of consumers

Table 28: Key high-level opportunities for insurers and fund managers

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APPENDIX A

DESCRIPTION OF DOMESTIC AND INTERNATIONAL CLIMATE SCENARIOS

ACRONYM	DESCRIPTION
Intergovernmental Panel on Climate Change ("IPCC")	IPCC scenarios are a combination of Representative Concentration Pathways ("RCP") and Shared Socioeconomic Pathways ("SSPs"). Time horizon associated with these scenarios is 2100, and there is no carbon price explicitly given. The x-y combination accounts for the different socio-economic development assumptions. X represents the SSP scenario outlined, and Y is the radiative forcing level. IPCC use Coupled Model Intercomparison Project ("CMIP") 6 which runs 100 different climate models across the world.
Network for Greening the Financial Systems ("NFGS")	NFGS scenarios use Integrated Assessment Models ("IAMs") and do not have a detailed representation of economic sectors beyond energy and land use. Carbon price is an endogenous variable and has strong carbon dioxide technology assumptions to reduce emissions. As of September 2022, scenarios have been updated to incorporate a range of data on transition risks, physical risks, and economic impacts at a higher sectoral and regional resolution. These have been included to reflect greater regional granularity and capture chronic physical risk in GDP projections for each scenario.
International Energy Agency ("IEA")	The IEA has provided medium to long-term energy projections using the World Energy Model ("WEM") which is a large-scale simulation model designed to replicate how energy markets function. The WEM is the principal tool used to generate detailed sector-by-sector and region-by-region projections for the WEO/IEA scenarios.
National Institute of Water and Atmospheric Research ("NIWA")	Statistical downscaling of IPCC RCP models was used to develop temperature and precipitation projections for New Zealand climate change for up to 41 different global climate models ("GCMs").
Climate Change Commission ("CCC")	The Climate Change Commission ("CCC") modelled long-term scenarios to 2050 and beyond. This involved tailoring different assumptions under Transport, Energy, Industry and Buildings, Land, and the Waste sectors specific to New Zealand and focuses on domestic emissions projections. They incorporated a range of technology, behaviour, and policy assumptions in each scenario.

APPENDIX B

DETAILED SCENARIO INFORMATION

The following table lays out the underlying assumptions for key parameters as provided by the scenarios that make up each scenario narrative. For each parameter, data points from each scenario are provided where they are readily accessible from the scenario documentation. If data was readily available, a Y (yes) response was recorded. Where data was not readily available a N (no) response was recorded. A no response is not a conclusion as to whether the information pertaining to the parameter exists in each scenario and, therefore, should not be used as a conclusive guide for determining data availability.

There are several climate models used by the NGFS and IPCC to calculate the various scenario parameters. To address consistency in calculation of parameters, all NGFS and IPCC data points below have been extracted from the data sets using the Global Change Assessment Model (GCAM). GCAM presents the interactions and behaviour of five systems: energy, water, agriculture and land use, the economy, and the climate to provide a set of global outcomes. GCAM is a dynamic recursive model, meaning it does not know the future state of the world when making decisions about the next period. After it solves each period (e.g., 2025-2030), the model then uses the resulting state of the world, including the consequences of decisions made in that period – such as resource depletion, capital stock retirements and installations, and changes to the landscape – and then moves to the next time step and performs the same exercise. Although both IPCC and NGFS parameter have been extracted using the GCAM model, variances in inputs and model version may still drive difference in the parameter outputs. For further information on GCAM and how it operates, see the NGFS Technical Documentation[22].

The IEA and CCC do not provide the ability to use GCAM with their datasets, instead using their own climate models to produce the various parameters presented in the table below. For more information on the modelling used by each of these organisations see the Global and Climate Model[23] documentation from the IEA and Modelling and Data information from the CCC[24].

