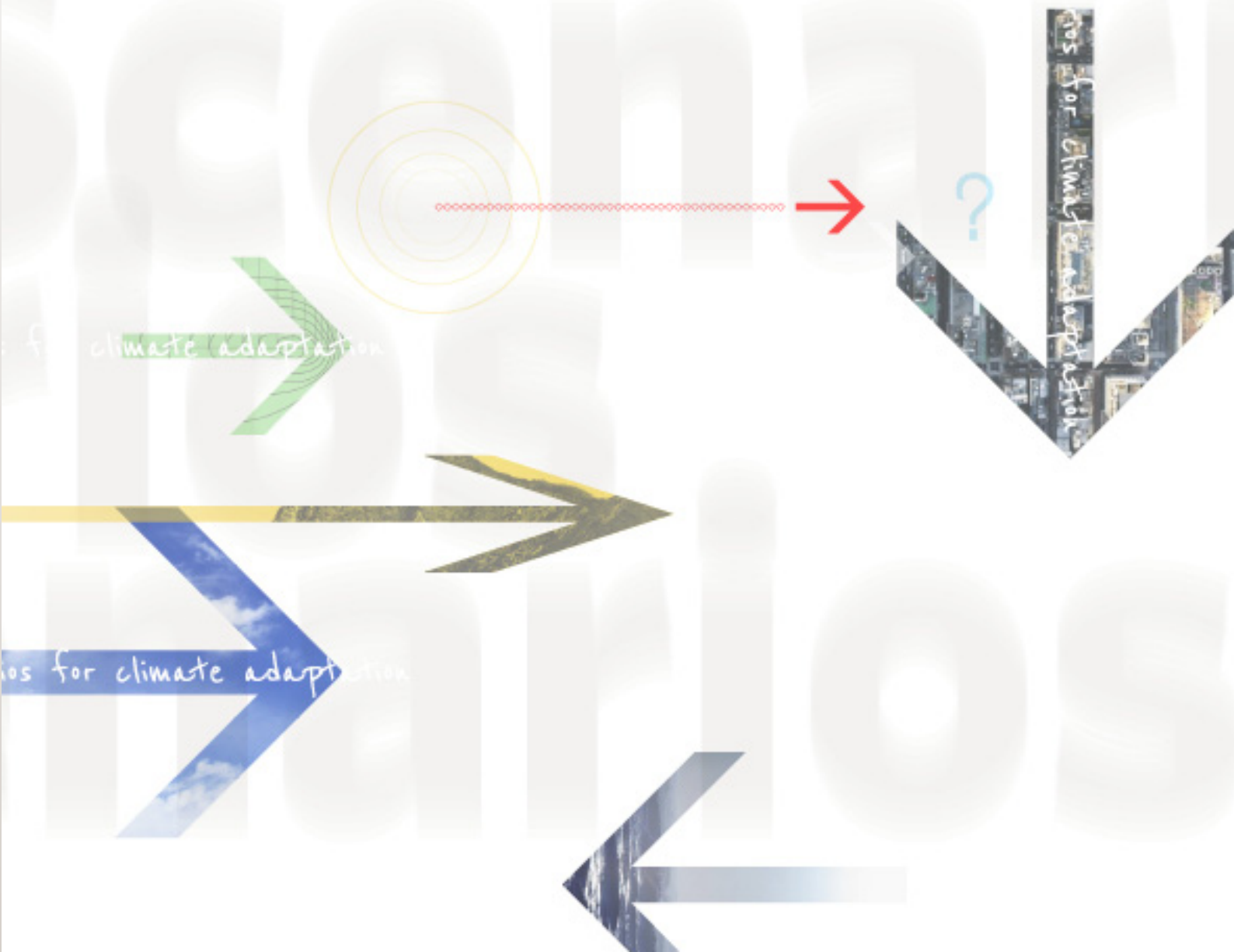
Scenarios *for* climate adaptation

Final Report



Scenarios for Climate Adaptation Report

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The Victorian Centre for Climate Change Adaptation Research (VCCCAR) is a consortium of Victorian universities supported by the Victorian Government to undertake multi-disciplinary research about state-specific climate change impacts and adaptation options. Its brief is to:

1. *Increase Government decision-making capacity about state-specific climate change impacts;*
2. *Encourage the inclusion of adaptation needs in Government strategic planning; and*
3. *Bring together expertise to work on the provision of multi-disciplinary advice to government, industry and the community.*

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Executive Summary

Report aims, background and scope

1. The aim of this report is to strengthen knowledge about the use of scenarios and scenario planning as tools for climate change adaptation decision making, drawing on the recent experience of Victorian climate adaptation policy makers and practitioners. Production of the report has been funded by the Victorian Government through the Victorian Centre for Climate Change Adaptation Research. This project has also led to the production of a *Scenarios for Climate Adaptation Guidebook*.

2. Initial work on this project was triggered by numerous conversations with climate change adaptation policy makers and practitioners reflecting on their greatest challenge: how to make well-considered, well-informed decisions about adaptation priorities in the context of a swirling and ever-expanding cloud of evidence about climate trends and risks. Their concerns reflect the larger challenge of making tough choices about the actions needed to reduce and address the risks of runaway climate change under conditions of rapidly increasing complexity, uncertainty and contestation.

   As recent events, such as the meltdown of the Fukushima nuclear power plant or the contagious spread of democratic revolutions in the Middle East remind us, we live in an age where predictions and decisions based on the extrapolation of past trends or overly linear mathematical models are likely to be unhelpful, misleading and maladaptive.

   Successful responses to the escalating risks of climate change therefore require new methodologies for thinking about the future – methodologies which strengthen the potential for imaginative, out-of-the-box thinking about drivers, tipping points and step changes in relation to both the variety of risks we face and the technological and social innovation needed to reduce and address these risks. Scenario planning – the development and use of diverse, plausible stories about how the future will unfold – provides one potentially useful set of tools for achieving this aim.

3. For the purposes of this report 'scenario' refers to:

   > *a plausible and often simplified description of how the future may develop, based on a coherent and internally consistent set of assumptions about driving forces and key relationships (IPCC, 2007b).*

   The scope of scenarios used in climate adaptation planning encompasses not only science-based climate change exposure and sensitivity scenarios, but broader social, economic and environmental factors affecting the adaptive capacity and resilience of places and population groups.

   'Scenario planning' encompasses the wide variety of ways in which the development and use of scenarios is being used to inform and improve all aspects and phases of climate adaptation planning and practice.

