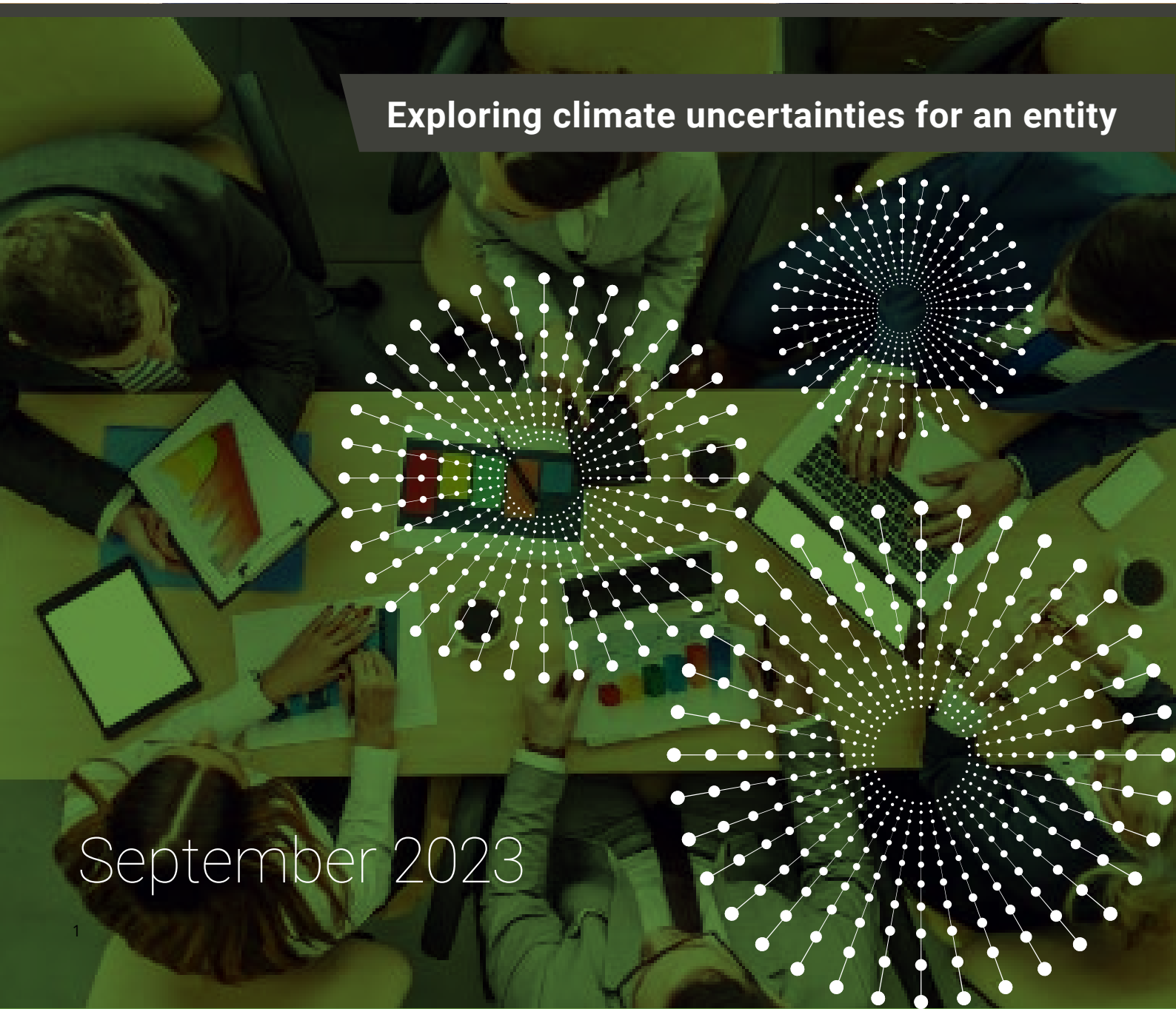
XRB | Te Kāwai Ārahi Pūrongo Mōwaho
EXTERNAL REPORTING BOARD

Staff Guidance

Entity Scenario Development

How to develop useful, plausible, consistent, and challenging scenarios for climate-related disclosures under NZ CS 1



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Contents

Why is the XRB issuing this guidance?

This guidance is a reference point for climate-reporting entities (CREs) as they plan and progress their climate-related scenario analysis process.

Disclosures explain an entity's journey to better manage climate-related risks and opportunities

This guidance is focused on supporting entities to get the most value from the climate-related scenario analysis *process*. For more information on the *disclosures* relating to scenario analysis, see our Climate-related Disclosures Staff Guidance.

Strong investment and engagement from entities into scenario analysis will result in better entity-level and investor decision making to support New Zealand's future climate resilience. We encourage entities to focus on the bigger picture, and on the value of doing climate-related scenario analysis, to get the most out of the process and move beyond solely focusing on reporting or compliance.

"A disclosure mechanism is no substitute for a holistic risk management regime. Directors will ultimately be judged on their actions." Chapman Tripp[1]

Entities need to embark on a journey from scenario analysis to transition planning (see p.5). However, this is just the beginning of a transformative and challenging journey, and entities embracing this process will be in a better position to navigate an increasingly uncertain future.

For entities to approach scenario analysis pragmatically, it helps to step back and think about the wider set of information primary users will be looking for:

- That the entity is aware of its climate-related risks and opportunities, and has followed a rigorous and robust process to identify those that are specifically relevant to the entity, and understands how to actively manage them.
- That the entity understands what it needs to do to improve its management of climate-related risks and is taking the appropriate steps to do it.
- That the entity understands the potential effects of climate-related risks and uncertainties on its assets, operation, strategy and business model, and the potential impact on its prospects.
- How the entity is going to position itself to thrive.
- That the entity has a plan to transition toward a low-emissions and climate-resilient future, including how the entity is going to position itself to survive and thrive in a climate-changed world.
- That the entity's transition planning is appropriately resourced, is appropriate to the risks identified, is credible, and will be implemented in a timely manner.
- The role the entity is playing in the climate crisis – its emissions, targets, and how it is planning to contribute to a transition to a low-emissions, climate-resilient future.

Getting from scenario analysis to transition planning

A 'HOW TO' OVERVIEW

How could climate change affect our sector?

What are the critical uncertainties our sector needs to prepare for?

Development of sector scenarios

(optional but recommended)

Benefits

- ✓ Comparability in disclosures
- ✓ Bridge between global and national analysis
- ✓ Rationalise costs
- ✓ Build a cross-sector understanding of climate-related risks
- ✓ Create sectoral collaboration to address climate-related risks and opportunities

How could climate change affect my entity?

What are the critical uncertainties we need to prepare for?

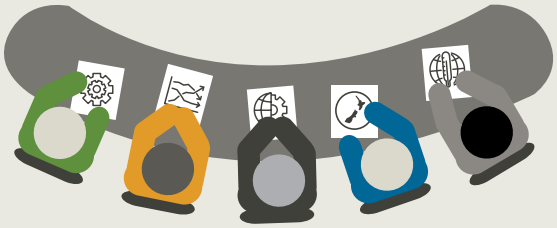
Are there gaps or weaknesses in our current strategy, business model, and/or operations?

If business as usual is not a credible option anymore, what are my options to become more resilient and seize opportunities?

Entity-level scenario analysis

Benefits

- ✓ Test resilience of business model and strategy under different climate scenarios
- ✓ Identify potential risks and opportunities that could be better managed or harnessed



What are the actions needed to address climate-related risks and opportunities?

When, and how much resource will be dedicated to these actions?

How to survive and thrive in a much more uncertain world?

Transition planning

Benefits

- ✓ The climate-related risks and opportunities identified during the scenario analysis process will likely require changes to the core strategy, governance, risk management practices and systems, and metrics and targets

This is likely to mean strategic pivots, transformation of operations, and change of business models

Key messages

Climate scenario analysis will help an entity achieve important objectives

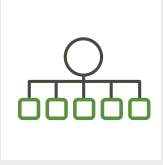
- Discover the meaning of climate change in terms of tangible potential consequences for the entity.
- Test the entity's resilience to climate-related risks (and ability to seize opportunities).
- Identify the drivers of change and critical uncertainties relevant for the entity to navigate a climate-changed world.
- Support the entity in its transition planning – consider what might need to change in its operations, processes, strategy and business plan to survive and thrive in a low-emissions, climate-resilient future.

Climate change is central to an entity's overall strategy

Climate-related driving forces are systemic and diffuse. Therefore, climate-related scenario analysis asks difficult questions about an entity's **ability to operate**, **generate sustainable revenues**, protect its **assets**, limit its **liabilities**, and **finance** itself, in a rapidly changing world (see Figure 1 from TCFD).

For most entities, the scenario analysis process is expected to raise existential questions, which other types of analysis can fail to reveal, and which a stand-alone plan cannot properly address. The insights gained from this exercise will inform the entity's strategic repositioning, and the transformation the entity will need to initiate to become low-emissions and improve its climate resilience.

The outputs of this process will also inform the transition planning to accomplish this transformation (see infographic on the previous page).



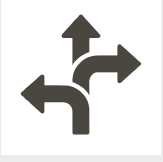
A strong mandate from the highest governance level, and a diversity of perspectives from across the entity and the whole value chain, are key

Effective and committed leadership is essential to the success of a scenario analysis process.

Diverse expertise, experience and perspectives, combined with climate, risk and future insights from a range of external sources, provide the key ingredients for decision-useful scenarios.

Scenario analysis involves grappling with uncertainty and making judgements

Participants are required to think creatively, interrogate their own mental models, and be frank. This process can be unsettling, but it is a well-established method for developing resilient strategies.



Achieving climate resilience requires an adaptive and flexible strategy

The scale of change brought about by climate change is such that it will require a level of innovation and flexibility akin to what is required by start-ups, even from large and well-established organisations.

Who this guidance is for and how to use it

Who is this guidance for?

This guidance has been written with the following users in mind:

- **The internal champion** within the CRE who is responsible for coordinating the entity's climate-related work.
- **A decision maker** who wants to understand how much resource their entity will need to invest in this process, and why they should be directly involved in some key steps.
- **A strategy person** who wants to understand how this is relevant and how it connects to the entity's overall strategy.
- **A participant** who wants to understand the process and what is expected from them at each step.
- Someone who wants to **obtain external support** from a service provider and needs to understand what a climate-related scenario analysis process looks like.
- **A service provider** who wants to ensure that their proposal is a good fit with the overall scope of the exercise and the capabilities of its potential client.
- **A user** of reporting who wants to understand what to look for when reading entities' scenario disclosures.

How to use this guidance

This guidance assumes a general understanding of scenario analysis as a strategy tool – find an introduction on the External Reporting Board (XRB) or the Task Force on Climate-related Financial Disclosures (TCFD) websites.

We have structured this XRB Staff Guidance in accordance with the six-step scenario analysis process recommended by the TCFD.

Each of the six sections of this guidance contains:

- a summary of the key outputs to document at the end of each step
- conditions for a successful process
- recommendations about the use of sector scenarios
- considerations for MIS Managers
- tips on how to leverage the thinking done for further work down the line.

The relationship of this guidance with TCFD guidance

The TCFD has published comprehensive guidance on the use of scenario analysis in disclosing climate-related risks and opportunities that is highly relevant to all entities[2]. The XRB's guidance aims to complement this TCFD guidance by showing how it can be put into practice by CREs in New Zealand to support high-quality disclosures.

Guidance overview

Overview of Scenario Development Steps	Key Outputs
1. Engage stakeholders and prepare an effective group - Climate is central to an entity's overall strategy, and climate-related scenario analysis requires participation from across the organisation. A clear mandate from the peak governing body is required, as well as early involvement from the strategy function. - Effectively managing long-term, systemic, and highly uncertain risk is extremely challenging. This is beyond business as usual for most organisations. Identify gaps, make a multi-year change plan, and set realistic objectives for the year. - Bringing in outside perspectives will reduce the risk of 'groupthink' and defaulting to business-as-usual norms, so involve external stakeholders. To be useful, scenarios need to be challenging. - Setting the scene for scenario participants unfamiliar with the implications of climate change is a crucial first step. Involve experts with a grounding in climate science and climate-related risks and opportunities. - Fostering a future-looking mindset in a group of participants requires facilitation skills. - Before exploring how future events might plausibly unfold, participants should reach a shared understanding of the climate context the entity (and its stakeholders) currently operates within. - Clearly define the objectives, milestones, deliverables, and key outputs from the outset. Allocate roles and responsibilities.	– Project charter – Briefing paper on climate context
2. Define the problem The goal is to ensure the analysis is useful, so this step should not be overlooked. A way to think about the focal question is to ask what the entity would need to know to make better decisions. One way for entities to scan what could be material, and help define relevant boundaries, is to question what might impact its ability to operate and generate sustainable revenues, reduce its assets, increase its liabilities, and challenge its ability to finance itself. A process of participatory systems mapping may help with this.	– Focal question/s – Boundaries of the analysis – Time horizon/s – Mapping of the entity's value chain
3. Identify driving forces and critical uncertainties Understanding which driving forces will have the greatest influence in shaping outcomes for the entity is an essential step in creating climate-related scenarios. Assessing the level of uncertainty for each driving force will help to define what each scenario should explore, and the key differentiating characteristics between scenarios, by allowing uncertainties to play out in different ways.	– Driving forces – Critical uncertainties – Conceptual model (interactions and impacts) – Scenario axes
4. Select temperature outcomes and pathways Scenarios need to describe the temperature outcome and the path taken to reach it. In scenario analysis, there may be many markedly different pathways toward a given future temperature outcome, with divergent risks and opportunities along each pathway. The number and combination of scenarios should be selected based on the insights needed.	– Temperature outcomes – Emissions pathways – Rationale for selection of scenarios
5. Draft narratives and quantify The drafting of narratives that provide rich, compelling illustrations of the temperature outcomes and pathways selected will bring alive plausible future events. Quantification of aspects of each narrative may assist entities to characterise the financial impacts of climate-related risks and opportunities. Scenario archetypes are useful building blocks to use with caution. Quantify with purpose to assess the relative size of the issues, not to discover future values. To be useful, modelling needs to be targeted and directed by a qualitative narrative.	– Scenario narratives – Quantification – Rationale for use of scenario archetypes
6. Assess strategic resilience This involves a structured process of systematically interrogating, in each of the scenarios, what would be the implications for the strategy and business model of the entity. Decisions about which options to select will be made later, but the scenario analysis group can generate a long list of options and criteria of selection. Climate resilience requires an adaptive and flexible strategy. This means that monitoring early signals to inform how uncertainties evolve will be key for entities.	– Quality check – Resilience assessment – List of options and criteria – Research plan – Monitoring plan – Review plan

A note for CREs in the finance sector

Caution advised: Existing models may struggle with climate risk

There may be a natural tendency to approach the handling of climate-related risk among financial institutions in the same way that other, less diffuse and uncertain risks are handled. This may see financial entities leap directly to attempting to quantify climate-related impacts using existing financial models and tools, with the simple addition of parameters to represent physical or transition risk factors sourced from publicly available data.