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23 IEA. (2022). Global Energy and Climate Model. Retrieved from https://iea.blob.core.windows.net/assets/3a51c827-2b4a-4251-87da-7f28d9c9549b/GlobalEnergyandClimateModel2022Documentation.pdf

24 Climate Change Commission. (2022). Modelling and Data. Retrieved from He Pou a Rangi: Climate Change Commission: https://www.climatecommission.govt.nz/our-work/advice-to-government-topic/inaia-tonu-nei-a-low-emissions-future-for-aotearoa/modelling/

Table 29: Summary of parameter by scenario

	CATEGORY	PARAMETER	SCENARIO	SUMMARY OF PARAMETER			SOURCE
				2030	2050	2100	
ORDERLY	Climate	Total net emissions (for all gases)	CCC Tailwinds	47MtCO₂e	3.8MtCO₂e		(CCC, 2021a)
			NGFS Net Zero 2050	25.9BtCO₂e	-294.82MtCO₂e		(NGFS, 2023)
			IEA NZE	21BtCO₂e	0MtCO₂e		(IEA, 2021a)
			IPCC SSP 1-1.9	42 BtCO₂e	26 BtCO₂e		(Riahi, et al., 2017)
		Gross methane emissions	CCC Tailwinds	24MtCO₂e	13MtCO₂e		(CCC, 2021a)
		Average increase in temperature	NIWA RCP 2.6		+0.7°C(0.4, 1.3)		(NIWA, 2023)
			IEA NZE		+1.5°C(1.4, 1.7)	+1.4°C(1.3, 1.5)	(IEA, 2021a)
			IPCC SSP 1-1.9		+1.6°C(1.2, 2.0)	+1.4°C(1.0, 1.8)	(IPCC, 2021a)
		Precipitation change	NIWA RCP 2.6		Increases in the west of the South Island, decreases north and east of the North Island		(NIWA, 2023)
		Sea level rise	NIWA RCP 2.6		0.23m	0.46m	(NIWA, 2023)
	Socio-economic	GDP	NGFS Net Zero 2050[25]	Global: US$176 trillion (-1.2%) NZ: NZ$ 330 billion (-0.5%)	Global: US$ 289 trillion (2.0%) NZ: NZ$ 485 billion (-0.7%)		(NGFS, 2023)
			IPCC SSP 1-1.9	US$152 trillion	US$284 trillion		(Riahi et al., 2017)
		Population growth	NGFS Net Zero 2050	8.3 billion	9.3 billion		(NGFS, 2023)
			IPCC SSP 1-1.9	8.0 billion	8.5 billion		(Riahi et al., 2017)
		Native forestry land area	CCC Tailwinds	0.24Mha	0.74Mha		(CCC, 2021a)
		Exotic forestry land area	CCC Tailwinds	2.1Mha	2.4Mha		(CCC, 2021a)
		Dairy farming land area	CCC Tailwinds	1.7Mha	1.6Mha		(CCC, 2021a)
		Sheep + Beef farming land area	CCC Tailwinds	7.4Mha	7.1Mha		(CCC, 2021a)
		Horticulture farming land use area	CCC Tailwinds	0.14Mha	0.22Mha		(CCC, 2021a)

25 Data provided in; GDP, (GDP % change due to chronic physical risk)

	CATEGORY	PARAMETER	SCENARIO	SUMMARY OF PARAMETER			SOURCE
				2030	2050	2100	
ORDERLY	Policy	Emissions outcome	CCC Tailwinds	Net zero by 2040			(CCC, 2021b)
			NGFS Net Zero 2050	Net zero by around 2050			(NGFS, 2023)
			IEA NZE	Net zero by 2050			(IEA, 2021a)
			IPCC SSP 1-1.9	Net-zero by around 2050			(IPCC, 2021)
		Carbon price	CCC Tailwinds	NZ$140	NZ$250		(CCC, 2021a)
			NGFS Net Zero 2050	US$124	US$400	US$489	(NGFS, 2023)
			IEA NZE	US$130	US$250		(IEA, 2021b)
			IPCC SSP 1-1.9	US$304	US$650		(Riahi et al., 2017)
	Technology	Transport	CCC Tailwinds[26]	17% electrified	85% electrified		(CCC, 2021a)
			NGFS Net Zero 2050		50% of the global energy supply for buildings, industry and transport is from electricity by 2050		(NGFS, 2023)
			IEA NZE		88% of all transport energy sourced from either electricity, hydrogen, or bio energy by 2050		(IEA, 2022)
		Renewable electricity	CCC Tailwinds	94%	100%		(CCC, 2021a)
			IEA NZE	61%	88%		(IEA, 2022)
		Renewable energy	CCC Tailwinds	55%	90%		(CCC, 2021a)
				30%	67%		(IEA, 2022)