   'Climate change adaptation' is defined as follows:

   > *Adaptation involves changes in social-ecological systems in response to actual and expected impacts of climate change in the context of interacting non-climatic changes. Adaptation strategies and actions can range from short-*

term coping to longer-term, deeper transformations, aim to meet more than climate change goals alone, and may or may not succeed in moderating harm or exploiting beneficial opportunities (after Moser and Ekstrom, 2010).

This definition usefully highlights the systemic nature of climate change, non-climatic factors and our responses, and the need for the latter to avoid unintended negative outcomes.

Principles of climate change adaptation

4. In general, climate change adaptation is the process of reducing one's vulnerability to climate change impacts. Vulnerability is a function of exposure to climate change impacts, one's sensitivity to them and one's ability to positively respond (adaptive capacity) (IPCC, 2007a).

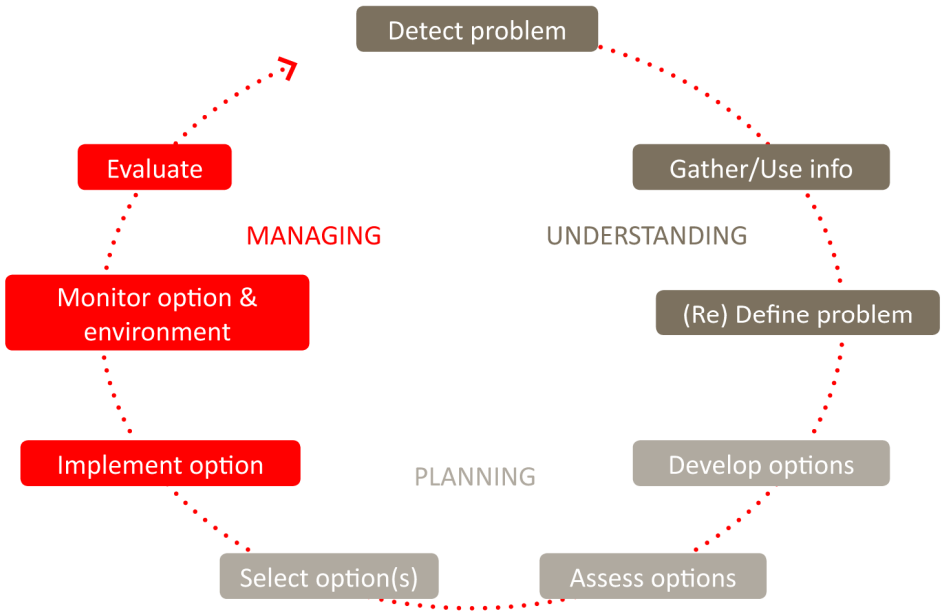
5. Climate change adaptation is a multi-faceted, ambiguous idea that we all 'frame' or interpret in different ways depending on our pre-existing views, norms and experiences (Fünfgeld and McEvoy, 2011). This framing then shapes our approach to adaptation, including which hazards we prioritise and which adaptation options we consider plausible or desirable.

6. Climate change adaptation policy and practice is about making complex value-laden decisions with far reaching, path dependent consequences in the context of highly uncertain knowledge about future climate trends and impacts. Many different types of adaptation have been identified that depend on factors like scale, timing, and the actors involved. In particular, adaptation decision makers need to attend to the following questions and general answers.

Question	General answer
What do we need to adapt to?	An ever-shifting cascade of interacting, potential and actual impacts and feedbacks, including the effects of our responses.
What is good adaptation?	Adaptation that is effective and efficient in reducing vulnerability to climate change impacts and lifts general resilience through improving social equity and environmental sustainability.
Who or what needs to adapt?	Everybody and everything needs to adapt to direct and/or indirect climate change impacts. Different groups have different roles. Our own (in)actions may enable or hinder others' adaptation.
How will adaptation occur?	There are many types of adaptation processes, including incremental improvement and/or transformation of existing structures and processes, and proactive anticipatory actions or post-impact reactions. Adaptation is a continuous, ever-changing process involving cycles of decision making, planning, action, observation, and above all, social learning and continuous adjustment.

7. A useful framework of adaptation is provided by Moser and Ekstrom (2010) (see Figure 1 below). It points to the importance of developing understanding (e.g. through scenario processes) and planning. For both, diverse forms of knowledge and flexible ways of operating are needed, which may require changes to the conventional ways we operate.

Figure i-A: Phases and sub-processes throughout the adaptation process



Source: Moser and Ekstrom (2010)

8. A group's capacity to adapt at any given time stems from the different types and levels of 'capital' that they and those around them have:
    - financial capital (e.g. investments, assets);
    - human capital (e.g. health, knowledge, capacity to learn);
    - social capital (e.g. relationships, understanding of others),
    - physical capital (e.g. safe buildings, reliable utilities); and
    - natural capital (e.g. quality soil, shade trees, pollinating insects) (Nelson et al., 2007).

    These are shaped by one's position in existing structures and the adaptation actions of others. Adaptive capacity may grow or decline over time as adaptation (or maladaptation) occurs.

9. Government needs to not only manage its own adaptation needs, but facilitate enabling and impact-specific forms of adaptation for others. Government's role in shaping the context in which others adapt, promoting public good and addressing cases of market failure means that it especially has a role in proactive or 'planned' adaptation, which can involve decisions with long lead times and far-reaching consequences, as well as putting in place appropriate reactive adaptation measures, such as emergency management. It also has a key role in transformational adaptation: that which fundamentally alters existing institutions or structures to improve our ability to manage climate change. Such adaptation may be necessary for it to help construct, as it needs to, the type of governance and regulatory environment that enable and facilitate good adaptation by others.

10. Adaptation requires that we consider long-term threats and implications. At the same time, uncertainty about the detailed characteristics, timing and interactions of climate change impacts and the effects of our adaptation responses means that conventional 'observe, predict, respond' management approaches are limited in their ability to accurately or usefully inform adaptation strategy (Hulme et al., 2009). Alternative ways of preparing ourselves for the future – such as the scenario planning discussed below – are needed, as is a responsive and flexible ('adaptive') way of managing.

11. Within the evidence-based policy paradigm, the notion of 'robust decision making' is increasingly promoted as being key to adaptation planning. In such decision making, strategies are selected either for their ability to work under a range of possible future conditions or for their ability to flexibly switch between modes as needed (Wilby and Dessai, 2010). This profoundly differs from the conventional idea of developing an optimal strategy for conditions that are judged to be most likely. Climate change demands we maintain focus on all possible outcomes, especially when these could be highly consequential. It also demands that we make difficult value-laden decisions about the future that cannot be justified by 'robust' or 'credible' evidence as we know it, but rely instead on reflection and discussion about the ethics and opportunities involved.