However, a growing number of experts warn that this approach is unable to adequately reflect the complexity, uncertainty and non-linearity of the impacts of climate-related risks and opportunities, and should be treated with caution.[3]

The Institute and Faculty of Actuaries (IFOA UK) warns in its Emperor's New Climate Scenarios report that "many climate-scenario models in financial services are significantly underestimating climate risk", and that "scenario analysis outcomes [are] being taken too literally and out of context" (p.6).

A joint report from the Financial Stability Board and Network for Greening the Financial System has also warned that the nature of climate risk means that many initial climate scenario analysis exercises "could underestimate real impacts of transition and physical risks and therefore they stand out primarily as learning opportunities" (p.24).

As explained by the Economics of Energy Innovation and System Transition (EEIST) Project: "In situations of non-marginal change – as with the low-carbon transition – 'equilibrium' (in modelling terms) cannot be assumed. Without equilibrium, an optimal allocation of resources cannot be specified – hence the deep uncertainty. Investors cannot specify climate risk in a fully probabilistic sense".[4]

Extensive guidance exists

A wealth of scenario analysis-related guidance exists for the finance sector. Existing guidance documents provide examples of approaches to TCFD-aligned scenario analysis around the world, which complement the CRE-focus of this XRB guidance.

- The Hong Kong Securities and Futures Commission (2021) provides several examples of different approaches to scenario analysis taken by asset managers.
- The UK Financial Conduct Authority's Climate Financial Risk Forum (CFRF) provides detailed guidance on scenario analysis for the financial sector, as well as specific scenario analysis guidance for asset managers, banks, financial firms, physical risk underwriting, and on data, disclosure and metrics.[5]
- The Singapore GIC (2023) describes how to integrate climate scenario analysis into investment management.
- IFOA UK provides a UK-based case study on climate scenario analysis for pension schemes.

In New Zealand, financial sector participants may also wish to have regard to the XRB's sector-level scenario work for financial institutions.

A note for MIS Managers

The scenario analysis process can generate fund-level insights in an efficient way

This guidance outlines the practical steps of the scenario analysis ***process***, not the obligations for managers of registered investment schemes (MIS Managers) in primary legislation with regards to the disclosure itself.[6]

It is also important to remember the distinction between obtaining insights and the disclosures themselves. With regard to the disclosures, it is important to identify the specific climate-related risks and opportunities that are material for each fund, and to test the resilience of the business model and strategy.

However, an organisation managing a hundred funds does not necessarily need to do the whole process entirely separately for each fund. This can be done by grouping funds based on similar characteristics that result in similar exposure to climate-related risks and opportunities. This could be many things: type of assets (equities, properties, infrastructure, sovereign bonds), geography (e.g. EU vs USA), sectors (although caution is advised, as economic sectors do not necessarily overlap with climate risk exposures), etc. Defining how to structure the scenario analysis in an efficient way, while allowing sufficient coverage to be relevant at the fund level, is an important preparatory step.

It is also important to bear in mind at the outset the reminder from the Economics of Energy Innovation and System Transition (EEIST) Project that "scenarios lead to a decision; they are not the decision itself" (p.12). In other words, scenarios are not crystal balls.

Note that this is similar to a corporate entity undertaking several activities. This entity would also need to think about each of these activities when conducting its scenario analysis.

But the value is greater than individual fund-level insights

A practical question for MIS Managers to consider is the level at which it is the most relevant and efficient to *think* at for each step of the scenario analysis process – individual fund-level, or also at a higher level.

This higher level will vary from one MIS Manager to another, depending on where the risk and strategy functions sit for the scheme(s) and fund(s). For the lack of a specific word, this will be referred to in this guidance as the 'upper' level, acknowledging it could mean very different things from one entity to another.

Why think at this 'upper' level? An entity wanting to make the most of this exercise will also be interested in improving its risk management processes, or embedding climate-related risk management in long-term decisions. This could lead to more strategic decisions, such as stopping some funds or developing new types of funds to better manage climate-related risks and opportunities.

Technical concepts

Driving forces	Broad-scale external factors that may affect the outcomes of the focal question(s). Also known as 'drivers'.
Focal question	A question that guides a project or a process by providing clarity, direction, and boundaries. A focal question should be specific, short, precise, and reflect the desired outcome and the domain of the project.
Participatory systems mapping	A method for building and analysing causal system models in groups.
Critical uncertainties	The driving forces that are most influential and most uncertain. These will define the range of scenarios required to explore the potential futures.
Conceptual model	A simple representation of a system focused on the relationship expected to be seen between variables.
(Scenario) Archetype	Scenarios, pathways and projections done by others at a global, national, regional or sectoral level. These are the 'building blocks' of a scenario architecture.
(Scenario) Architecture	Describe the structure made of scenario 'building blocks' (archetypes), on which an entity scenario relies.

See also:

- The definitions of physical and transition risks in Climate-related Disclosures (NZ CS 1), p.12.
- "The fundamentals of climate-related risk" in the XRB's Climate-related Disclosures Staff Guidance (p.25) for further detail on important terms such as hazard, exposure, and vulnerability.
- A broader glossary of climate change and sustainability-related terms maintained by the Global Association of Risk Professionals.

1. Engage stakeholders and prime an effective group

Bringing together the right blend of skillset and knowledge is vital to creating useful scenarios. Similarly, the scenario analysis process is about changing people's perspectives. Therefore, the people that will have to draft and implement transition planning should be involved.

Beyond participation across the entity, also engage with relevant external stakeholders. Diverse viewpoints and expertise help to contextualise the entity's current position and shed light on the climate-related risks and opportunities it faces.

1.1 Engage the highest-level governing body as project sponsors

Those charged with governance must make climate-related scenario analysis a priority

As discussed above, climate change is central to an entity's overall strategy. Effective and committed leadership is essential to the success of a scenario analysis process.

Support from across the organisation, and time commitment from usually time-poor leadership functions (e.g. chief risk officer, strategy lead, or a board member responsible for the strategic integration of climate-related risks and opportunities), is required for the process to be valuable.

Senior leadership teams and managers therefore need a strong mandate to prioritise the analysis, allowing them to harness the internal and external expertise required to do it justice.

This requires championship from the board. The highest-level governing body of the entity needs to agree that this is a high priority project, and set the right incentives and conditions for success.

If there isn't yet a clear champion and that strong buy-in at governance level needs to be built beforehand, a useful strategy is to frame the conversation around risk. This includes entity-specific and sector-specific risks and opportunities, but also directors' duties, as climate is increasingly central to these duties.[7]

The role of leadership in the scenario analysis process

Which leaders need to be involved will depend on each entity's internal structure, and should focus on who is making strategy and risk management decisions.

For example, in CREs where the chief executive (CE) is heavily involved in defining the strategy and deciding which risks should be managed and how, the level of engagement needed from the CE will be high for the scenario analysis process to be meaningful for decision making.

Conversely, in CREs where the CE is more remote and relies on advice from a head of strategy and a chief risk officer, active participation might not be required from the CE, but will be needed from the head of strategy and the chief risk officer.

A lot of the value of the scenario analysis process is in changing thinking pattern to make better long-term decisions.

Compliance-driven approaches are unlikely to address an entity's full range of legal risks

Entities genuinely embracing the process will be in a strong position to provide high-quality disclosures. Conversely, entities focusing on the disclosures and choosing a 'de minimis' approach may expose themselves to greater legal risk.

Work by entities (and consultants) focused solely on compliance with NZ CS is unlikely to deliver the useful insights needed to address the wider range of legal risks an entity might face. Other climate-related legal risks that may be influenced by how entities approach scenario analysis include the following:

- **Civil liability of its directors** to the company for false or misleading representations – see, for example, section 22 of the Financial Markets Conduct Act 2013 and directors' duties under the Companies Act 1993.
- **Risks to the company** under Part 10 of the Crimes Act 1961, secondary legislation, or the NZX Listing Rules.

Chapman Tripp prepared a legal opinion for the Aotearoa Circle that explains legal risks in further details.

For further examples see the Climate Litigation Risk Chapter of the CFRF, or the Global trends in climate change litigation: 2023 snapshot, published by the Grantham Research Institute on Climate Change and the Environment.

Considerations for MIS Managers

For steps 1.1 to 1.4, the appropriate level to consider is usually the 'upper' level (see A note for MIS Managers), because the objective is to embed climate-related risk management in long-term decision making.

1.2 Ensure senior leaders and management have a mandate to act

Senior leaders within the entity need a mandate that allows them to:

- enlist the support of internal participants from all areas of the entity's activities
- engage external support/expertise as required
- prioritise scenario analysis to the extent that its momentum is maintained, and milestones and deliverables are met.

1.3 Engage the strategy function

The core purpose of climate-related scenario analysis is to enhance the resilience of an entity's strategy. This means that an entity's core strategy must be open to revision. It is therefore critical that an entity's strategy team, or whomever is primarily responsible for developing an entity's strategy, plays a leading role in the scenario analysis process.

1.4 Identify the entity's gaps, draft a multi-year plan, and define realistic ambitions for the coming year

Effectively managing long-term, systemic, and highly uncertain risk is extremely challenging. This is beyond business as usual for most organisations. In practical terms, this means an entity's current risk management system and processes might need to evolve significantly, over several steps, which will require time. Voluntary TCFD reporters have indicated that a three-to-five-year period is needed to fully integrate the TCFD framework into an entity's risk management processes.

This poses several risks for the scenario analysis process – for example, by being constrained by the entity's current situation, or being derailed by people's natural reluctance to transformational change, or even by disengagement from key participants if they perceive it as implausible.

Conducting a gap analysis and thinking how this work will connect with current risk management processes might be a necessary first step. This means assessing the entity's current situation, defining where it will likely need to be, identifying intermediate milestones, and scoping the objectives for the coming year (or Minimum Viable Product).

The identification of the entity's capabilities will also highlight if external support is needed to conduct the scenario analysis process itself. See Appendix 5: Procurement tips.

1.5 Engage with external stakeholders

Bringing in outside perspectives will reduce the risk of 'groupthink' and defaulting to business-as-usual norms. To be useful, scenarios need to be challenging.

For an entity, that could mean early involvement of stakeholders such as:

- key customers
- key suppliers
- funding partners
- union representatives
- key infrastructures managers
- local councils from key areas for the entity
- participants to sector scenario analysis processes relevant to the entity
- iwi/Māori entities.

Chapter 2 of the Just Transitions Aotearoa Group's Guide to just transitions can be a useful starting point to identify and develop a group of stakeholders to work with.

Entities may be reluctant to risk exposing their own fragility to external stakeholders and could be tempted to hide problems until they have a plan to mitigate them. However, it is worth bearing in mind that climate change poses significant challenges for everyone. Any concerns should be carefully weighed against the real benefits of involving external stakeholders for scenario drafting.

These include:

- getting direct insights from the entity's value chain
- getting insights on how they see themselves in the various potential futures explored
- increasing their awareness of climate-related risks and opportunities – being on the same page will facilitate future conversation about coordinated mitigations strategies
- demonstrating that the entity is taking climate-related risks seriously and is doing what it needs to.

There are also significant downsides and risks in keeping the process too tight, including:

- misidentification and/or misevaluation of risks and opportunities
- missing opportunities to achieve transformative change by using insufficiently challenging scenarios resulting in a low-value scenario analysis process for the entity, while competitors engage in a robust process.

Considerations for MIS Managers

In the case of MIS Managers, key stakeholders could be key investors and/or asset owners, key investees, relevant intermediaries, representatives of key stakeholders, or a selection of those categories. Considering materiality, fund managers could consider both 'upper' level and individual fund-level when identifying key stakeholders.

For example, it could be valuable to involve representatives of retail customers to ensure their perspective is included in the scenarios. The fund manager will have to decide if this perspective is valuable for a specific fund, or if the 'upper' level is more practical.

The same fund manager could decide to engage with specific parties for some of the funds under management – for example, from the energy and healthcare sectors for a fund focused on New Zealand equities, and from the property sector for another fund. The fund manager then could decide that the other funds, being largely made of sovereign bonds, could be assessed jointly without needing specific stakeholders.

1.6 Seek out core baseline knowledge to enrich participants' climate literacy

Setting the scene for scenario participants unfamiliar with the implications of climate change is a crucial first step.

Participants will need to be able to make informed decisions about how climate-related risks and opportunities might plausibly affect the entity in years and decades to come. Doing so will require an understanding of where and how climate-related risks and opportunities might arise, not only through physical geography, but also via factors such as value chains, market access, technologies, consumer preferences, labour availability and regulatory factors.

It is useful to start a scenario analysis process with a knowledge-sharing workshop led by climate scientists and experts with a grounding in climate-related risks and opportunities.

Often these workshops will be structured around the descriptions of the current consensus of what the world could look like under different temperature outcomes (e.g. 1.5°C and 3°C), and the description of some commonly used shared socio-economic pathways (SSPs).[8]

These high-level scenarios are a useful starting point, but it is important to recall that they were developed for different purposes (e.g. the SSPs have been focused on supporting policy development at international and national level, not entity-level risk assessment).

See Appendix 3 for further details on the limitations of these meta-scenarios and what an entity should consider when using them. See also Appendix 5: Procurement tips.

1.7 Clearly describe the process and its expected outcomes

People frequently approach scenario analysis from different perspectives, and have different expectations of what the process entails and will produce.

While following a process can be useful, participants need to be empowered to contribute to the best of their ability. This requires a clear understanding of the 'why', and a shared vision of the end game for the entity. The process should, at the outset, clearly define the objectives, milestones, deliverables and key outputs. This includes understanding the objectives of the transition planning that will be informed by this scenario analysis (see the infographic on p.5 and XRB's staff guidance on getting started on transition planning).

1.8 Foster a future-looking mindset

A future-looking mindset is key to the success of scenario analysis, and participants need to be clear about what they are (and are not) doing in developing climate-related scenarios. Fostering a future-looking mindset, particularly with a group of diverse participants, requires skilled facilitation.

This is about creating open-mindedness, trust, and empowerment among participants. It takes time, and participants should have room for reflection and discussion. They should not be rushed through the process, nor talked to/at most of the time.

To be empowered, participants should be provided with the required knowledge to have a good understanding of the problem and its potential consequences so they can then apply their own specific expertise to this common ground.

Future-mindedness is optimistic. It is about creating confidence about our collective ability to take action and shape outcomes. It is also about deliberately looking for the upside, the possibilities, and orienting towards finding opportunity.

Future-mindedness is pragmatic. This means acknowledging that unknown events beyond our control will likely change the situation, then thinking through what that might look like.