26 Road transport only

TOO LITTLE TOO LATE

CATEGORY	PARAMETER	SCENARIO	SUMMARY OF PARAMETER			SOURCE
			2030	2050	2100	
Climate	Total net emissions (for all gases)	CCC Headwinds	57MtCO$_2$e	22MtCO$_2$e		(CCC, 2021a)
		IEA APS[27]	34 BtCO$_2$	21 BtCO$_2$		(IEA, 2021b)
		IPCC SSP2-4.5[28]	63 BtCO$_2$e	53 BtCO$_2$e		(Riahi, et al., 2017)
		NGFS NDCs	35.1 BtCO$_2$e	26.7 BtCO$_2$e		(NGFS, 2023)
	Gross methane emissions	CCC Headwinds	29MtCO$_2$e	24MtCO$_2$e		(CCC, 2021a)
	Average increase in temperature	NIWA RCP4.5		+0.8°C(0.4, 1.3)	+1.4°C(0.7, 2.2)	(NIWA, 2023)
		IEA APS		+1.8°C(1.7, 2.0)	+2.1°C(1.9, 2.3)	(IEA, 2021a)
		IPCC SSP2-4.5		+1.7°C(1.6, 2.5)	+2.7°C(2.1, 3.5)	(IPCC, 2021a)
	Precipitation change	NIWA RCP4.5		Increases west and south, decreases north and east with moderate magnitude		(NIWA, 2023)
	Sea level rise	NIWA RCP4.5		0.24m	0.55m	(NIWA, 2023)
Socio-economic	GDP	NGFS NDCs[29]	Global: US$ 175 trillion (-1.6%) NZ: NZ$ 329 billion (-0.7%)	Global: US$ 274 trillion (-5.1%) NZ: NZ$ 477 billion (-2.3%)		(NGFS, 2023)
		IPCC SSP2-4.5	US$142 trillion	US$230 trillion		(Riahi, et al., 2017)
	Population growth	IPCC SSP2-4.5	8.3 billion	9.2 billion		(Riahi, et al., 2017)

27 No reported CO$_2$e figures available, CO$_2$ used instead
28 Assume Kyoto Gases as proxy for total global CO$_2$e
29 Data provided in; GDP, (GDP % change due to chronic physical risk)

TOO LITTLE TOO LATE

CATEGORY	PARAMETER	SCENARIO	SUMMARY OF PARAMETER			SOURCE
			2030	2050	2100	
Policy	Emissions outcome	CCC Headwinds	Net zero by 2040			(CCC, 2021a)
		IEA APS	Emissions are reduced but net zero is not achieved			(IEA, 2021b)
		IPCC SSP2-4.5	Net zero after 2100			(Riahi, et al., 2017)
	Carbon price	CCC Headwinds	NZ$140	NZ$250		(CCC, 2021a)
		NGFS NDCs	US$34	US$50		(NGFS, 2023)
		IPCC SSP2-4.5	US$0	US$54		(Riahi, et al., 2017)
	Native forestry land area	CCC Headwinds	0.20Mha	0.50Mha		(CCC, 2021a)
	Exotic forestry land area	CCC Headwinds	2.1Mha	2.5Mha		(CCC, 2021a)
	Dairy farming land area	CCC Headwinds	1.7Mha	1.7Mha		(CCC, 2021a)
	Sheep + Beef farming land area	CCC Headwinds	7.4Mha	7.0Mha		(CCC, 2021a)
	Horticulture farming land use area	CCC Headwinds	0.11Mha	0.13Mha		(CCC, 2021a)
Technology	Transport	CCC Headwinds	6% electrified	76% electrified		(CCC, 2021a)
	Renewable electricity	CCC Headwinds	94%	98%		(CCC, 2021a)
		IEA APS	46%	71%		(IEA, 2021b)
	Renewable primary energy	CCC Headwinds	50%	80%		(CCC, 2021a)
		IEA APS	19%	37%		(IEA, 2021b)