12. Constraints on adaptation are numerous and emerge from multiple sources and at each stage of adaptation. Part of the adaptation project is to identify and address these barriers and limitations. Some are in the form of gaps (e.g. in knowledge, communication, technologies, policy coverage), and others are in the form of obstructive or perverse structures and processes. These require more transformational change and will become more pressing as climate change progresses. They include the need to integrate mitigation of greenhouse gas emissions into our adaptation responses.

Scenario planning

13. Scenario planning involves the development and use of representations of plausible futures and pathways to inform and inspire strategic decision making and planning in a wide range of organisational and policy making contexts. It is increasingly used by a wide variety of private and public sector organisations to identify risks, opportunities and strategic options in the context of complex and uncertain future conditions and events.

14. Scenarios are not silver bullets for forming definitive judgements on how the future will unfold or determining an optimal set of decisions to achieve an optimal outcome. They are learning processes shaped by the quality of interaction, inputs and follow-up.

15. Scenario planning methods are suitable for situations of high uncertainty and low control. In contrast to techniques that attempt to *predict* the future such as forecasting, scenario planning emphasises the need to maintain awareness of uncertainty. It aims to inform and enable good decisions and strategies despite such a challenge.

16. Managing rather than reducing uncertainty is particularly pertinent to climate change, where the rising complexity involved means a large part of the uncertainty about the specific manifestation of climate change impacts is irreducible.

17. A continuum exists between more predictive and more exploratory forms of scenario planning, which address in turn what is *likely to* happen and what *could* happen. Normative scenarios are exploratory, but also ask 'what *should* happen?'.

18. Scenario processes provide a critical opportunity to interrogate our assumptions. Many scenario practitioners argue that the main value of scenarios is in helping us to 'move away from the "one future" mentality and expose the inherent and sometimes irrational assumptions that lie behind our vision of the future (Braithwaite, 2010). To achieve this in adaptation, scientific climate change scenarios need to be complemented by searching discussion and analysis of other influences on and ideas about the future.

19. Decisions about the pertinence of scenario planning to climate change adaptation and preferred approaches will be strongly shaped by how climate change adaptation challenges and responsibilities are framed (e.g. the scope of climate change impacts, the remit of adaptation, the roles and responsibilities of different groups). At the same time, participatory, exploratory scenario planning approaches also provide a valuable opportunity to identify and explore these different framings of climate change adaptation.

20. Typical stages in a scenario planning process include:
    - problem framing and definition;
    - tracking or exploring key related issues;
    - analysing and prioritising critical and highly uncertain issues;
    - imagining plausible scenarios;
    - identifying a range of possible strategies and testing them against the scenarios leading to strategic decisions;
    - going beyond the scenario planning process to implement these decisions.

21. Benefits common to many scenario planning processes include:
    - creating opportunities and a framework within which to imagine, visualise and interrogate alternative stories about how the future will unfold;
    - challenging taken-for-granted mental models about the ways in which problems and solutions are framed;
    - fostering creative learning by individuals, organisations and societies;
    - improving the robustness of strategic planning, decision making and evaluation.

22. Limitations of scenario planning identified in the literature include:
    - ambiguity about the purpose and conflation with forecasting;
    - failure to think beyond a mere extrapolation of the status quo;
    - failure to integrate the often challenging outcomes of a scenario planning process into decision making.

23. There has been limited research on how to optimise the use of scenario planning by policy makers. As the European Environment Agency (2009)notes:

> *'The shortage of research on scenario planning and its influence means that there is limited guidance on how to optimise scenarios, in terms of both outputs and uptake by policy-makers' (p.5).*

24. It is important to consider how a given scenario process can provide policy makers with knowledge that is salient, credible and legitimate (Cash et al., 2003). This means asking:
    - Are the scenarios relevant to information and decision making needs? (saliency)
    - Are the scenarios scientifically sound? (credibility)
    - Who developed the scenarios and how? (legitimacy) (Rounsevell and Metzger, 2010)

Scenario planning for climate adaptation

25. Faced with ever-expanding levels of complexity and uncertainty, climate adaptation policy makers and practitioners are increasingly using scenario planning processes and outputs to assist with the key climate adaptation challenges of **understanding, planning and implementing.**

26. Scenario planning has the potential to improve **understanding** of climate adaptation trends, impacts and risks through:
    - identifying and communicating the full range of potential climate adaptation trends, uncertainties and risks;
    - providing tools for breaking out of constrained thinking by highlighting the ways in which the future is not pre-determined, illuminating critical unknowns and encouraging participants to 'think the unthinkable';
    - contributing to a more holistic analysis of interactions between multiple bio-physical, social, political and technological trends and drivers;
    - communicating climate change risks and adaptation challenges to citizens, stakeholders and decision makers.

27. Scenario planning has the potential to improve climate adaptation **planning** through:
    - providing tools which clarify the range of values and mental models which decision makers and stakeholders bring to consideration and prioritisation of climate adaptation options;
    - providing policy makers and planners with key inputs into adaptation planning decisions and priority setting. This includes regional and local scenarios of global climate change under different global emissions pathways as well as a wide variety of social, economic and environmental trends and drivers;
    - enabling the crystallisation and synthesis of a small number of plausible alternative scenarios which can be used to identify and test the robustness of potential policy and practice responses.

28. Scenario planning has the potential to improve climate adaptation **implementation** strategies and capabilities through:
    - engaging stakeholders in the exploration of climate change adaptation risks and options and in the development of collaborative plans and strategies;
    - providing a framework for checking, reviewing and evaluating the impacts and effects of climate change adaptation policies;
    - contributing to the embedding of informed strategic conversations within organisations leading to an evolving creation of shared understandings and visions;
    - building ongoing organisational resilience and capacity for robust and reflexive strategic planning.

29. Key questions for scenario planning processes for climate change adaptation include:

Key considerations	Examples of possible responses
Purpose of scenario planning	Explore issues, raise awareness, set agenda for change, educate others, build relationships, identify and select options, test strategies, develop evidence.
Purpose of adaptation efforts	Manage discrete climate risks, build general adaptive capacity and resilience, empower others, build relationships, question or justify existing policies.
Types of knowledge to be included	• Formal knowledge: climate science, economics, environmental and social science models and data; predictive or possibilities • Informal knowledge: organisational knowledge, community-based knowledge, imagination.
Breadth of issues considered	Extent to which the following are incorporated:

	• pervasive indirect climate change impacts (economic, social etc.), as well as direct biophysical impacts • possible positive and negative effects of different adaptation responses • present-day vulnerabilities, including the existing 'adaptation deficit' and other needs of different groups • barriers and limitations to adaptation (e.g. research and development needs, political will).
Scale(s) to be considered	Extent to which the following are incorporated: • long and/or short time periods, both in terms of climate change and the decisions considered • changes at the global, national, regional and/or local geographic levels • existing and future developments at higher and lower levels of government and society • the influence of other organisations and sectors • the influence of one's own adaptation actions on the above.
Who participates in scenario development	• Internal to the organisation (which departments, levels of management) • External to the organisation (which partners, stakeholders, community members, or climate change, adaptation and scenario experts).
Who scenario outputs are shared with and how	• Internal to the organisation (which departments, levels of management) • External to the organisation (which partners, stakeholders, community members, general public) • Publication of scenarios as report or website, static or interactive.
How the results of the process are used to support adaptation decision making	• Used in early stages only or used throughout adaptation planning process • Used as prompt and heuristic only, or used as evidence in selection and justification of adaptation options.