It is also about stimulating people's imaginations, pushing participants to think outside the box and be innovative.

For a facilitator, being systematic about looking at one perspective, then asking about an opposite perspective, helps move participants from 'being right' to a more exploratory discussion. Facilitators must also be non-judgemental to enable the expression of a full range of views. This is one of the reasons the facilitator should not be in a position of authority (see section 1.10).

The TCFD has summarised what scenarios are and are not (see Table 1).

Defining what scenarios are and are not	
ARE	**ARE NOT**
Products of internal insights and collaborative learning	**Products of external consultants**
Plausible alternative futures	**Probabilistic predictions**
Significantly different views of the future	**Variations around a single reference case or value**
Specific, highly decision-focused views of the future	**Generalised views of feared or desired futures**
Movies of the evolving dynamics of the future	**Snapshot descriptions of an endpoint in time**

Table 1: ***What scenarios are and are not.*** *This guidance document supports the TCFD's recommendation to apply these 'rules of engagement' in framing what scenarios are and are not (adapted from The Scenario Planning handbook[9]).*

1.9 Assess the current context and external environment

Before exploring how future events might plausibly unfold, participants should reach a shared understanding of the climate context the entity (and its stakeholders) currently operate within.

This typically includes an analysis of the following:

- **Physical risks:** Past and present sensitivity to acute and chronic physical climate hazards, such as the impacts of storms, heatwaves, droughts, or longer-term shifts in temperature, sea level, etc.
- **Transition risks:** Past and present sensitivity to economic, regulatory, legal, market and societal moves to address climate change, such as emissions pricing, shifts in consumer preferences, or changes in energy and transport costs.
- How these climate-related trends and shifts have interacted with wider driving forces of change to influence outcomes, such as reducing the return on investment in some market segments compared to others, or increasing competition for skilled staff.of change to influence outcomes, such as reducing the return on investment in some market segments compared to others, or increasing competition for skilled staff.

This information allows the identification of current impacts of climate change (and current financial impacts, if desired) and a better understanding of the range of issues, knowledge gaps, and implications of forward-looking risks and opportunities.

This phase of the analysis is grounded in the past and present (referred to in NZ CS 1 as "current impacts"), and with a relatively clear base of qualitative (and perhaps quantitative) evidence to support the conclusions reached.

Starting from a solid footing of this nature is important given the level of uncertainty involved. This baseline needs to be discussed and agreed by the group of participants.

Using sector-level scenarios

Sector-level scenario analysis relevant to the entity's activity(ies) will likely contain a list of the past/current impacts, risks and opportunities. This can be a useful starting point, however, participants in entity-level scenario analysis should look to identify additional material data points, and risks and opportunities that are relevant for their specific entity.

Participants might also want to reassess the risks identified at sector level when viewed from the perspective of the entity. Judgement on their respective importance may differ.

Considerations for MIS Managers

MIS Managers should look to identify important contextual elements at both the 'upper' level (to identify relevant risks and opportunities for the financial system in general), and then at the fund level. For example, at fund level, funds focused on shares versus real assets may face substantially different climate-related risks and opportunities.

1.10 Allocate roles and responsibilities

It is essential to identify the major functions of, and allocate responsibilities to, individuals who have the required skills and knowledge to carry out scenario analysis. An indicative list of functions is below.

- **Project administration:** Monitor progress and maintain participants' active engagement.
- **Facilitation:** Ensure everyone's role is clear, and that everyone can contribute. Foster a future-looking mindset. Ensure participants good understanding and use of scenario analysis concepts. Ensure the group remains focused on the agreed objectives and outputs.
- **Climate expertise:** Set the scene. Build a common group understanding of past, current and anticipated climate change effects.
- **Entity-relevant expertise:** Identify driving forces. Translate climate-related impacts into risks for the sector operations and business models. Draft the scenario narratives – this might include strategy, risk, operations, procurement, finance, and sustainability.
- **Key stakeholder representation:** Avoid siloed thinking, and help identify driving forces and risks. This might include key customers, key suppliers, funding partners, trade union representatives, iwi, mātauranga Māori expertise, relevant sector representatives, consumer groups, and local government.

Ownership by the entity's representatives is vital

Contracting a specialist consultant or project administration team may bridge capacity or capability gaps. It may also help clarify accountability for the steady progression of the process and the quality of the outputs.

However, ownership by the entity's representatives is vital. As stated by the TCFD, scenario analysis is an **explicitly participatory process**. It cannot be a service provided to a group or an entity attempting to analyse its climate-related risks and opportunities. Consultants can facilitate, but key decision makers must engage in the development and analysis of scenarios if they are to be of value in assessing strategic resilience. For example, the drafting of the narratives for each scenario should be done by the group, not by a consultant. It is also essential for the facilitator to not perform any of the other roles (see list above) because it can be a source of tension and lead to lower-quality analysis.

Quality assurance: Set milestones to keep the process on track

A built-in review process that includes regular milestone updates is a useful way of monitoring whether quality and scheduling expectations are being met. We suggest using the list of outputs in this guidance (described at the end of each phase) and the TCFD's scenario quality check factors table (see Appendix 1).

Key outputs to document: Project charter, briefing paper on climate context

Clearly document participant roles and responsibilities, project objectives, planned steps, milestones and deliverables.

Document the findings of the assessment of the climate context and external environment.

Conditions for success

1	Get a clear mandate from the highest governing body, as well as early involvement from the strategy function.
2	Anticipate the needs of the entity for the next few years, and set realistic goals for the exercise.
3	Employ experienced facilitators to help navigate any points of potential confusion or con-tention that could slow progress. Scenario analysis processes can stall unless facilitated well.
4	Seek diverse participation from across (and beyond) the entity, both for leadership roles and in assessing the context and external environment. Expect to seek input from additional perspectives, beyond those initially envisaged.

2. Define the problem

*The **focal question** provides a guiding purpose to the scenario analysis process. If this is the first time an entity does a climate-related scenario analysis, adopting the TCFD's suggested focal question: **"How could climate change plausibly affect our business [model and strategy], what should we do, and when?**" can be used.*

2.1 Define the focal question

TCFD scenario guidance recommends selecting a focal question that constrains the scope of the analysis, while allowing sufficient flexibility to explore future possibilities of interest to participants and primary users.[10] The goal is to ensure the analysis is useful, so **this step should not be overlooked.**

A way to think about the focal question is to ask what the entity would need to know to make better decisions.

Rigorous lines of enquiry flow from the TCFD's suggested question, providing the scenarios with enough specificity to support high-quality disclosures. Those lines of enquiry include the following:

- Which specific physical and transition risks and opportunities are plausible for our business?
- When, where, and how could they materialise?

When an entity is more experienced in conducting scenario analysis, it can decide to explore more targeted focal questions to inform specific decisions.

Thinking ahead: Transition planning

While it is too early to focus explicitly on solutions, it is useful to have in mind some key questions the entity will need to think about when planning its transition to a low-emissions, climate-resilient future state, such as:

- What do we need to know more about to be better prepared?
- How might our strategy, operation and/or business model need to change to increase resilience?

2.2 Map the entity's value chain and its system boundaries

Participants need a shared view of the entity and the system in which it operates

While each participant will likely have their own mental model of the entity, these could be substantially different across participants. Explicitly mapping the entity and its value chain will increase the likelihood that everyone has a shared perspective of the entity and its associated

system boundaries, and so reduce the risk of blind spots. This map will also help to put driving forces into context (see section 3.1), as well as being useful in defining the scope of the work (see section 2.3).

We encourage entities to describe their boundaries in terms of which regions and/or other geographies they interact with specifically. For example, what are the sources of key supplies, where are their export markets, where do technology inputs come from, and where do products go at end of life. Although maps produced overseas might provide a useful starting point, the value chain maps produced by CREs should be New Zealand-specific.

How to define boundaries?

A common question about boundaries is: Where to stop? The answer relies on a materiality assessment. Therefore, having a map of the value chain will help participants appreciate where to draw limits, based on expected climate impacts and how material they might be. It will also highlight information gaps, such as the origin of some key materials, or critical geographic dependencies.

We recommend using robust methods of participatory systems mapping[11,12]. In the initial stages of using scenario analysis, simpler visual approaches, such as a rich picture[13] (aka mind map) or shared mental model may be easier to agree and develop.

One way for entities to scan what could be material and help define relevant boundaries is to question what could impact its **ability to operate**, **generate sustainable revenues**, devalue or damage its **assets**, increase its **liabilities**, and challenge its ability to **finance** itself. These are core components in the TCFD's chart on climate-related risks, opportunities and financial impact reproduced below.

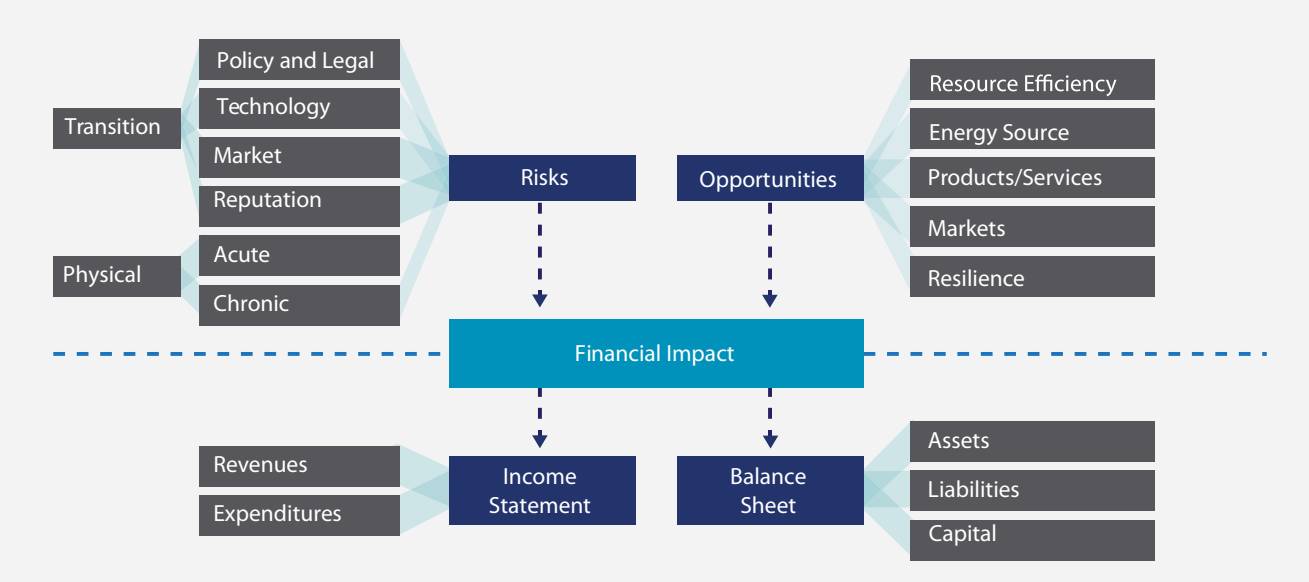


Figure 1: ***Categories of Climate Opportunity and Climate Risk*** *and categories of resulting financial impacts. Credit: FSB TCFD*

Don't set limits before the discussion – allow for the exploration to be broad in scope and then rationalise it with more targeted discussions on the scale of the impacts expected by participants.

Thinking ahead: Drafting options and transition planning

The system mapping will also be valuable when drafting options to increase the entity's resilience (see section 6.2), and at the transition-planning phase.

Finance sector: Value chain considerations

Financial institutions should be cautious before assuming that, because their potential investable universe is large, there is no value in exploring the value chain beyond the financial system itself.

The TCFD was created because climate change poses a systemic risk to the financial system. This risk is of a greater magnitude than COVID-19 or the 2007-2008 Global Financial Crisis. Yet, in these two examples, we observed flow-on effects and feedback loops from and to the 'physical' economy, with differences of impact depending on countries or sectors.

This highlights the need for CREs in the finance sector to have these systemic interactions in mind when making judgements about the boundaries of their value chain. Setting a boundary amounts to excluding what is beyond it, and therefore making an upfront judgement that what is excluded does not bring material risks and opportunities for the entity.

This also means that the value chain might be different for different activities or funds. Entities are reminded to refer to the definition of 'value chain' in NZ CS 1.

2.3 Define the scope of the scenario analysis

The scope of the scenario analysis is bounded by the focal question. There are nevertheless key decisions to be taken regarding how the focal question will be applied to the subsequent selection of drivers of change, and data gathering.

For example: What role will international developments play in climate outcomes for the entity? How will these be represented in the scenarios? How will developments affecting the entity be factored into the scenarios? Participants must decide what is in and out of scope of the analysis, bearing in mind the requirement to disclose the impacts of climate-related risks and opportunities outlined in NZ CS.

Using sector-level scenarios

The scenario analysis work done in sectors relevant to the entity's activity(ies) will likely contain a description of the scope considered.

Entities should tailor this scope to their own situation. Differences could include if an entity works at the intersection of several sectors (rather than solely within a sector); whether their main markets, suppliers or operations are located in different geographic locations than is common for the rest of the sector; or if they have a very different business model.

Identifying key differences between the entity's specific circumstances and the sector-level work helps to identify areas where more entity-specific information or analysis is needed, and also to explain variations with other entities using the same sector(s) as reference points.

2.4 Define a time horizon

When selecting time horizons, factors to consider include the entity's and national emissions reduction targets, the useful life of assets or infrastructure, and the availability of supporting data. This is particularly important when there are long-term investments in assets or infrastructure.

Entities should also challenge norms in selecting the time horizon for the analysis, as climate-related risks and opportunities may keep evolving beyond the timescales of typical planning processes.[14]

In most **archetypes**, physical risks are relatively minor before 2050. In other words, currently available archetypes understate the pace at which physical impacts are observed in reality. Therefore, using archetypes at longer time-horizons (e.g. 2070 or 2100) is necessary to avoid missing some key risks. This does not necessarily mean that an entity's scenario narrative will be set much beyond 2050 for other aspects. Using these longer time horizons help to explore potential impacts that most current global scenarios put in the long-term future, but might happen faster in reality (as has been consistently experienced over the past decade). This will highlight what are often referred to as 'fat tail risks', which are risks with low likelihood but high potential impact. The key question for entities is therefore, "Which time horizon from scenario archetypes allows us to explore physical risks?".

Post-2050, the physical impacts of different IPCC Shared Socioeconomic Pathways (SSPs) become much more pronounced, providing greater insight into how novel risks may emerge. It is also possible to reflect these long-term impacts in short-term scenarios. While this is still relatively uncommon in scenario analysis (due to the tendency to rely on Integrated Assessment Model [IAM] and other economic model outputs) there are approaches available that seek to help achieve this. As noted by Stiglitz et al, "IAMs have very limited value […] They fail to provide much in the way of useful guidance, either for the intensity of action, or for the policies that deliver the desired outcomes".