	CATEGORY	PARAMETER	SCENARIO	SUMMARY OF PARAMETER			SOURCE
				2030	2050	2100	
HOTHOUSE	Climate	Total net emissions (for all gases)	CCC Current Policy Reference	62 $MtCO_2e$	35 $MtCO_2e$		(CCC, 2021a)
			NGFS Current Policies	38.6 $BtCO_2e$	34.3 $BtCO_2e$		(NGFS, 2023)
			IEA STEPS[30]	36 $BtCO_2$	34 $BtCO_2$		(IEA, 2021b)
			IPCC SSP5-8.5[31]	70 $BtCO_2e$	83 $BtCO_2e$		(IPCC, 2021b)
		Gross methane emissions	CCC Current Policy Reference	31$MtCO_2e$	29$MtCO_2e$		(CCC, 2021a)
		Average increase in temperature	NIWA RCP8.5		+1.0°C(0.5, 1.7)	+3.0°C(2.0, 4.6)	(NIWA, 2023)
			IEA STEPS		+2.0oC	+2.6oC	(IEA, 2021b)
			IPCC SSP5-8.5		+2.4°C(1.9, 3.0)	+4.4°C(3.3, 5.7)	(IPCC, 2021a)
		Precipitation change	NIWA RCP8.5		Increases in west and south of the South Island, decreases in north and east of the North Island		(NIWA, 2023)
		Sea level rise	NIWA RCP8.5		0.28m	0.79m	(NIWA, 2023)
	Socio-economic	GDP29	NGFS Current Policies[32]	Global: US$ 175 trillion (-1.6%) NZ: NZ$ 329 billion (-0.7%)	Global: US$ 273 trillion (-5.7%) NZ: NZ$ 475 billion (-2.6%)		(NGFS, 2023)
			IPCC SSP5-8.5[33]	US$166 trillion	US$361 trillion		(Riahi, et al., 2017)
		Population growth	NGFS Current Policies	8.3 billion	9.3 billion		(NGFS, 2023)
			IPCC SSP5-8.5[34]	8.2 billion	8.6 billion		(Riahi, et al., 2017)

30 No reported CO_2e figures available, CO_2 used instead
31 Assume Kyoto Gases as proxy for total global CO_2e
32 Data provided in GDP, (GDP % change due to chronic physical risk)
33 Data for SSP5-8.5 unavailable, SSP5-6.0 used instead
34 Data for SSP5-8.5 unavailable, SSP5-6.0 used instead

HOTHOUSE

CATEGORY	PARAMETER	SCENARIO	SUMMARY OF PARAMETER			SOURCE
			2030	2050	2100	
Policy	Emissions outcome	CCC Current Policy Reference	Net zero not achieved, emissions decrease slightly by 2050			(CCC, 2021a)
		NGFS Current Policies	Net zero not achieved, emissions continue to rise by 2050			(NGFS, 2023)
		IEA STEPS	Net zero no achieved, emissions decrease slightly by 2050			(IEA, 2021b)
		IPCC SSP5-8.5[35]	Net zero not achieved, significant increase in emissions by 2050			(Riahi, et al., 2017)
	Carbon price	CCC Current Policy Reference	NZ$35	NZ$35		(CCC, 2021a)
		NGFS Current Policies	US$0	US$0		(NGFS, 2023)
		IEA STEPS[36]	US$15	US$30		(IEA, 2021b)
		IPCC SSP5-8.5[37]	US$0	US$26		(Riahi, et al., 2017)
	Native forestry land area	CCC Current Policy Reference	0.11Mha	0.19Mha		(CCC, 2021a)
	Exotic forestry land area	CCC Current Policy Reference	2.1Mha	2.8Mha		(CCC, 2021a)
	Dairy farming land area	CCC Current Policy Reference	1.7Mha	1.7Mha		(CCC, 2021a)
	Sheep + Beef farming land area	CCC Current Policy Reference	7.4Mha	6.8Mha		(CCC, 2021a)
	Horticulture farming land use area	CCC Current Policy Reference	0.11Mha	0.13Mha		(CCC, 2021a)
Technology	Transport	CCC Current Policy Reference[38]	5% electrified	69% electrified		(CCC, 2021a)
	Renewable electricity	CCC Current Policy Reference	93%	94%		(CCC, 2021a)
		IEA STEPS	42%	60%		(IEA, 2021b)
	Renewable primary energy	CCC Current Policy Reference	48%	61%		(CCC, 2021a)
		IEA STEPS	16%	26%		(IEA, 2021b)