30. There are broadly 'top-down' and 'bottom-up' approaches to adaptation planning. The role of scenarios – the types of scenarios that are relevant, the methods used to develop them, the scale at which they are developed and applied – differs significantly depending on the orientation. The 'top-down' development of global assessments generates scenarios derived from global trends, while the 'bottom-up' development of local and regional assessments is focused on understanding place-based vulnerability and adaptation needs, for which scenario planning techniques are one set of tools that can be employed.

31. The following typology provides a useful basis for categorising the major ways in which scenario planning is being used to inform and support climate adaptation policy making:
    A. **Off-the-Shelf**: Applying pre-existing, down-scaled scenarios to specific locations, population groups and policy challenges
    B. **Tailored Exploration**: Building and using context-specific scenarios to explore possible climate futures, impacts and adaptation policy options
    C. **Tailored Visioning**: Building and using context-specific scenarios to envisage desirable futures and pathways

Scenario planning for climate adaptation: Learning from recent Victorian experience

32. This project helps fill the knowledge gap about how scenario planning is being applied to climate change adaptation in practice and with what results. Focused on Victorian policy makers and practitioners, it reports findings from an online survey, case study inventory, key informant

interviews and two stakeholder workshops about people's experiences with and reflections on the value and challenges of using scenario planning to support climate change adaptation.

33. A range of positive examples of the use of scenario planning to strengthen the capability and resilience of organisations and communities exists. These focused on climate change adaptation to a variable degree. The case study examples (summarised in Appendix A) represent an important resource for social learning.

34. Of the 33 identified examples of scenario planning for climate adaptation in Victoria the most common aims were:
    - to explore the implications and risks of climate change for a specific location, community or organisation;
    - to inform policy making decisions and strategies;
    - to foster common understanding of climate change risks;
    - to improve collaboration between stakeholders and decision makers;
    - to explore and visualise desirable futures.

35. The range of scenario planning approaches and methods currently in use in Victoria include:
    - **Off-the-Shelf** climate change scenarios, either being used alone as inputs into climate change adaptation planning, or, more commonly, combined with other trend-based data (e.g. socio-economic projections, water, food, electricity demand/supply projections etc) to produce more context-specific scenarios.
    - **Tailored Exploration** scenarios, constructed through a process of identifying, exploring and prioritising a wide range of drivers of change and their interactions.
    - **Tailored Visioning** scenarios, either emerging out of a Tailored Exploration process in which more desirable futures and drivers of untenable future conditions are identified, or by being constructed through a focused process of goal setting for the future.

36. Scenario planning is frequently and effectively being used as a tool for engaging stakeholders and for building shared understanding of climate change risks, challenges and priorities. This use of scenario planning is particularly common in the early stages of climate change adaptation planning and can play a valuable role in assisting stakeholders and decision makers:
    - explore and develop shared framing of the complex and multifaceted nature of climate change impacts (both direct and indirect);
    - highlight the importance of human agency and choice (as opposed to passive acceptance of pre-determined future pathways and drivers);
    - stimulate and inform discussion about assumptions, ethical principles, goals and priorities;
    - identify and consider a broad range of climate adaptation policy and practice options.

37. The use of scenario planning as a tool for deciding on and implementing specific climate adaptation policy options and investment pathways continues to be more problematic. Many policy makers continue to expect firm, confident predictions about the likelihood of future climate trends and impacts. They therefore prefer predictive approaches, often combined with other modelling, cost benefit and forecasting techniques, over more open-ended scenario planning processes of the sort demanded by the unpredictability of climate change impacts. This risks placing too much faith in the predictive capacity of such techniques in the context of climate change, leading to erroneous or maladaptive policy and investment choices. It also neglects the need for discussion about underlying assumptions, and overlooks the opportunity for more innovative, far-reaching and positive change.

38. More generally, the following benefits of and limitations on scenario planning for climate change adaptation were identified:

Benefit	Limiting factors
Greater awareness and understanding of climate change trends, its extensive impacts and its implications for different groups	Shared understanding of the aims, scope of, need and distribution of responsibilities for climate change adaptation
Exploration and integration of the many different issues and forms of knowledge that are pertinent to climate change adaptation	Shared understanding of what scenarios are, the aims and scope of scenario planning, and their relationship to climate change adaptation
Exposure and exploration of different worldviews, assumptions, and framings of climate change and adaptation	Engaging relevant decision makers and stakeholders in the scenario planning process
Consideration of a broader, more holistic range of approaches and options in responding to the climate change issue	Including a genuinely broad range of inputs, issues and pathways in the scenario planning process
Greater awareness of the role of human choices and actions in shaping the future	Accessing, analysing and integrating relevant data for input into the development of scenarios, including down-scaled climate change scenarios
Greater awareness of the ethical and political issues that climate change adaptation raises about organisational and societal goals and priorities	Relating high-level issues and changes to an organisation's or individual's narrower sphere of influence and options for action
Greater awareness of the potential for and need to avoid maladaptive responses	Acceptance of the results of a scenario planning process as credible, legitimate and salient by management, colleagues and other stakeholders
Greater awareness of the relationships between the potential adaptation responses of different levels of government, organisations and sectors	Integrating tangible and intangible results of a scenario planning process into subsequent adaptation planning and action
Understanding of the need for, and steps towards, greater collaboration within and between organisations	Addressing the need for repeated and cross-organisational scenario planning

39. Key success factors included:
    - clarity of aims and purpose;
    - the existence of detailed, context-specific data;
    - effectively engaging relevant stakeholders;
    - maximising the diversity of the expertise and experience of the people involved;
    - having a supportive organisational culture;
    - using skilled scenario planning facilitators.

Improving the use of scenario planning for climate change adaptation: Ten key principles

40. The following principles for developing and using scenario planning for climate adaptation are informed by learning from recent Victorian policy and practice experience, as well as research literature on scenario planning in other Australian and international jurisdictions.