Using sector-level scenarios

Time horizons used at sectoral level can provide a useful starting point for entities, andalignment can facilitate comparability. However, entities should consider whether adjustments to these horizons are needed to be relevant to their own situations.

For example, an entity facing a critical asset replacement decision in 2034 can opt for the 'medium term' to be defined as everything that happens before the replacement date, even if a sector of relevance has defined that time horizon as up to 2030.

Considerations for MIS Managers

The selection of time horizons should be based on the fund characteristics (i.e. term to maturity of bonds, characteristics of commodities, equities strategies, tangibility/liquidity of investments).

It can therefore vary for different funds in a given scheme, and for different schemes within an entity. (See the part dedicated to time horizons in the XRB's guidance for MIS Managers.)

An investment horizon of 10 years is already considered to be long-term in finance. However, such a time horizon does not provide all the insights needed to identify climate-related long-term trends. Therefore, selecting time horizons solely on the basis of individual funds' characteristics could result in an organisation missing long-term climate-related risk and opportunities relevant for the overall risk management, strategy and processes (governing its schemes and funds).

Key outputs to document: Focal question, scope and timeframes

Document the focal question the entity will explore. This includes the operational and spatial boundaries, timeframes, and any notable scope exclusions.

Mapping of the entity's value chain.

Conditions for success

1	Follow the TCFD guidance when selecting a focal question, starting with a core climate-related risk and opportunity focus.
2	Allow additional lines of enquiry to be developed and incorporated under the focal question to fill knowledge gaps and anchor the analysis in the specific context of the entity. Ideally, these should reflect the questions that keep decision makers up at night.
3	Set relevant time horizons based on the entity's needs, considering capital allocation and asset lifecycles, strategic decision-making horizons. Take a risk-management perspective, rather than relying on arbitrary targets.
4	Use the focal question as framing for all project documentation, ensuring participants have a clear and consistent understanding of their purpose when engaging in the work.

3. Identify driving forces and critical uncertainties

Driving forces *(also known as 'drivers') are typically broad-scale external factors that influence the direction of future change. Understanding which driving forces will have the greatest influence in shaping outcomes for the entity is an essential step in creating climate-related scenarios. Assessing the level of uncertainty surrounding each driving force will help to define what each scenario should explore, and provide the key differentiating characteristics between scenarios by allowing* ***critical uncertainties*** *to play out in different ways.*

3.1 Identify driving forces

The goal is to construct a conceptual understanding of the entity's environment and its various climate-related relationships.

Three questions typically underpin the identification of driving forces in climate-related scena rio analysis:[15]

1. What are the key factors that will influence climate-related risks and opportunities?
2. Will these factors be influential over the full time horizon of the scenario/s?
3. Are the most influential factors certain and predictable, or can they change materially over time?

Driving forces are commonly identified in a workshop setting by exploring the focal question across different dimensions, such as social, technological, economic, environmental, and political (STEEP – see Appendix 2 for details). They can be grouped by macro, micro and decision scales, as suggested by the TCFD.[16]

3.2 Categorise driving forces for their influence and uncertainty

The identified driving forces should next be categorised for their relative influence and uncertainty. The focal question should be at the forefront of thinking in making these categorisations. One method for doing so is by using an influence-uncertainty matrix (see the illustrative example in Figure 2).[17] The driving forces that are most influential and most uncertain are known as 'critical uncertainties' and provide a means of differentiating the scenarios. Different scenarios will explore the different ways these critical uncertainties could go.

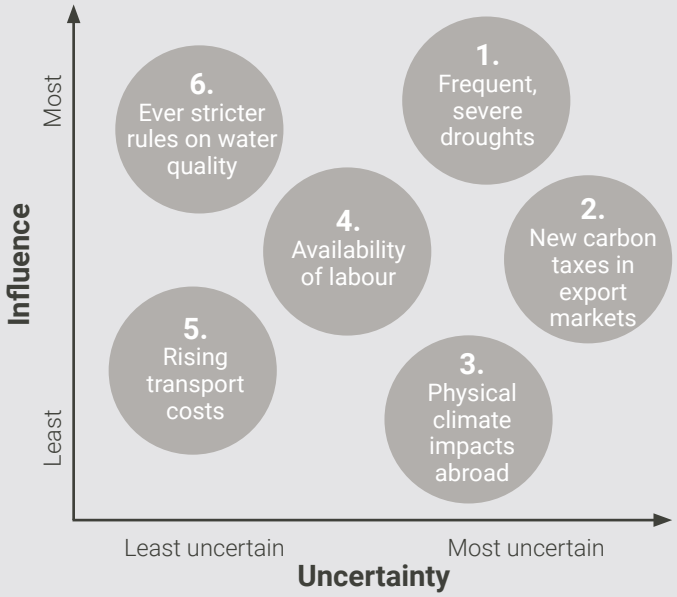


Figure 2: ***Plotting illustrative driving forces on axes of influence and uncertainty for the agriculture sector.*** *Participants have decided drivers 1 and 2 are the most influential and uncertain. Driver 3 is considered uncertain but less influential, driver 6 is considered highly influential and is felt to be a near certain factor in all scenarios.*

One way for entities to think about influence is to consider the relative impact on the entity's **ability to operate**, to **generate sustainable revenues**, to **finance** itself, and impacts on its **assets** and **liabilities** at each different time horizon (see Figure 1).

As the level of complexity increases, so too does the importance of being systematic. Methodology and tools are cornerstones of risk management.

Using sector-level scenarios

Sectoral scenario analysis processes that have followed the sectoral guidance will have a documented list of driving forces for entities to review.

The most significant and uncertain of these will have been employed as the key mechanisms for differentiating scenario outcomes.

Entities should identify their own driving forces and then compare them to what has been identified at a sectoral level (not the other way around, to avoid bias contamination).

This comparison will surface the points of divergence with sector scenarios.

Entities could find that they:

- have identified new drivers of change
- need to re-categorise some drivers to reflect their own exposure
- disagree with the level of uncertainty of some drivers.

3.3 Understand views on the interactions and impacts of critical uncertainties

The facilitator should draw out views from participants on how they see the critical uncertainties interacting with the entity, and with each other, to influence future outcomes.[18] The mental models participants hold of these interactions will shape their understanding of how the scenario will play out. Surfacing, challenging and enhancing participants' mental models in this way is a key aspect of scenario analysis.[19]

Discussions, interactive workshops, and/or conceptual modelling can make it easier to come to a shared understanding of how the entity may be affected by climate-related risks and opportunities in the future. For example, the interactions between the critical uncertainties and the impacts on an entity can be plotted on a whiteboard in a workshop setting to create a simple conceptual model [20]

Entities may choose to plot driving force interactions in a structured visual format (see the illustrative example in Figure 3).[21]

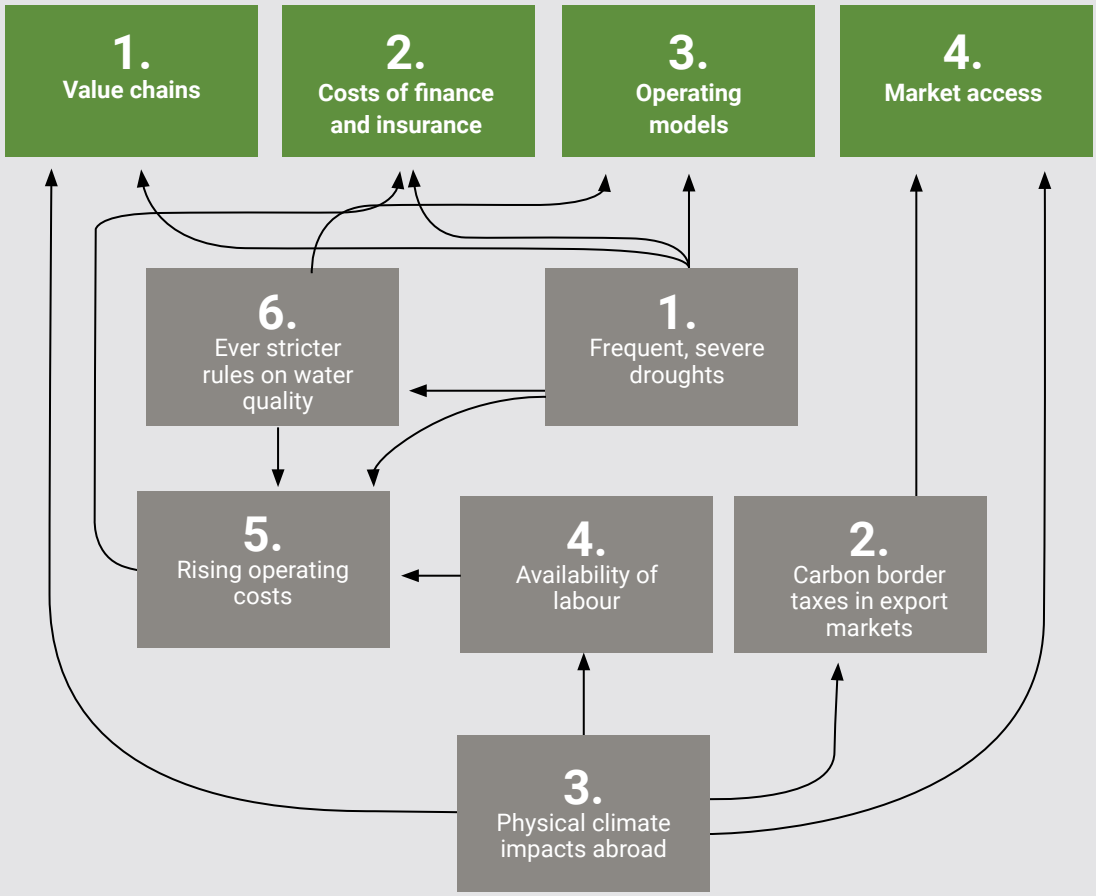


***Figure 3:* A simple conceptual model.** *This simple model illustrates how driving forces interact with each other. This can help to clarify discussions and progress scenario development, and in later stages, also communicate quantification needs to modellers.*

By illustrating how participants see the entity in relation to the key identified driving forces, a conceptual model makes explicit the otherwise implicit views of stakeholders regarding the plausible future developments each driver may trigger. This allows different scenarios to be shown visually, their implications to be discussed in group settings, and even for their key variables to be quantified if the appropriate data and expertise are available to do so.

Interactions between driving forces and risks/opportunities

External factors drive change, and this change can result in risks and/or opportunities. Driving forces are by definition neutral, being the external factors through which change happens. It is the ***change*** that may happen as a result of the driving force that presents specific risks and/or opportunities for an entity. Some risks and opportunities can also be reinforced or mitigated by other, unrelated, driving forces. See the technical terms definitions.

Conceptual models in the financial sector

CREs in the financial sector might be familiar with such conceptual models through the term '*risk transmission channel*'.

For climate change, they can be both macroeconomic and microeconomic. Climate risk drivers can translate into traditional financial risk categories (credit risk, market risk, liquidity risk, operational risk and reputational risk), rather than representing a new type of risk. However, they do present very specific characteristics (high uncertainty, non-linearity, heterogeneous distribution).[22]

The XRB's guidance for MIS Managers contains a simple conceptual model adapted from the Bank for International Settlements (see p.30).

Using sector-level scenarios

If sectoral scenario analysis processes have made this type of conceptual model accessible (it is not always present in the final report), entities can refine the model with reference to their own situation and interactions.

Thinking ahead: Transition planning

While the scenario analysis will focus on a selection of the most influential and uncertain driving forces, documenting driving forces and their interactions with the entity and its system will be useful when exploring potential options for transition planning.

An emerging approach is to consider socio-economic tipping points. These can help entities to explore just how fast the transition can evolve (and therefore, risks and opportunities), which informs future low- or zero-emissions technology choices by the entity.

3.4 Use scenario axes to develop a scenario matrix

Scenario axes are used to structure the development of a matrix that provides 'scenario themes' or 'logics'.[23] The critical uncertainties are typically chosen as scenario axes.

In the context of climate-related scenario analysis, it is often the case that more than two critical uncertainties are identified. This means that an entity might benefit from developing several scenarios within the same quadrant of the matrix to explore several critical uncertainties (see the matrix below, and also section 4.3).

We recommend using at minimum the scenario axes described in the TCFD guidance that have been utilised by the Network for Greening the Financial System (NGFS)[24] (see Figure 4, below).

This enables linking these scenarios with temperature outcomes and emission reduction pathways developed by international organisations such as the IPCC (see Appendices 3 and 6).

Doing so will enhance the consistency and comparability of scenarios across the economy.

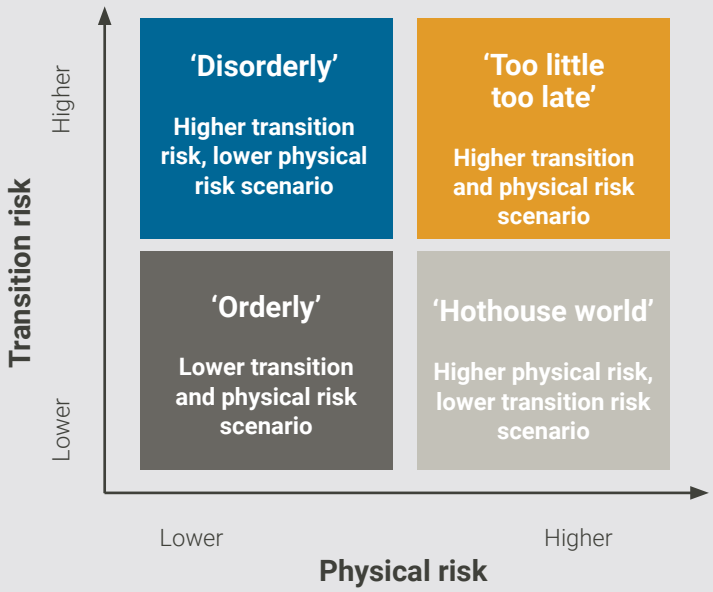
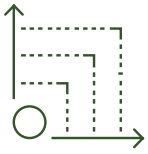


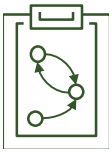
***Figure 4:* A scenario matrix.** *This matrix maps physical and transition risk drivers against each other to create scenario themes. The scenario theme names are from the NGFS.*

Thinking through how various critical uncertainties might play out under the logic of each quadrant in the scenario matrix is a first step toward scenario development (see Appendix 2).

Key outputs to document: Scenario axes, prioritised driving forces, and a conceptual model



Document the driving forces elicited from participants, their ranking for influence and uncertainty, and the critical uncertainties the scenarios will be structured around.



A conceptual model of the entity's ecosystem and its relationships to the driving forces.