35 Data for SSP5-8.5 unavailable, SSP5-6.0 used instead
36 Assume Chile, Columbia as smallest increase in prices by 2030 and 2050
37 Data for SSP5-8.5 unavailable, SSP5-6.0 used instead
38 Road transport only

APPENDIX C

STAKEHOLDERS ENGAGED

Section 2 of the report provides an overview of the approach used to develop the scenario narratives, and high-level risks for the life insurance, health insurance and fund management sectors. The workstreams/governance groups used to aid this process are outlined below.

- **Workshops** – Workshops were used to introduce topics, present results of desktop research and discuss options going forward. All Users were invited to attend these sessions.
- **Working Groups** – Working Groups were used to gain consensus on key decisions. Discussions in the Workshops were used to inform further work and enable development of proposed approaches that were put to the group for voting. Decisions were ratified by the Chairs of FSC's Climate and ESG Committee. As with the workshops, all Users were invited to attend these sessions and applicable regulators and industry group guests were invited to attend the beginning of these sessions.
- **Steering Committee** – The Steering Committee was formed to determine the direction of the project and track project timelines, delivery outputs and stakeholder satisfaction.

External stakeholders were also engaged throughout the project in order to leverage their expertise, keep consistency across similar sectors and enable input from the standard setter and regulator. Stakeholders engaged throughout the project are listed in Table 30.

STAKEHOLDER GROUP	STAKEHOLDER NAME	
External stakeholders	Financial Markets Authority	Responsible Investment Association of Australasia
	Reserve Bank of New Zealand	Corporate Trustees Association
	External Reporting Board	Investor Group on Climate Change
	Ministry for Environment	United Nations Principles for Responsible Investment
	New Zealand Bankers' Association	Centre for Sustainable Finance
	Insurance Council of New Zealand	

STAKEHOLDER GROUP	STAKEHOLDER NAME	
Working Group members	AIA New Zealand	Medical Assurance Society New Zealand Limited (MAS)
	Asteron Life	Mercer (NZ) Ltd
	AMP Services (NZ) Limited	Milford Asset Management Limited
	ANZ Bank	Mint Asset Management
	ASB Bank Limited	Mosaic Financial Services Infrastructure
	BNZ Investments and Insurance	New Zealand Police Association
	Booster Financial Services	nib NZ Limited
	Castle Point Funds	Nikko Asset Management
	Chapman Tripp	NZ Funds
	Chubb Life Insurance New Zealand Limited	Oyster Group
	Craigs Investment Partners Superannuation Management Limited	Partners Life
	DLA Piper New Zealand	Pie Funds Management Ltd
	Fidelity Life Assurance Co Limited	Public Trust Corporate Trustee Services
	Fisher Funds Management Limited	Southern Cross Healthcare
	Forsyth Barr Investment Management Limited	Smartshares Ltd
	Generate Investment Management Ltd	Swiss Re Life & Health Australia Ltd
	Harbour Asset Management	Trust Investments Management
	Implemented Investment Solutions Limited	Trustees Executors Ltd
	Kiwi Wealth Limited	Westpac NZ Limited and BT Funds Management (NZ) Limited
	Macquarie Group	

Table 30: Stakeholders engaged through the project

Financial Services Council NZ

Grow the financial confidence and wellbeing of New Zealanders

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Financial Services Council

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Financial Services Council New Zealand

JUNE 2023