1. ***Clear, shared framing of climate change adaptation challenges and aims***

Developing shared understanding of climate change adaptation is necessary for effective, widespread and coordinated action. As a value-laden concept, climate change adaptation is framed in diverse ways. Effort is needed to identify and reconcile different frames. Scenario processes can help with this, but are also shaped by such framings.

2. ***Clear, shared understanding of the strengths – and limitations – of scenario planning***

Scenario planning is best seen as a learning tool to support more informed and reflective consideration of climate adaptation risks and options rather than as a 'silver bullet' capable of delivering predictive forecasting. Scenario planning can also provide a strong platform for increasing the robustness of climate adaptation choices leading to decisions that proactively and effectively address a range of possible futures, rather than aiming for an optimal response to one single pathway. While quantitative modelling of climatic trends – and of other social, economic and environmental drivers – can be a useful input in scenario building, the real value and power of scenario planning lies in its emphasis on plausibility rather than probability; multiple rather than singular futures; and out-of-the-box surprises rather than linear trends.

3. ***Clear, shared understanding of the primary goals of the specific scenario planning process***

Scenario planning has the potential to make a useful contribution in meeting a range of key climate adaptation challenges, including understanding key trends and impacts; identifying and selecting options and implementing and evaluating strategic policies and plans. Like any process that engages multiple stakeholders it is important that those involved in building and using scenarios are clear about the objectives and expected outcomes they are working towards.

4. ***High-level support for the scenario planning process from key internal and external stakeholders and champions***

Maximising high-level support from internal and external 'champions' at an early stage in the scenario planning process is likely to significantly increase the likelihood that outcomes will usefully inform decision making. High level buy-in is also likely to strengthen the potential for scenario planning to have an ongoing positive influence in developing an organisational culture and community of practice capable of dealing with high levels of complexity and uncertainty.

5. ***Time and resources invested in planning, preparing and ensuring the right mix of skills and knowledge***

Successful scenario planning processes require a significant investment of time and resources, with careful consideration given to the choice of specific approaches and methodologies, and, commonly, the employment of skilled scenario planning facilitators.

6. ***Broad range of relevant experience, expertise and evidence drawn on***

The encouragement of a broad and inclusive approach to sources of advice about key drivers and possibilities is an essential basis for avoiding 'group think' and for identifying and exploring unexpected, out-of-the-box possibilities.

7. ***Identification and consideration of the full range of plausible drivers and pathways deliberately encouraged***

The robustness of climate adaptation strategies and policies will be significantly influenced by the robustness of the range of drivers and scenarios identified and considered.

8. ***Scenarios sharply defined and capable of effective communication to key audiences***

Lindgren and Bandhold (2009) note the following key characteristics of good scenarios also include:

- consistency – the stories, processes and events must all fit an internal logic;
- differentiation – they must be structurally diverse, not deviations around a common base;
- memorability – scenarios must be easily represented, communicated and stick in people's minds after they have been heard;
- challenge – they must challenge people's perception of the future and how the world works.

9. ***Careful consideration given to ways in which outcomes of scenario planning process are to be integrated with strategic planning and decision making***

The commonly cited gap between scenario planning and effective inputs into specific decision making processes and outcomes partially reflects the larger challenge of strategic planning and decision making under conditions of uncertainty and complexity. Careful consideration of the actions needed to integrate scenario planning with specific decision making challenges and tasks is, however, a key precondition for bridging this gap.

10. ***Scenario planning embedded as an ongoing driver of organisational culture and decision making processes***

The value of scenario planning is likely to be maximised when the process and outputs are integrated and when relevant decision makers are fully involved in all steps of the scenario development process. In practice many organisations only take the process half way, creating scenario narratives without applying a systemic approach to using narratives to inform and shape decisions or to embed learning within organisational decision making processes.

There is increasing evidence that the most effective climate adaptation strategies are not discrete, one off initiatives but rather those that involve the creation and maintenance of an ongoing organisational 'state' of continual learning and capacity building that fosters flexibility, innovation and resilience.

41. The following steps are suggested as a framework for designing and implementing climate adaptation scenario planning initiatives and projects.

Phase 1: Preparation

1. Clarify adaptation goals and issues relevant to your organisational context
2. Decide whether scenario planning is the right tool
3. Define aims and expected outcomes of the scenario planning process
4. Select a suitable approach: Off-the-Shelf, Tailored Exploration or Tailored Visioning
5. Identify stakeholders and design the process.

Phase 2: Scenario Building and Refining

6. Refine scope and objective
7. Create space for 'out-of-the-box' thinking
8. Identify and gather key drivers
9. Assess and prioritise drivers
10. Explore and select scenario trajectories
11. Generate scenarios.

Phase 3: Using Scenarios

12. Conduct gap analysis
13. Identify possible strategic directions
14. Re-run scenarios to test possible strategies

15. Assess implications for strategy and decisions
16. Articulate strategy or decision outcomes.

42. Beyond these phases it is also suggested that steps be taken to promote the embedding of scenario planning methodologies and approaches into the ongoing practices of organisations and networks grappling with climate change adaptation. There is significant potential benefit to be realised from building a culture and community of practice around reflexive scenario planning among those seeking to improve organisational capacity to respond to rapidly changing and complex contingencies, risks and challenges.

Broader debates and areas for further work

43. Further research is especially needed in the following areas:
    - Applied, longitudinal research on whether and how scenario planning is contributing to improved decisions and outcomes in climate change adaptation, particularly in policy, what barriers exist, and how they can be overcome.
    - How to frame and communicate climate adaptation in ways that resonate with a diverse range of policy makers and stakeholders.
    - The perceived strengths and weaknesses of, and tensions and overlaps between, predictive forecasting and scenario planning.
    - How scenario planning methodologies can be tailored to be of the most value to diverse public, private and non government organisations.
    - Local and regional data sets for analysis of local and regional level social, economic and environmental drivers.
    - How particular organisational and institutional arrangements and cultures assist or inhibit flexible and resilient policy making under conditions of complexity and rapid change.