Conditions for success

1	Elicit driving forces in an open, participatory setting, encouraging inputs from a wide range of perspectives. Exploring many and varied driving forces is needed to provide useful insights when developing narratives.
2	Facilitate the process of assigning influence and uncertainty to driving forces carefully, particularly what is meant by 'uncertainty' in driving forces.
3	When developing a conceptual model, it is important to account for differences of opinion on the anticipated impacts of critical uncertainties. Negotiating a shared view can require skilled facilitation.

4. Select temperature outcomes and emissions pathways

Scenarios need to describe a temperature outcome and the path taken to reach it. There can be many markedly different emissions pathways to the same temperature outcome, with divergent risks and opportunities accompanying each pathway.

4.1 Select temperature outcomes and emissions pathways

The TCFD recommends that organisations consider the resilience of their strategies in relation to climate-related scenarios that focus primarily on temperature outcomes.[25] NZ CS 1 follows this approach, requiring CREs to analyse, at a minimum, a scenario with a 1.5°C temperature outcome, one with a 3°C or greater temperature outcome, and at minimum a third scenario in their analyses.

Temperature outcomes may be realised via different emissions pathways (e.g. orderly vs disorderly reductions) with different corresponding transition risk profiles. Selecting outcome and pathway combinations that challenge the entity to the greatest extent is recommended.

Keep in mind that the goal is to identify risks and opportunities, not to predict or forecast the most likely future(s).

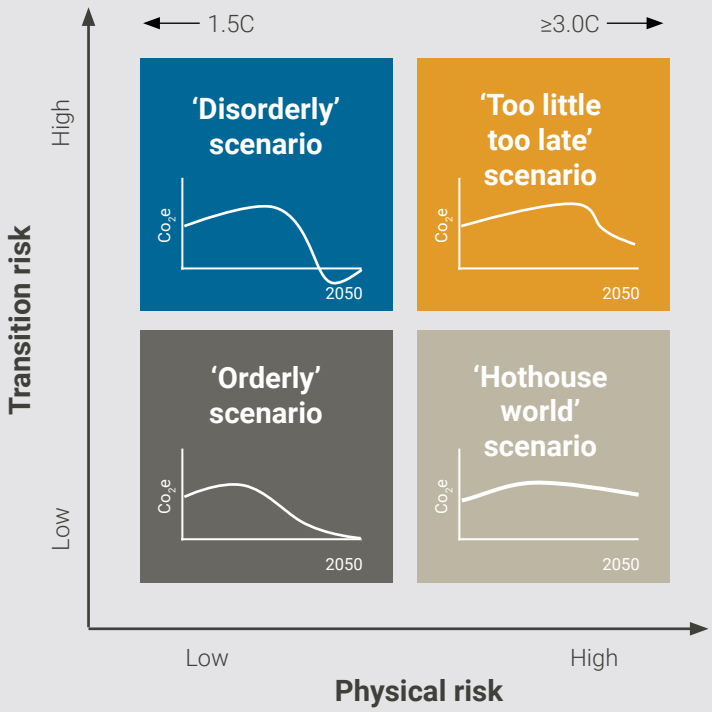


***Figure 5:* A scenario matrix developed using the NGFS scenario axes** *(adapted from [27]). The graphs are illustrative of different emissions reduction pathways which broadly align with ~1.5°C, ≥2°C and ≥3°C temperature outcomes, noting that hothouse world is a higher physical risk scenario than too little too late tends to be.*

4.2 Start with the fundamentals and build a richer picture over time

The first iteration of scenario analysis should cover, at minimum, the foundational aspects of climate-related risks and opportunities that the entity sees as the most relevant and challenging (and therefore material to its primary users).

The greater the diversity of temperature outcomes and emissions pathway combinations, the richer the understanding of the plausible evolution of climate-related risks and opportunities. Consideration should also be given to scenarios where New Zealand achieves net zero, but the rest of the world does not, and vice versa.

Once these fundamentals are covered, more attention can be given to aspects of the pathways to which the entity will be more sensitive (see examples in next section).

4.3 Select scenarios

The number and combination of scenarios should be selected based on the insights needed

The requirement in NZ CS 1 is not intended to constrain entities to explore only three scenarios. Participants should keep the disclosure objective in mind and focus on using the scenario process to obtain the required strategic insights. A systematic exploration might require more scenarios depending on the number of critical uncertainties identified.

"[A] key principle is that the differences between scenarios are sufficiently great to capture the key impacts and uncertainties of the drivers a company has identified. A lack of scenario diversity (scenarios having too narrow a perspective) may be a signal that insufficient consideration is being given to different perspectives, a diversity of input is lacking, or critical challenge in the scenario process is lacking." *TCFD (2020) Guidance on Scenario Analysis for Non-Financial Companies, p.18.*

Exploring different pathways leading to a same temperature outcome is useful

Combinations of emissions reduction pathways leading to a higher physical risk outcome (≥3°C) could be developed to illustrate transition/physical risk interaction. Similarly, different emissions reduction pathways aligning with a 1.5°C outcome will illustrate different aspects of transition risk and opportunity. The NGFS provides guidance describing its use of outcome and pathway combinations.[26] The TCFD also offers guidance on the role and value of pathways in promoting scenario diversity.[27]

Two examples of the usefulness of several scenarios for a same temperature outcome:

Example 1: An entity has identified two critical uncertainties that could unfold (or not) in a world with a 3°C temperature outcome:

1) Geopolitical tensions, or an inability to insure the transport of goods due to increased risks, could prevent or limit access to some countries on which it is highly reliant for both demand and supply.
2) Physical impacts could reduce the availability of key agricultural inputs.

In this example, both could eventuate simultaneously, but participants decided that such a scenario would not be useful as it will make it impossible for the entity to operate. They therefore opted to explore both uncertainties in separate scenarios to identify what each of them would mean for the entity, and how it could increase its resilience. For example, the first scenario calls for diversification or prioritisation of more politically stable areas of the world. The second scenario could open up opportunities to explore alternative raw materials, and/or investment within its value chain to improve the resilience of supply.

Example 2: An entity has identified two critical uncertainties that could unfold (or not) in a world with a 1.5°C temperature outcome:

1) The successful development (or not) of a key technology on which it depends to reduce its emissions while still delivering its current products/services.
2) Changes in behaviour and policies resulting in customers stopping use of its current products/services.

In this example, the entity depends on highly emitting products and services and knows that a world achieving a 1.5°C temperature outcome means a drastic change in technology, stringent new government bans, or a significant reduction in demand for its services. The participants decided that it would be useful to explore both scenarios to generate a larger range of options for the entity.

In the scenario assuming a technological leap forward, participants considered that it would not happen by itself, but would require active investments and a partnership strategy from the entity. This in turn would require underwriting existing assets and investing massively in new assets at the same time.

The alternative scenario calls for a strategic pivot by the entity to provide new low- or zero-emissions products/services aligned with future constraints.

Comparing both scenarios will inform strategic discussions down the line and will help explain the entity's decisions to primary users of climate-related disclosures.

Thinking ahead: Refining scenarios – more specific is more relevant

Solely using temperature outcomes as the default way to differentiate scenarios (i.e. a low, medium and high temperature scenario) originated with the recommendations of the TCFD. Therefore, this has been a natural starting point for most organisations' first attempts to interrogate the implications of climate change. However, for most organisations, the critical uncertainties will lie in how the world got there (i.e. the pathway) rather than a temperature endpoint.

As entities become more experienced with the scenario analysis process, the selection of scenarios will become more strongly linked to critical uncertainties. For example, an entity's scenarios could become centred upon relevant tipping points rather than solely focused on a defined temperature outcome. So, they might opt for "the climate in which stem rust can thrive in New Zealand and prevent wheat culture", instead of "2°C". Many other forms of differentiation are possible and should be considered.

The evolution of the use of scenario analysis can be seen in the case of Shell, which has a dedicated team and has explored many scenarios over the past 50 years.

Using sector-level scenarios

It is important to distinguish two aspects:

1) The usefulness of sector scenarios to inform an entity's scenarios.
2) The usefulness of sector scenarios to improve comparability between entities.

Entities could use sector scenarios as contextual inputs, but should not use them as is

CREs should not take sector scenarios at face value and use them directly without identifying their specific critical uncertainties.

The choice of climate scenarios is the entity's responsibility. The decision by an entity whether to use, and the extent to which adapt, a given sectoral scenario should be based on the entity's own analysis.

Still, sector scenarios can be useful to help draft entity-level scenarios.

An entity can decide to use the sector scenarios as a baseline on which to apply its own set of critical uncertainties to build richer and more specific scenarios, and maybe branch out in various directions.

Entities should consider using sector scenarios as a comparison point for primary users' benefit

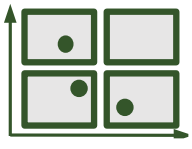
An entity could decide that a given sector scenario (e.g. 1.5°C) is not useful (maybe not challenging enough, or not relevant enough to the entity's situation), and it may deviate significantly, or even make a completely new scenario. It could also decide to align with sector scenarios later as they improve and better reflect the entity's critical uncertainties.

Even in this situation, the sector scenarios would be useful to compare disclosures within a sector, as an entity will be able to explain where it deviated and why (see the XRB's Climate-related Disclosures Staff Guidance for all sectors, pp.36-38).

This will help primary users to compare two entities within a sector if they both use sector scenarios as a reference point.

Note that sector scenarios could be considered as a baseline by some primary users, who would need convincing explanations for an entity deciding to ignore some of the risks or opportunities raised at sector level.

Key outputs to document: Temperature outcomes and emissions pathways



Document which temperature outcomes and emissions pathways combinations have been selected for the scenario analysis. Include the rationale for this selection of scenarios.

Conditions for success

1	Be clear about the role of temperature outcomes in defining each scenario. Scenarios typically gain a name and various other distinguishing characteristics as they move through the development process, but it will be important for preparers and primary users of disclosures to understand each scenario's temperature outcome at a glance.
2	Make explicit reference to pathways developed internationally, illustrating how the pattern of emissions reduction they follow have informed the development of each scenario's pathway.
3	Explore alternative pathways to one temperature outcome. If not, it should be a conscious decision that can be explained to others.
4	Task (at least) one participant (the 'black hat') to robustly challenge existing value chains and business models. This should help to break group think and lead to more open discussions.

5. Draft narratives and quantify

Scenarios are plausible stories of the future that illustrate key developments relevant to strategic decision making. Drafting narratives that provide a rich, compelling illustration of the temperature outcomes and emissions pathways selected will bring alive plausible future events. Quantification of the appropriate aspects of each narrative will assist later characterisation of the financial impacts of climate-related risks and opportunities.

5.1 Drawing on higher-level scenarios, pathways and projections

Scenario archetypes are useful building blocks…

Rather than starting from a blank page, entities should develop their scenarios by incorporating relevant elements of the building blocks and assumptions provided by work already done at higher levels. This may include the IPCC's global scenarios and pathways, the NGFS scenarios, International Energy Agency (IEA) scenarios, and scenarios and projections of relevance in Aotearoa New Zealand. These scenario archetypes are useful building blocks that will help the entity explore the implications of climate-related risks and opportunities in its context.

… to use cautiously

Drawing on these higher-level sources of plausible future pathways is as much of an art as it is a science. The IPCC, NGFS, IEA and others have developed projections for factors ranging from global average temperature to the price of carbon, global trade settings and land use change, over decades or even centuries. The various agencies and organisations involved in this work have done so for a range of different purposes, using different methodologies and assumptions. It is therefore essential to check that these are broadly consistent when combining scenarios (see Appendix 3). Entities are also free to, where they consider it necessary, change assumptions in those scenarios in a transparent manner.

Using sector-level scenarios

The work done at the sector level would have already drawn from higher level sources of scenarios (such as IPCC scenarios, etc). However, an entity must describe the scenario analysis *it has undertaken.* The entity should be able to explain why it chose a given set of assumptions for its own entity-level scenarios, including assumptions drawn from sector-level scenarios and any higher-level scenarios that fed into sector-level scenarios. Entities should therefore pay close attention to these assumptions to ensure they are consistent with the entity's context and objectives for this exercise. This includes awareness of the limitations of scenario archetypes (see Appendix 3).

See also Appendix 4, which answers questions such as, *"What if several sectoral scenarios are relevant for my entity and they do not use the same assumptions?"*.

Entities can benefit from existing higher-level work while supplementing it with tailored insights

The benefits of a scenario development guided by archetypes include the following:

- The findings of higher-level work can indicate the broad direction a scenario should take, given a set of base assumptions.
- Drawing logical connections from global to national and sectoral scale will provide useful building blocks for CREs to draw on in completing their own scenario analysis at entity scale.
- The comparability of scenarios will be greatly enhanced where entities refer to common assumptions and building blocks.

However, this higher-level information should be supplemented by insight and secondary research providing additional depth and detail specific to the entity's context wherever possible. For example, emerging technologies and business models of competitors and their impacts are often poorly captured in archetypes. Academic literature and industry analyses often explore potential future developments in depth and can provide important specialist insights.

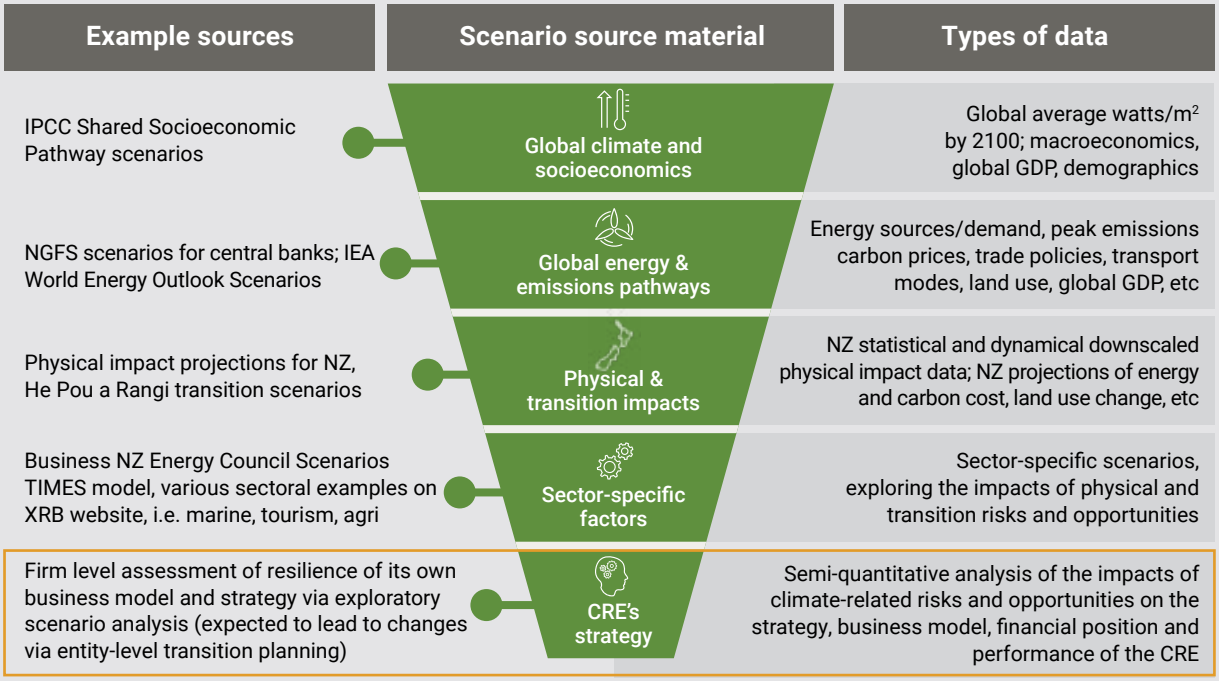


***Figure 6:* A shared architecture for structuring and beginning to quantify various aspects of a scenario narrative.** *This architecture combines higher-level, publicly available scenarios and projections to provide some broad guide rails for sectors to use in developing their own scenarios. If the underlying assumptions and building blocks each sector employs in developing their own scenarios are consistent, then the subsequent analyses undertaken will more readily align, and primary users will be in a position to compare findings more readily.*

5.2 Draft scenario narratives

A narrative is a **story**. A narrative is not simply a list of assumptions. It should be a richly developed and evocative 'movie of the future'. The TCFD provides extensive guidance on how to draft scenario narratives in a creative and compelling way.[28] An example of a narrative is provided by the Aotearoa Circle marine scenarios.[29]

Good scenario narratives should focus on what matters most to key stakeholders and describe challenging, compelling, plausible and internally consistent visions of how the operating context may evolve over time.