44. The use of scenario planning to support climate change adaptation touches on a number of broader debates that also demand attention:
    - The purpose of climate change adaptation and its relationship with existing goals, structures and processes and with mitigation efforts.
    - Implications of increasing complexity and uncertainty for climate adaptation policy analysis, development and implementation.
    - The distribution of roles, responsibilities and relationships for action on climate change adaptation, implications for adaptive capacity and other tasks, and implications of possible changes over time.
    - The tension between uncertainty around specific climate change impacts and the need for proactive, consequential action by government;
    - How to increase the transparency and thus social and political legitimacy of scenario planning processes without downplaying the value of synthesising different values, ideas and forms of knowledge into comprehensive scenarios.
    - The extent to which ‘robust decision making’ is feasible or desirable, not only in contrast to more predictive approaches but to decision making based on a less passive, more proactive stance towards the future, involving a normative rejection of some possible futures and commitment to trying to construct a desired future.
    - The extent to which an acceptance of uncertainty and of the value of imagination (as in open-ended scenario planning) can be reconciled with conventional science-based standards and sources of credible and salient evidence for policy.

1. Introduction

In this section

→ Report aims and background

→ Definitions and scope of scenario planning for climate adaptation

→ Methodology

→ Report structure and overview

1.1. Report aims and background

This report aims to strengthen knowledge about the most effective ways to develop and use scenario-based strategies to improve climate change adaptation decision making and planning, drawing on the recent experience of Victorian climate adaptation policy makers and practitioners.

The report is an outcome of the *Scenarios for Climate Adaptation* project funded by the Victorian Government through the Victorian Centre for Climate Change Adaptation Research (VCCCAR).[1] This project has also led to the production of a *Scenarios for Climate Adaptation Guidebook for Practitioners*, which provides a concise overview of key approaches and methodologies for using scenario-based strategies to inform and improve climate adaptation outcomes.

Understanding and managing complexity and uncertainty is one of the greatest challenges facing climate adaptation policy makers and practitioners. The long time frame over which climate change will occur, the diversity of potential impacts and the complexity of interacting social, economic, political and environmental drivers have highlighted the deficiencies of traditional linear planning and decision strategies. Scenario-based approaches are therefore being used by an increasing range of Victorian, Australian and international government and non-government organisations as a key tool in addressing this challenge.

The rapidly expanding use of scenarios for climate adaptation has not as yet been accompanied by an extensive program of systematic evaluation or analysis (Wilkinson and Eidinow, 2008). This means that there is only limited understanding of the strengths and weaknesses of the many potential approaches and methods. To maximise the value of scenario planning it is crucial that policy makers are clear about the outcomes that scenarios can deliver and that they can apply a scenario approach that best fits their purpose, informed by a clear, shared understanding of the aims, role, strengths, weaknesses, risks and opportunities that each approach represents.

The *Scenarios for Climate Adaptation* project aims to help meet this challenge by gathering and synthesising learning about the development and use of climate adaptation scenario planning strategies and through the production of a concise, practical guide for climate adaptation policy makers and practitioners.[2]

1.2. Definitions and scope of scenario planning for climate adaptation

An early finding of this project was that 'scenario' and 'climate change adaptation' mean different things to different people. As processes and definitions, they are continually evolving. While we recognise this evolution is an important process, we draw upon the following key definitions to frame this research.

[1] The Victorian Centre for Climate Change Adaptation Research (VCCCAR) was established with funding from the Victorian Government as a Centre for Research Excellence in climate change adaptation. VCCCAR is managed by the University of Melbourne on behalf of partner universities, including Latrobe, Monash and RMIT universities. It provides funding and opportunities for multi-disciplinary and multi-institutional research teams to address adaptation priorities identified by the Victorian Government. Further information: http://www.vcccar.org.au/

[2] The *Scenarios for Climate Adaptation Guidebook for Practitioners* accompanies this Report and can be accessed at: http://vcccar.org.au/content/pages/scenarios-climate-adaptation

The broad definition of **climate change adaptation** adopted for this report, discussed in detail in Chapter 2, was developed by Moser and Ekstrom (2010):

> *Adaptation involves changes in social–ecological systems in response to actual and expected impacts of climate change in the context of interacting non-climatic changes. Adaptation strategies and actions can range from short-term coping to longer-term, deeper transformations, aim to meet more than climate change goals alone, and may or may not succeed in moderating harm or exploiting beneficial opportunities.*

This report adopts the following definition of **scenarios** employed by the Intergovernmental Panel on Climate Change (IPCC, 2007b):

> *[A scenario is] a plausible and often simplified description of how the future may develop, based on a coherent and internally consistent set of assumptions about driving forces and key relationships.*

The Scottish Government's (2006) slightly simpler definition is also useful:

> *[Scenarios are] alternative descriptions or stories of how the future might unfold. They compile information about divergent trends and possibilities into internally consistent images of plausible alternative futures.*

The term **scenario planning** is used throughout the report as a catch-all term referring to the variety of ways in which scenarios are developed and used to inform and improve all aspects and phases of climate adaptation planning and practice.

It is important to note that the scope of scenario planning for climate adaptation in this report encompasses not only climate change trend scenarios (i.e. data and trends in relation to climate change exposure and sensitivity), but also climate change adaptation drivers (i.e. data and trends in relation to key factors affecting the adaptive capacity and resilience of places, population groups, infrastructure and institutions), local knowledge and views, and the outcomes of structured imagination exercises.

1.3. Methodology

The methodology for the *Scenarios for Climate Adaptation* project, explained in greater detail in Chapter 5, has involved the following elements:

i) Establishment of a cross-disciplinary project team, bringing together a diverse range of expertise and experience in climate adaptation and scenario planning.[3]
ii) A critical review of Australian and international literature on the use of scenario planning for climate adaptation.

[3] The project team comprises Professor John Wiseman, Taegen Edwards, Che Biggs and Dr Lauren Rickards, all from the University of Melbourne. The project's Technical Reference Group includes: Dr Darryn McEvoy, RMIT University; Dr Roger Jones, Victoria University; Professor Ray Ison and Andrea Grant, Monash University; Dr Penny Whetton, CSIRO; and Barry Warwick, Victorian EPA.

iii) Development of a case study inventory bringing together examples of the ways in which scenarios are currently being used to inform and improve climate adaptation policy making in Victoria, and an analysis of the lessons learned from these experiences.
iv) An online survey of 100 climate adaptation policy makers and practitioners and 21 in-depth interviews with climate adaptation experts and scenario planning practitioners.
v) The commissioning, production and presentation of four discussion papers exploring key theoretical and historical aspects of scenario planning for climate adaptation.
vi) Two interactive stakeholder workshops with Victorian climate adaptation policy makers and practitioners.
vii) Development of this project report and a guidebook for practitioners, drafts of which were subjected to feedback from a number of stakeholders and discussed as part of another interactive workshop held during the 2011 VCCCAR Annual Forum.

1.4. Report structure and overview

Table 1A gives an overview of the logic and structure of this report and explains the main questions and key sources of information drawn upon for each chapter.

The report begins by clarifying the definition and scope of climate change adaptation and by providing a critical overview of the major challenges and barriers facing climate adaptation policy makers and practitioners. As Fünfgeld and McEvoy (2011) note the defining characteristic of climate adaptation policy and practice is the challenge of making complex decisions with far-reaching consequences in the context of highly uncertain knowledge about future climate trends and impacts. Drawing on the work of Smit et al. (2000), we also note that the key questions which climate adaptation decision makers need to address include:

- What do we need to adapt to?
- What is good adaptation?
- Who or what needs to adapt?
- How should adaptation occur?

We then draw on the recent work of Moser and Ekstrom (2010) to discuss a range of barriers to climate adaptation that occur at the following phases of the adaptation process:

- Understanding: Detecting, analysing and defining the scope and scale of the problem.
- Planning: Identifying, assessing and selecting policy and practice options.
- Managing: Implementing, monitoring and evaluating climate adaptation plans and policies.

In Chapter 3 we provide a brief overview of the history and scope of scenario planning leading to a discussion of the potential – and limitations – of scenario planning for informing complex decision making under conditions of uncertainty. Informed by the work of Chermack and Lynham (2002), we suggest that benefits of scenario planning include the capacity to: imagine, visualise and interrogate alternative stories about how the future will unfold; challenge taken-for-granted mental models about the ways in which problems and solutions are framed; foster creative learning by individuals, organisations and societies; and improve the robustness of strategic planning, decision making and evaluation. Noting the wide variety of scenario planning approaches and methodologies, we argue that the following typology, developed by Borjeson et al. (2006) is particularly helpful, although we also note that, in keeping with the majority of scenario work, our primary focus is on exploratory scenarios:

- Predictive scenarios (what is likely to happen)

- Exploratory scenarios (what could happen)
- Normative scenarios (what ideally should happen).

In Chapter 4 we provide a more detailed discussion of the case for using scenario planning to improve climate adaptation decision making. The potential value of scenario planning is illustrated by systematic consideration of the way in which particular scenario planning techniques can assist in overcoming the key climate adaptation barriers identified by Moser and Ekstrom (2010). Here, we introduce the following generalised typology of the major approaches to using and developing scenarios employed by climate adaptation policy makers and practitioners:

A. **Off-the-Shelf**: Downscaling and applying pre-existing scenarios to specific locations, population groups and policy challenges
B. **Tailored Exploration**: Building and using context-specific scenarios to explore possible climate change futures, impacts and adaptation policy options
C. **Tailored Visioning**: Building and using context-specific scenarios to envisage desirable futures and pathways.

We use these three broad approaches as a simplified model to distinguish between applications of scenarios for climate adaptation in practice and to explore some of the different issues and challenges arising from each, recognising that real world applications often employ more than one approach.

While the overall report is underpinned and informed by an extensive review of relevant policy, practice and research literature, Chapter 5 provides a more detailed account and analysis of the recent experiences of Victorian climate adaptation scenario planning initiatives. The main findings from the online survey, development of a Victorian case study inventory and stakeholder workshops with Victorian policy makers and adaptation planners are presented and discussed. It is clear from the range of example applications collected that there is substantial experience in using and developing scenarios in Victoria. While scenario planning techniques are being used effectively as tools to strengthen understanding and engagement, both with adaptation challenges and between different stakeholders, findings from this research suggest there are significant challenges, especially in ensuring that scenario outcomes can directly influence decisions being made about adaptation.

Chapter 6 summarises some of the main implications of recent Victorian experience for the question of whether scenario planning for climate adaptation is meeting its potential. Based on the preceding discussion, it distils a set of guiding principles to consider when applying scenario planning to climate adaptation challenges in order to maximise the benefits from the process.

In Chapter 7 we introduce a generalised methodology incorporating a range of methods and models of scenario planning for different climate adaptation decision contexts. This chapter brings together the key considerations that face policy makers and practitioners in choosing to undertake a scenario-based process, including the particular technique to employ, the phases to work through as well as ways of identifying and overcoming a range of practical problems frequently encountered in scenario planning practice.

The concluding section includes consideration of broader conceptual debates about the challenges of political and policy decision making under conditions of complexity and uncertainty, as well as key policy, practice and research implications. Finally, there are two appendices that include further information about Victorian applications of scenario planning to climate adaptation and a range of other identified case studies as well as lists of useful links and resources such as detailed guidance for undertaking a scenario planning process.

Table 1-A: Report structure at a glance

Chapter	Chapter Title	Key questions	Main sources of information
2	Climate change adaptation: Definitions, debates and challenges	What do we know about climate change adaptation?	Literature review; Interviews with climate adaptation experts
3	Scenario planning: A tool for decision making under complexity and uncertainty	What do we know about scenario planning?	Literature review; Interviews with scenario planning practitioners
4	Scenario planning for climate adaptation: Evolving applications, key variables and three broad approaches	What do we know about the different ways in which scenarios are used or developed specifically to assist climate adaptation?	Literature review; Case study analysis
5	Scenario planning for climate adaptation: Learning from recent Victorian experience	What is the nature and extent of Victorian experience of scenario planning for climate adaptation and what key lessons can be extracted?	Online survey; interviews; stakeholder workshops; case study analysis
6	Towards guiding principles for improving the effectiveness of scenario planning for climate adaptation	What main principles underpin 'best practice' scenario planning for climate adaptation?	All information sources
7	Towards improved use of scenario planning for climate adaptation: An integrated methodology	In order to use or develop scenarios for climate adaptation, what needs to be considered and what choices can be made?	All information sources
8	Summary of conclusions and future priorities	What broader debates does this research have implications for?	All information sources, especially Critical perspectives papers
Appendix A	Case study inventory	What examples are there of applications of scenario planning to climate adaptation in Victoria, the rest of Australia and internationally?	Online survey; literature review
Appendix B	Useful links and resources	What tools and guidance exist for doing scenario planning for climate adaptation?	Literature review

2. Climate change adaptation: Definitions, debates and challenges

In this section

→ About this chapter
→ What is climate change adaptation?
→ Adaptation to what?
→ What is good adaptation?
→ Who or what needs to adapt?
→ How should adaptation occur?

2.1. About this chapter

This chapter sets the scene for discussion of the relevance of scenario planning to climate change adaptation by introducing the concept of climate change adaptation and many of the debates and challenges familiar to adaptation policy makers and practitioners.

2.2. What is climate change adaptation?

Climate change adaptation is a complex, 'wicked' problem requiring rapid, integrated and collaborative action across multiple spatial scales and governance contexts Fünfgeld and McEvoy (2011).[4] Climate change adaptation policy and practice is about making complex, value-laden decisions with far-reaching, path-dependent consequences in the context of highly uncertain knowledge about future climate trends and impacts.