Narratives that remain at the level of bland generalisations of events are not considered useful, as highlighted by the TCFD view on the construction and use of scenario narratives (see below). Attention should be given to crafting the details that make tangible the implications for the entity or its key stakeholders, and how those are expected to impact behaviours (secondary consequences).

The TCFD's view on scenario narratives:

> *"A scenario narrative tells a story with a sequence of events; a plot; a beginning, middle, and end; characters, and a setting. The narrative describes developments in the scenario around different economic, technical, environmental, and social dimensions. The main reasons for formulating narratives or storylines are to:*
>
> - *help the [entity] to think more coherently about the complex interplay between driving forces within each scenario and across alternative scenarios;*
> - *make it easier to explain the scenarios to various stakeholders and user communities;*
> - *make the scenarios more useful, in particular to [entity] leaders and managers who contribute to an [entity's] strategic, financial, and operational planning; and*
> - *provide a guide for additional assumptions to be made in detailed planning analyses, because at present no single scenario can possibly respond to the wide variety of informational and data needs of the different users within an [entity] and its external constituencies."*[30]

This approach to scenario analysis is a primarily qualitative one, particularly in its early iterations. It places a greater emphasis on ensuring the narratives resonate with participants as they will need to use these narratives in subsequent assessments of the resilience of their own individual strategies.

The critical uncertainties identified in step 3, and any conceptual model of how forces interact with each other and the sector, provide the basis for the drafting process.

Fostering collective buy-in to what is a creative process will require participants staying committed, and making sound stakeholder management a critical consideration. Participants should be involved in the drafting of scenarios, not just the facilitator or consultants.

Using sector-level scenarios

Reusing a sector scenarios narrative directly in an entity's own narrative is unlikely to be of much use for primary users or the entity, nor will it meet the disclosure requirements in NZ CS.

Entities' scenarios narratives should focus on the specific drivers able to impact the entity's own operations, markets, strategy, and business model.

However, an entity's narrative could refer to relevant aspects of a sector narrative, such as how stakeholders in the entity's value chain are expected to behave under a certain scenario (e.g. customer behaviour changes, shifts in key suppliers' operations, type of regulations that would be expected to take place…).

5.3 Quantification

Many aspects of climate-related scenarios lend themselves to quantification at all stages of the process, from inputs to outputs. This is not just about the quantification of financial impacts.

Quantification might be undertaken via estimation, extrapolation, modelling or statistical analysis. It is therefore essential to document the methods employed in quantifying the scenarios.

Quantify to assess the relative size of the issues, not to discover future values

The purpose of quantifying scenarios is to support the evaluation of strategic resilience, not to discover the precise future values of key variables.

When it comes to quantification, a minimalist mindset is helpful to avoid common pitfalls.

The challenge of quantification in this space is high, and expectations are often not aligned with available data, nor the level of complexity and uncertainty related to climate change impacts. Entities should also be aware of concerns about all-encompassing models or misleading claims of precision, and choose expert providers carefully.

Quantify with purpose

For participants, quantification could be used to assess or confirm their assessment of the relative impact of specific issues.

For other stakeholders, such as primary users, data projections that illustrate key aspects of the issues raised under each narrative can help clarify what the full implications of the scenario may be.

To be useful, modelling needs to be targeted, and directed by the qualitative narrative

Specialist modelling, which illustrates the evolution of factors of interest, can be undertaken to generate targeted quantification (where time, resources, data and expertise allow).

Numbers can provide a false sense of certainty. When facing significant uncertainties, a natural response is to over-rely on models to manage the complexity and provide answers.

Models can be used to provide insights, but the value of these insights highly depends on clear and targeted lines of questioning.

In other words, the scenario narratives should drive the questions asked of the models. Models should not drive the narratives.

Modelling can support initial assessments of the anticipated financial impacts accompanying a given narrative. If going down this route, employing a conceptual model developed at step 3 will be useful in communicating to modellers:

- **what** it is that participants would like to quantify, and for what purpose
- **how** they envisage its value chain and its most influential driving forces to function and be structured
- **where** existing models might most readily plug in to provide externally calibrated and validated inputs.

Key outputs to document: Scenario narratives, quantification, and process

The narratives accompanying each scenario, including any data which have been developed or collated in support of the narrative.

A brief description of the process followed in developing the narratives (and any quantification) should be included to explain the work undertaken.

Conditions for success

1	The drafting of the scenario narratives needs to be a collective, creative process. Ensure the narratives resonate with participants as they will need to use these narratives when assessing strategic resilience, and during transition planning.
2	A narrative is a story, not a list of assumptions. It should be a richly developed and evocative 'movie of the future'. Focus on what matters most to key stakeholders and articulate compelling, plausible and internally consistent visions of how the operating context may evolve over time.
3	Be clear that the purpose of quantifying scenarios is to support the evaluation of strategic resilience, not to discover the precise future values of key variables.
4	Describe how each scenario unfolds over the entire timeframe selected for the analysis, rather than simply focusing on specific time-slices or endpoints. Sense-check the assumptions involved in developing the narratives against the critical uncertainties, and against the guide rails provided by archetypes.

6. Assess strategic resilience

Systematic interrogation, in each of the scenarios, of what would be the implications for the strategy and business model of the entity is likely to highlight resilience issues calling for profound changes. Participants will draft potential options to increase the entity's resilience, identify criteria to assess these options and signals to monitor uncertainties.

6.1 Quality checking the rigour and robustness of scenarios

The TCFD sets out 12 factors for assessing the quality of scenarios (see Table C4[31)] This checklist can also be a helpful means of monitoring the integrity of the scenario development process as it unfolds.This checklist can also be a helpful means of monitoring the integrity of the scenario development process as it unfolds.

We recommended setting regular milestone updates as part of stakeholder engagement, which is the first step of the process (see step 1). There should be few surprises at this point regarding the quality of the result if this approach is adopted.

Ensuring the participation and perspectives of those in the entity's value chain provides a further check and balance on quality and coherence.

Finally, ensuring that the scenario development process is fully documented is important for both future iterations of the process, the next step of transition planning, and to comply with record-keeping requirements set by the regulator.[32]

6.2 Interrogating the scenarios to assess resilience

This excerpt from the NZ CS 1 (paragraph BC41) illustrates the significance of implications of scenario analysis:

> *"[The] implications of scenario analysis for the entity's business model and strategy should be, due to the nature of climate change itself, profound and of critical strategic relevance to the entity."*
>
> *"[Scenario analysis is expected to lead to] an increased understanding by the entity of the need for transformation, and the fundamental lack of resilience that most business models and strategies have to a diverse range of climate outcomes."*
>
> *"If the implications are not indicative of a lack of resilience and need for transformation, the scenario analysis is unlikely to meet the TCFD's criteria of plausible, challenging and coherent."*

This involves a structured process of systematically interrogating, in each of the scenarios, what would be the implications for the strategy and business model of the entity. A facilitated workshop can be an effective way to approach this.

The type of questions posed to participants could include the following examples (adapted from TCFD guidance[33]).

At the level of the entity's external stakeholders:

- For each group of external stakeholders, what value changes are involved in each scenario?
- What are the associated business opportunities?
- What are the new bottlenecks in the market(s)?
- Who is impacted and what might they do about it?

At the level of the entity:

- If it was certain a given scenario would occur, what opportunities and risks or threats would the entity face based on the relationships between the scenario's driving forces and the entity's strategy?
- It is essential that this first line of questioning covers the following themes for each scenario (see Figure 1):
  - Would the entity (in its current form) still be **able to operate**? What would change for the entity? What would change for its value chain?
  - Would the entity (in its current form) still be **able to generate sustainable revenues**? What would change for the entity? What would change for its clients?
  - What might happen to the entity's **assets**? What would be the consequences?
  - Would it create **liabilities** for the entity?
  - Would the entity be able to access the **finance** it needs?
- How does the entity's current business model, strategy, policies, and capabilities prepare it for the future described in each scenario? Does the entity's current strategy and associated strategic positioning look sound across only one or several of the scenarios?

Documenting the findings of this process is important to capture insights, and for regulatory purposes.

6.3 Drafting strategy options

Thinking ahead: From scenario analysis to transition planning

From this point onward, the objective is to take advantage of the scenario analysis setting and participants' engagement to raise the "so what?" question. However, due to the challenging and uncertain nature of climate-related impacts, these are expected to raise fundamental or even existential questions for the entity. Therefore, it will take time and iterations to develop a truly climate-resilient strategy.

This is still an integral part of the scenario analysis, but it is not expected that the scenario analysis process will result in a fully formed strategy and implementation plan.

Reflecting on the implications of each scenario is the first step toward identifying strategy options to best take advantage of the opportunities, and mitigate the risks the entity may face. One approach is for participants to create a long list of strategy options, clustered around themes or challenges that the options address.

An open and creative approach to option generation should be taken

This could mean asking questions that help participants to think outside the box, such as:

- What would our clients or customers really need or want if we could do anything for them?
- What should we do to provide it if we had an infinite amount of money?
- What should we do to provide it if we did not have any existing assets? Or if we could displace our assets overnight? Or if we could transform our assets overnight?
- Etc.…

The scale of changes brought about by climate change is such that it will require a level of innovation and flexibility akin to what is required by start-ups, even from large and well-established organisations.

Climate resilience requires adaptability and flexibility

Such questions allow the identification of what the entity should aim for in the long term (i.e. a direction of travel). It will also provide insights about the differences and commonalities of transition needs between scenarios. Commonalities will be useful to identify 'no-regrets' options, while differences will inform where the entity needs to maintain flexibility.

The TCFD recommends that entities seek out strategy options that are likely to serve multiple purposes, performing well in more than one scenario, and supporting multiple strategic objectives. There is a lot of useful related content in part D. Strategic Management Using Scenarios in the TCFD's Guidance on Scenario Analysis for Non-Financial Organisations.[34]

Not knowing is still a useful insight

Additionally, participants might find that they cannot answer these questions yet, which should inform further research work (about future market expectations, for example).

After this more creative stage (which is typically still considered part of scenario analysis), more constrained lines of questioning can be expected in transition planning.

Using sector-level scenarios

Sector-level scenario analysis might not have included this resilience assessment step. However, it might have identified collective options that could be relevant for entities either to be involved with directly (such as a sector-wide transition plan focused on cross-cutting issues) or that inform transition approaches of others in their sector or value chain.

6.4 Identifying evaluation criteria to navigate options

Establishing evaluation criteria will help entities to assess their options, with criteria that might include factors such as (adapted from The Scenario Planning Handbook[35]):

- the level of risk the option carries for the entity
- the value the option may generate for the entity
- the option's relative ease of implementation.

Entities will, in time, need to make decisions about which strategy options are the right ones to pursue. The purpose is not only to respond to strategy disclosure 15(b), but also to reassure investors and other stakeholders that they are well placed to navigate the uncertainties of climate-related risks and opportunities. The following questions (adapted from the TCFD[36]) can be used to help evaluate available strategy options:

- Which are most attractive in each scenario?
- Which are most attractive across all scenarios?
- What contingencies could protect attractive options in scenarios in which the option is weak?
- How could options be combined?
- What steps are needed to move to a higher value, more resilient strategy?

The TCFD also calls on entities to assess scenario implications beyond the entity's boundary.

6.5 Monitoring signals for strategy resilience

Developing signals is an important adaptive strategy tool

Signposts or leading indicators can alert the entity that a given scenario and its associated dynamics are occurring, or that the context is evolving in unexpected ways.

Entities will need to monitor developments in relation to the critical uncertainties that characterise their scenarios. They will want to be alert to changes signalling the need to shift lanes on their strategic choices.

The deliberations that went into driver selection and prioritisation can be a useful starting point. The evolution of critical uncertainties will indicate which scenario the present is most closely resembling.

Signals can act as the canaries in the coal mine

The entity should define its own indicators of change (typically carrying threshold values or terms) signalling how the critical uncertainties are unfolding. They may align or not with scenario assumptions, but in either case will provide vital early insights for the entity regarding which strategic choices may bear fruit and which may need to be revisited.

This will inform the entity when a review of the climate scenarios would be valuable.

6.6 Reiteration and review

Entities should monitor what others are disclosing, checking for additional areas that subsequent iterations of scenario analysis may need to address, or major discrepancies between entities with similarities.

Scenarios should be reviewed and revised from time-to-time to reflect changing circumstances, or to integrate new information and data when available.[37]

The TCFD also anticipated that the quantification of financial impacts of climate-related risks and opportunities at entity level would become more robust as tools, methods and internal capacities mature.[38]

If fundamental changes occur that disrupt the entity's assumptions on critical uncertainties, revisiting the scenario analysis in its entirety may be advisable. If the core assumptions of the scenarios remain valid and relevant, there may be an opportunity to take a deeper dive into specific aspects of the scenarios, rather than conduct the same high-level analysis in its entirety again.

Key outputs to document: Quality check, resilience assessment and response, signal monitoring and reiteration and review plan

A brief description of the quality checking and robustness review process and high-level summary of its findings.

A brief description of the signal monitoring process the entity will follow to evaluate its strategic choices.

The resilience assessment, the list of options developed, criteria to assess options, list of unanswered questions requiring more research, and key strategy choices made (or to make).

A high-level review and reiteration plan, outlining when and under what circumstances the entity will review and reiterate its scenario analysis.

Conditions for success

1	Engage external peer reviewers to help bolster the rigour and robustness of quality checking and review processes. External perspectives will offer a useful counterpoint to any 'group think' that might have inadvertently set in.
2	Don't rule out disruptive strategy options that provide a platform for profound transition.
3	Ensure signal monitoring processes are robust and well-integrated with the core work of those involved in strategy development and review.
4	Explore options for more than one approach to scenario reiteration, given the propensity for changing circumstances to trigger different needs. Scheduling a series of thematic deep dives over a period of years may be optimal, but disruptive change may trigger a need for high-level revision of an entity's scenario analysis.

Appendix 1: Scenario quality check factors

The TCFD sets out 12 factors through which to assess the quality of scenarios (Table 2).[38] This checklist offers a means of monitoring the integrity of the scenario development process as it unfolds (or is subsequently reiterated).

Table 2: ***Scenario quality checklist*** *(adapted from [38]).*

Factor	Check the scenario has
Time horizon	Appropriate short, medium and long-term time horizons for the decisions that must be made.
Focal question	A focal question targeting the climate-related decisions the entity must make.
Driving forces	A clearly articulated set of underlying causes of change in relation to the focal question, derived from STEEP categories of external drivers (see Table 3).
Scenario logic	Clearly defined relationships between core scenario assumptions and the drivers of change, and between drivers of change and the entity's business model and strategy. These should be coherently reflected in the scenario storyline.
Pathways	A clear and coherent trajectory between present and future temperature outcomes, illustrating the cause-effect relationships described by the scenario logic.
Uncertainty	Explicitly described key sources of uncertainties via the interaction of critical uncertainties (significant but uncertain drivers).
Storyline	A seamless, integrated narrative describing the causal train of events, their drivers, assumptions and affected systems.
Plausability	Events unfold in a manner that is possible and credible in the eyes of decision makers.
Distinctive and diverse	Differing assumptions about the interplay of driving forces under each scenario, with a sufficient number of scenarios produced to appropriately explore a range of outcomes.
Consistency	Application of the scenario logic is consistent between scenarios.
Relevance	Insights into the future evolution of climate-related risks and opportunities that directly relate to the strategic decisions an entity must take.
Challenging	Sufficiently challenge conventional wisdom and avoid falling into simplistic extrapolation of present conditions into the future. The scenarios need to help to evaluate the performance of the business model and strategy under difficult circumstances to be of greatest value.

Appendix 2: Driving forces detail

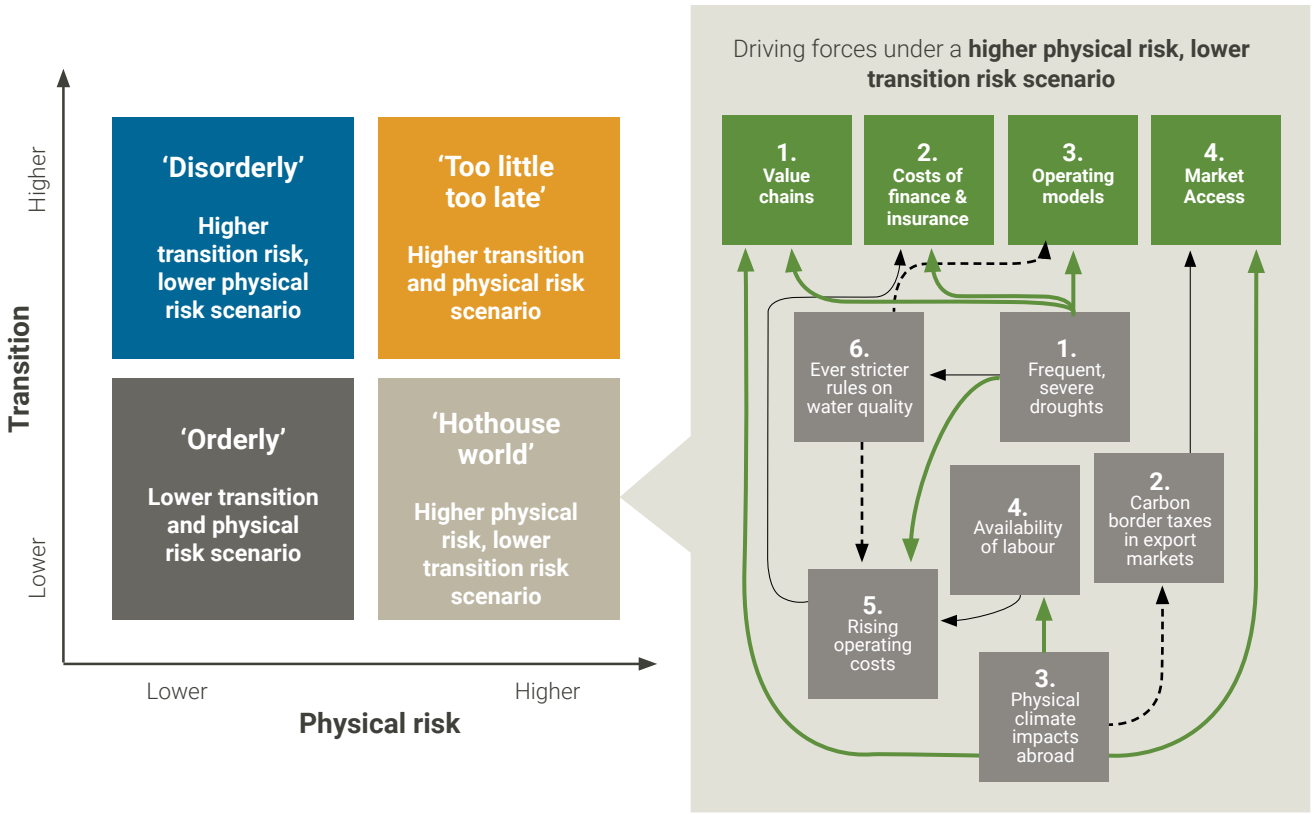
Additional considerations for identifying driving forces

A framework commonly employed to facilitate the identification of driving forces is a workshop-based 'STEEP' analysis. This calls on stakeholders to interrogate Social, Technological, Economic, Environmental and Political categories for driving forces of relevance to the focal question. The boundaries of each category are intentionally fluid rather than restrictive. In the context of climate-related scenario analysis, important driving forces are the risks and opportunities that may result in material financial impacts on the company or affect the resiliency of the company's strategy. To be considered a driver, a factor needs to (1) be continuous over a period of time and (2) influence the outcomes of the focal question durably and consistently.

Table 3: ***STEEP categories with examples of driving forces in New Zealand*** *(adapted from [39]).*

Catagory	Description	Examples in a New Zealand context
Social	Demographics, social norms, lifestyle trends, health, education, rural-urban divide	Migration, attitudes to lifestyle and consumption, distribution of wealth and opportunity, attitudes to science and the role of business in society
Technological	Research trends, emerging and/or disruptive technologies, technology uptake and market penetration	Biological methane inhibiting technologies, battery storage and electricity distribution, development of alternative or synthetic proteins, digitalisation
Economic	Macro and microeconomic policy, trade settings, finance, capital allocation	Interest rates and capital costs, public and private sector debt, trade settings and deals, value of exports
Environmental	Climate change, biodiversity loss, water, pollution, land use change, waste management, energy	Physical climate impacts, freshwater regulation and land use regulations, waste disposal options, energy systems
Political	Climate policy, law, regulation, legal liabilities, political attitudes and trends	Net-zero emissions targets, emissions regulations, border settings and freedom of movement, legal challenges

***Figure 7:* Evaluating the implications of each quadrant**. *The interaction of driving forces under a higher physical risk, lower transition risk scenario are explored using the conceptual model of Figure 5. Carbon taxes may play a much lesser role (if any) in market access, but severe droughts and physical impacts domestically and abroad are amplified in their influence on outcomes relative to other scenarios. The different weights and styles of the arrows between concepts illustrate differences brought on by this quadrant.*



Appendix 3: Scenario architectures

Employing shared architectures will help entities build on current climate knowledge to produce comparable scenarios, but caution is advised.

'Scenario architecture' is the ensemble of scenario archetypes, pathways and projections on which relies a given set of scenarios for the entity.

Origins of the architectures

The 'Orderly', 'Disorderly', 'Hothouse world', and 'Too little too late' architectures are loosely based on the structure of the NGFS climate scenarios. Adopting it as the structure for scenarios in New Zealand will help to align with global financial climate-related risk analysis practices.

Using the architectures: Key points and caveats to bear in mind

Global level projections and pathways have been developed for different purposes than risk management.

A growing number of experts in risk management warn that the misuse of these scenarios without proper understanding of their limitations and assumptions result in underestimating climate risks. The latest of these warning comes from the IFoA (Institute and Faculty of Actuaries, UK), which warns that "scenario analysis outcomes [are] being taken too literally and out of context".

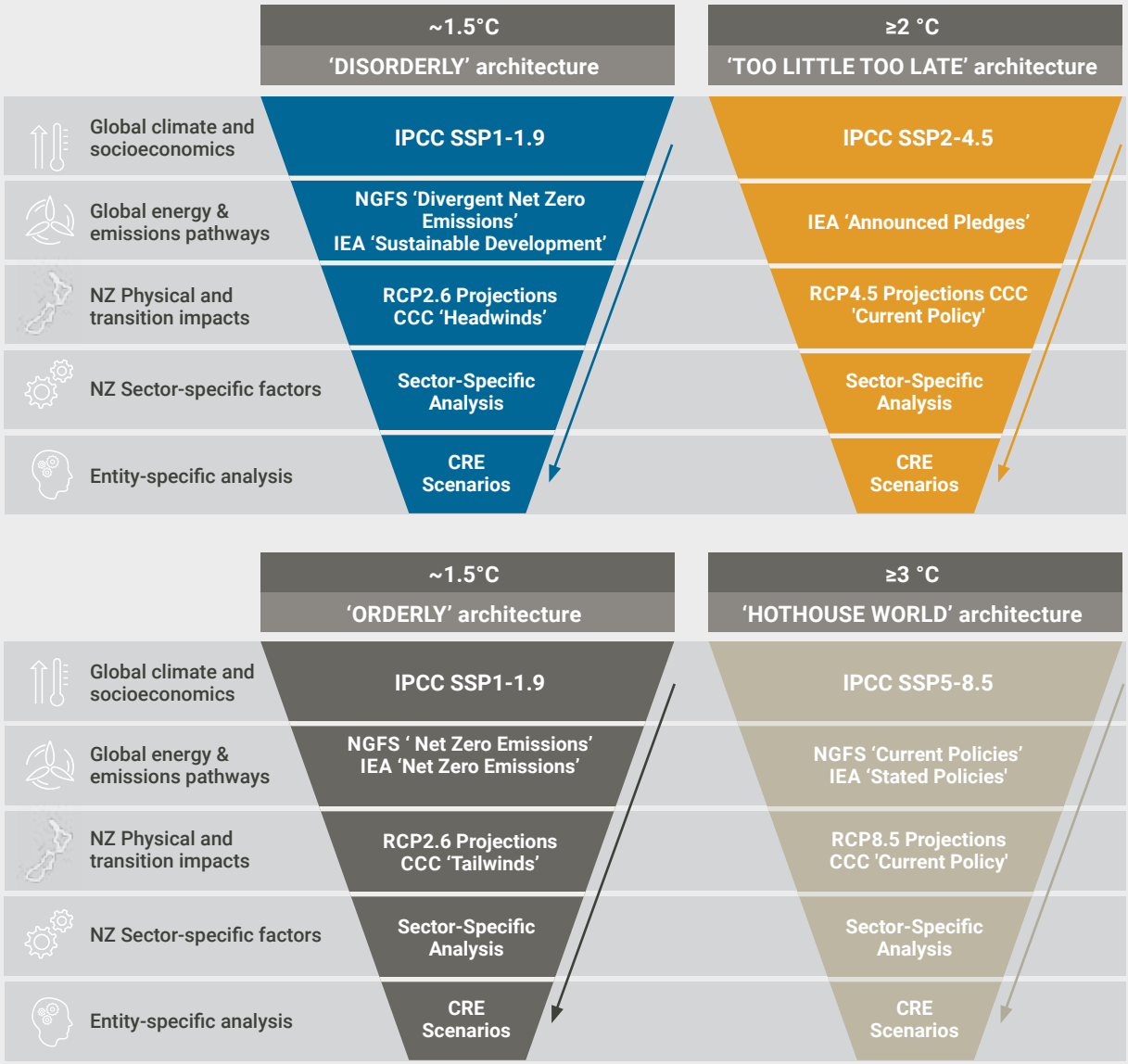
The NGFS itself warned that the nature of climate risk means that many of the initial climate scenario analyses exercises "could underestimate real impacts of transition and physical risks", and therefore they "stand out primarily as learning opportunities".

Participants to scenario analysis should be mindful of the limitations and assumptions of the projections and pathways when they select them to define the backbone of an entity's scenarios.

These caveats aside, the broad groupings of high-level data presented here can and should be used to structure thinking on the development of scenario narratives. Waiting for all providers of scenario archetypes to align on methods, inputs and assumptions would require waiting many years, or draw on a much narrower range of inputs.

Ultimately, the responsibility for sourcing, validating or generating data appropriate to the analysis of climate-related risk and opportunity lies with those using these to develop scenarios and disclose their findings.

Figure 8: ***Scenario architectures.*** *Broadly aligned sets of scenarios, pathways and projections can form a shared architecture for sectoral scenarios. These provide high-level assumptions and building blocks which are plausible and broadly coherent, and can be used to paint a picture of the world an entity might find itself in. It should be noted that the NGFS use three different IAMs to generate the* ***data associated with the scenarios*** *they have developed. Modellers have used a prescribed set of assumptions and inputs in generating these data. Of necessity, the assumptions and inputs set out above differ from those of the NGFS. However, the NGFS provides* ***technical documentation*** *describing these inputs and assumptions if sectors wish to evaluate the utility of employing NGFS IAM data in quantifying their scenarios.*



Note: *Using 8.5 is controversial from an anthropogenic forcing perspective (due to limitations in available fossil reserves, see Hausfather et al), but it gives an impact regime which tracks more closely to what we're actually observing than any other SSP-RCP combination.*

Appendix 4: How to leverage existing sector scenario analysis

Sector scenarios are useful, but should be used with realistic expectations. Entities are responsible for their own risk management.

For an entity to understand how to best use the outputs of sector scenarios analysis, the first step is to understand their role, their objectives, and their limitations.

The role of sectoral scenarios

There is a wide gulf between published 'meta' climate-related scenarios from organisations such as the Intergovernmental Panel on Climate Change (IPCC) and what is relevant to an individual entity.

Sectoral scenarios offer a practical and flexible means of bridging the divide.

Although not mandatory, sectoral collaboration can support greater comparability and reduce resource demands on CREs (see Figure 9).

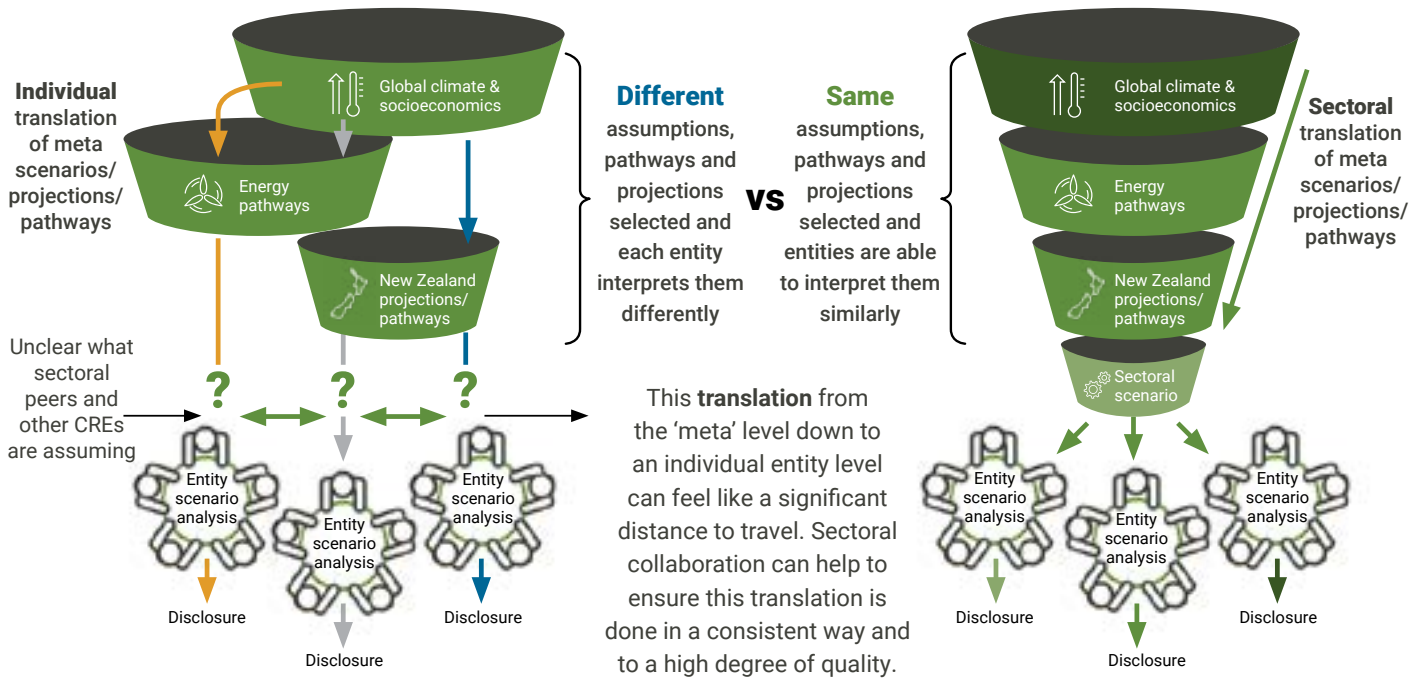


Figure 9: The role of sectoral scenarios in creating a shared scenario architecture

The objectives of sector scenarios

Sector scenario exercises tend to have the following main objectives:

1. Translate the global and national meta-scenarios and potential pathways into tangible potential consequences for the sector.
2. Develop common sector scenarios supporting entities' scenario analysis for better comparability.
3. Build a cross-sector common understanding of climate-related risks and opportunities, and of the scenario analysis process.
4. Support the wider sector, including entities that are not CREs, to prepare for climate-related risks and opportunities.

Another longer-term objective is to build on sectoral collaboration to address some of the climate-related risks and opportunities identified in a sector-level transition plan. Some actions can be more effectively tackled at a sector-level (e.g. participation in the regulatory process, joint research, funding of enabling innovation).

Sector scenarios limitations

Entities should have realistic expectations about sector scenario analysis exercises. They present inherent characteristics that limit their relevance for an entity's scenario analysis:

- **A wider scope**: A sectoral analysis cover a wide range of entities with different activities, business models, value chain, geographic locations, etc, and therefore cannot explore exhaustively all critical uncertainties, risks and opportunities for all entities within a sector.
- **Scope mismatch:** Sectors as defined along traditional economic lines do not overlap with exposure to climate-related risk, meaning that an entity can identify itself as part of a given sector, but find out that its main risks are linked to another sector.
- **Imperfect information**: Entities are the best expert about themselves. Sectoral work cannot benefit from the same level of granularity and insights that an entity can leverage across its whole organisation.
- **Voluntary work**: These exercises rely on the voluntary involvement from entities and stakeholders within the sector. Therefore, the absence of some stakeholders will always result in some blind spots in the analysis.
- **Negotiated outputs**: The outputs published reflect the end of a process between many stakeholders with various interests and risk appetites. This means that the output is likely to be limited to what most or all participants can agree, which is at odds with an entity's risk management objectives. (This is similar to the IPCC's reports, which are the products of negotiations, and therefore reflect the most conservative estimates made by the contributors, not the most challenging.)

Guidelines for entities when drawing in sector scenarios

To be crystal clear: **Entities are responsible for their scenarios**. This includes the choice to use existing scenario archetypes – sectoral or otherwise – or not, and how they use them.

That means that entities can depart from sector scenarios in many aspects, or even not use them at all, as they see fit.

Still, sector scenarios can be a useful starting point in many regards, as long as they are used with realistic expectations. The body of this guidance highlights this in further detail in text boxes for each step of the process when relevant.

Entities will also have to consider the relevance of sector scenarios as a reference point of comparison for the primary users of their disclosures. Explaining how an entity scenario compares with a sector scenario can contribute to primary users' understanding of the entity's scenario analysis.

What if several sectoral scenarios are relevant for my entity and they do not use the same assumptions?

It will not be uncommon for an entity to find that its risks and opportunities lie across several sectors, especially when looking at its value chain.

> *For example – A dairy products manufacturer may be interested in sectoral scenarios in agriculture, energy, transport and retail.*
>
> *A forestry products business may be interested in sectoral scenarios in agriculture, energy, transport and building.*

When designing its own scenarios, drawing from several sector scenarios provides the entity with a larger pool of high-level assumptions to consider. Because this is, in part, a risk management exercise, for their scenario to be most useful entities should consider using a set of the most challenging options presented to them. Materiality considerations will also play a part.

In addition to choices related to the design of an entity's scenarios, there might be aspects to consider for the disclosures. What is the most useful for the entity from a risk management perspective might not align perfectly with primary users' comparability needs.

Appendix 5: Procurement tips

What entities can expect from third party service providers

1) External support should be focused on knowledge transfer and capability building

The use of consultants and experts should always be framed as a knowledge transfer, with one of the explicit goals being to improve the organisation's capability.

Engaging consultants to produce the required disclosures is very unlikely to lead to high-quality disclosures. Furthermore, it is not sustainable in the long-term due to both the time-consuming nature of the process, and the need to embed the management of climate-related risks into the entity's operations and processes.

2) A clear process and clear requirements for the entity

Clear communication of the objectives and expectations for each step, and visibility over the overall process are key. This is to avoid entities commissioning bits of works that do not fit together.

A competent expert will know that, for the process to be successful, certain conditions must be met, and they will explain these upfront. This will translate into specific requirements for the entity, such as mandating the participation of the relevant leaders and functions from across the organisation.

3) Drafting a multi-year plan: Playing the long game – starting simple and adding complexity over time, with a clear direction

Climate risk management is challenging, and for most entities it will take several years to build the internal capability, systems, and processes to do it well.

Acknowledging that, it requires a bit of planning and conversations with experts to identify what will be needed over time, what are the current gaps for the entity, and what is a credible pathway to reach the end goal.

Entities that have a multi-year plan to get their organisation geared to the challenge will use their resources efficiently, ensuring each piece of work contributes to increasing the entity's capability to manage climate risks.

This gap analysis and planning can be done internally, but a competent expert will ask to see this capability analysis before starting work on scenario analysis, and will provide feedback on what can be realistically achieved.

4) Building strong foundations for participants

The capability gaps most commonly faced by entities are climate literacy, risk management, foresight, and system thinking.

Raising the climate literacy of participants is crucial and usually done through the explanation of the implications of the "meta-scenario", such as the RCPs and SSPs.

Similarly, the use of consistent vocabulary is important to avoid confusion, especially in relation to risks or scenario analysis. Therefore, competent consultants will have prepared short exercises for participants to grasp some essential concepts (such as "drivers for change") to ease upcoming discussions.

As highlighted in step 1.8, fostering a future mindset in a diverse group of participants requires facilitation skills. It will seem natural to some and difficult to others, so the role of the facilitator will be to allow all perspectives to be expressed in a useful way.

5) Partnership with others to cover the full spectrum of required expertise

As described in step 1.10, there are many roles and responsibilities to allocate for this process, and some of these roles should not be held by a same person (or it risks resulting in an imbalance in discussions, undermining the participatory nature of the process).

The range of skillsets required is also quite wide. Therefore, competent experts will tend to partner with others to ensure the process progresses as efficiently as possible, and focuses on where they can add the greater value.

When requesting third-party support, entities should pay close attention to the skillsets of individuals and the pairing of individuals to specific roles.

Appendix 6: Introduction to key scenario archetype providers

The Global Association of Risk Professionals (GARP) provides a useful primer on key scenario providers:

1) Intergovernmental Panel on Climate Change (IPCC)

A) Representative Concentration Pathways (RCPs) are a series of scenarios used by the IPCC, based on different projections of atmospheric concentrations of greenhouse gases and other air pollutants, and land use, by the year 2100.

Four RCPs were published in the Fifth Assessment report: RCP2.6, RCP4.5, RCP6.0, and RCP8.5. Each RCP corresponds to a different level of total atmospheric 'radiative forcing' (a direct measurement of the greenhouse effect), meaning that they each produce different degrees of future global temperature increase. By 2100, relative to a 1850-1900 baseline, the IPCC forecasts the following:

- The stricter mitigation scenario will be RCP2.6, with a median temperature increase of 1.6°C.
- RCP 4.5 and RCP6.0 are the intermediate scenarios.
- The highest emissions scenario, RCP8.5, will yield a median temperature increase of 4.3°C.

B) Shared Socioeconomic Pathways (SSPs) are a series of scenarios synthesized by the IPCC, which outline different states of socio-economic prosperity and resilience by the year 2100, based on different possible trajectories of development.

A new set of five SSPs were published in the Sixth Assessment Report: SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3- 7.0 and SSP5-8.5. These five new SSPs (SSPx-y) include indicative levels of radiative forcing alongside their socio-economic assumptions. The first number (x) in the label corresponds to the set of socio-economic assumptions, and the second number (y) is the level of atmospheric radiative forcing reached in 2100.

The following are outlined in the IPCC's Sixth Assessment report:

- SSP1-1.9: Warming is held to around 1.5°C above 1850-1900 in 2100, with "slight overshoot", with net-zero CO2 emissions around 2050.
- SSP1-2.6: Warming remains below 2°C, with net-zero emissions in the second half of the century.
- SSP2-4.5: A scenario that "deviates mildly from a 'no-additional climate-policy' reference scenario, resulting in a best-estimate warming around 2.7°C by the end of the 21st century".

- SSP3-7.0: A medium-to-high reference scenario resulting from no additional climate policy, with "particularly high non-CO2 emissions, including high aerosols emissions".
- SSP5-8.5: A high emissions reference scenario with no additional climate policy.

For more information, see Annex 2 of the CFRF's 2020 Scenario Analysis Chapter, and the GARP jargon buster.

2) Network for Greening the Financial System (NGFS)

The NGFS is a coalition of central banks and supervisors that has developed various scenarios, broadly split into two categories:

- 'Orderly' or 'Disorderly' transitions to either 1.5°C or 2°C warming.
- 'Hot-house world' scenarios of little policy action and high physical risks.

Table 1 (p.19) of CFRF Scenario Analysis Implementation Guide 2021 provides more details.

Note that the NGFS scenario outputs are currently all based on the use of IPCC SSP 2, in combination with the previous generation of IPCC RCPs. The new generation of IPCC scenarios supersedes these, but there will of necessity be a time lag between their release and their uptake in the next generation of NGFS scenarios.

3) International Energy Agency (IEA)

The IEA produces a range of scenarios, including the following:

- The Net Zero Emissions by 2050 Scenario (NZE), which "achieves an emissions trajectory consistent with limiting global temperatures to 1.5°C without a temperature overshoot (with a 50% probability), universal access to modern energy services and major improvements in air quality".
- Two scenarios – the Announced Pledges Scenario (APS) and the Stated Policies Scenario (STEPS) – that define a "set of starting conditions, such as policies and targets, and then sees where they lead based on model representations of energy systems, including market dynamics and technological progress".
- A Sustainable Development Scenario (SDS) that "maps out a pathway consistent with the 'well below 2 °C' goal of the Paris Agreement, while achieving universal access and improving air quality".

For more details, see: Understanding WEO scenarios.

4) NZ projections

A) **Climate physical impact projections for New Zealand** can be found on NIWA's website. Note that the latest currently available projections are from 2016 and based on the IPCC 5th Assessment report, and have not yet been updated to reflect more recent climate science findings.

B) **The Climate Change Commission** (CCC) also developed several scenarios and pathways, of which descriptions can be found in its final advice to the government: Ināia tonu nei: a low emissions future for Aotearoa (chapter 6).

The main scenarios:

- **Headwinds** – the least optimistic scenario, it examines a future where there are more barriers to adopting both technology and behaviour changes in the future.
- **Further Technology Change** – examines a future where there are fewer barriers to technology changes. Relative to the Headwinds scenario, technologies could be available sooner, perform better, or have lower costs that help drive greater adoption.
- **Further Behaviour Change** – examines a future where there are fewer barriers to people and businesses changing behaviour and choosing low emissions options. There are conservative improvements in technology as per the Headwinds scenario, but barriers to adopting existing technologies are lower.
- **Tailwinds** – our most optimistic scenario, it examines a future where there are fewer barriers to technology and behaviour changes.

Note that all these scenarios explore different pathways where New Zealand achieves net zero emissions.

Further details are available in chapter 12 of the *2021 Supporting evidence* report.

The CCC also developed a Current Policy Reference scenario that serves as a baseline to a 'Demonstration path' scenario to compare capital investment costs.

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