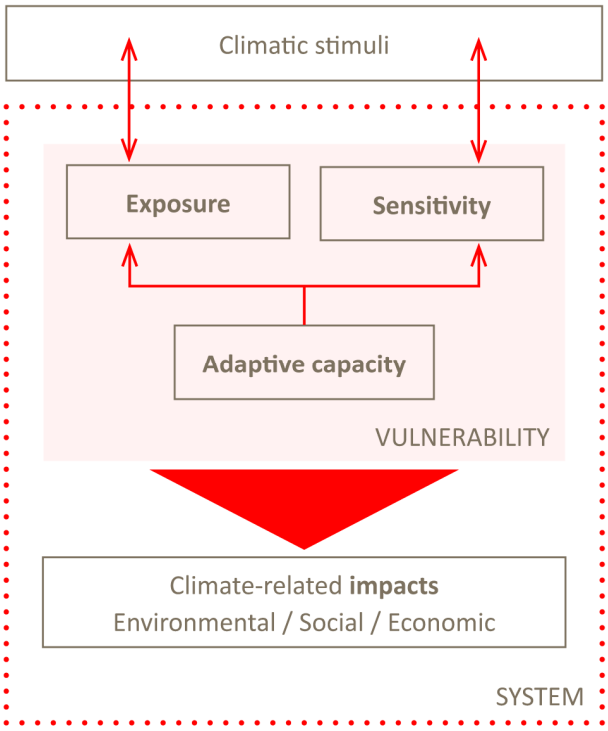
The way in which climate change adaptation is interpreted is heavily shaped by our pre-existing values, knowledge, experiences, as well as institutional structures, norms and processes. These different 'frames' are often implicit, but may be explicit and perpetuated through existing policies, modes of practice, and guidelines, for example, Fünfgeld and McEvoy (2011). Identifying and examining our different assumptions about adaptation is an important step towards shared understanding and effective action. As Moser and Ekstrom (2010) note, a shared, if pluralistic, understanding of climate change and adaptation is needed for effective, collaborative action.

In a general sense, adaptation means 'persistence through change'. An interdisciplinary concept, it refers to the process by which a system interacts with its shifting environment by adjusting itself in order to persist. While such a process is difficult enough, the challenge is immeasurably heightened when the threat in question is the unprecedented, unpredictable, long-term, self-created and global problem of climate change. The scale of the climate change challenge means that adaptation in the long term and at the large scale is going to require that at least some human and natural systems exhibit not only resilience (the ability to adjust and continue despite actual or potential disturbance), but transformability (the ability to change to new, better adapted systems) ((Cork, 2010); (Folke et al., 2010)). The scope, interconnectedness and uncertainty of climate change risks also mean that adaptation is not simply about putting in place a list of discrete 'adaptations' to climatic impacts, but adopting a new and more holistic way of thinking about and managing risk.

A common understanding of adaptation is the process of reducing vulnerability to climate change impacts, where vulnerability is specific to a certain subject (e.g. a system or part of a system, such as an individual, organisation, or place). Vulnerability is a function of how exposed and sensitive to a given climate change impact a given subject is at a particular point in time, in the context of their adaptive capacity and interaction with other impacts and processes (Figure 2A).

[4] The conceptual framework and logic of this section is significantly informed by 'Framing Climate Change Adaptation in Policy and Practice' by Hartmut Fünfgeld and Darryn McEvoy, Working Paper 1 for the VCCCAR 'Framing Climate Adaptation' project. See also Smit et al. 2000; Adger 2006.

Figure 2-A: Schematic diagram of vulnerability, its components and climate change impacts



Source: Fünfgeld and McEvoy (2011, p.41)

The most influential definition of climate change adaptation is that of the IPCC (2007a):

> *adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (p.869).*

While the IPCC definition helpfully highlights the systemic nature of the action required to reduce the harm caused by the direct and indirect impacts of climate change, it does not take account of the relationship between climatic and non climatic trends and impacts, or recognise the potential for negative as well as positive outcomes from adaptation efforts. Moser and Ekstrom (2010) instead suggest the following description:

> *Adaptation involves changes in social-ecological systems in response to actual and expected impacts of climate change in the context of interacting non-climatic changes. Adaptation strategies and actions can range from short-term coping to longer-term, deeper transformations, aim to meet more than climate change goals alone, and may or may not succeed in moderating harm or exploiting beneficial opportunities (p. 22026).*

The crux is that climate change adaptation needs to be understood through a systems view to allow cross-scale, cross-sectoral and long-term processes to be identified. This is especially pertinent to those with regulatory and advisory functions and responsibilities, namely government. Pre-existing change processes, and the time scale, type, multi-faceted aims, and successfulness of adaptation efforts, are all essential considerations, among others that we will highlight in this chapter.

Given the multifaceted nature of adaptation, numerous types of adaptation actions or approaches are possible and are needed to cater for differences in impacts, adaptors, goals and context. For example, conceptions of adaptation can differ according to the level of change an actor or system is willing to undergo, or has to undergo, in order to preserve some desired element of itself. Other typologies of adaptation are based on differences in:

- the social scale of concern (individual, household, community or societal);
- the spatial scale of concern (local, regional, national or transnational);
- the time scale of concern (short or long period of intervention or longevity of effect); and
- the roles different groups have in existing and potential governance arrangements.

Table 2A below provides an overview of some of the main types of adaptation based on discussions in the literature.

Table 2-A: Key categories of adaptation, the issue they represent, and useful references relating to them

Issue	Dichotomous categories of adaptation	Useful references
Timing of adaptation	**Anticipatory adaptation** Adaptation taken before the climate change impact is evident, either because a long planning horizon is required, it is more cost or risk-effective to act early and cautiously, or the actions have additional/enabling benefits.	**Reactive adaptation** Measures taken on an 'as needed' or 'just in time' basis, implemented and even designed in response to actual impacts. (Jones et al., 2007)
Source of adaptation	**Public adaptation** Adaptation measures taken by government.	**Autonomous adaptation** Adaptation taken by private individuals and businesses, including market-based adaptations. (O'Brien et al., 2009)
Target of adaptation	**Generic adaptation** Adaptation measures that aim to build adaptive capacity and/or the general resilience of a system.	**Specific adaptation** Measures focused on addressing specific climate change impacts. (Jones et al., 2007)
Speed and scale of adaptation	**Transformative adaptation** Adaptation via step-change the leads to new systems, structures or paradigms, and/or elimination of existing ones.	**Incremental adaptation** Adaptation via incremental, practice-level change. (Howden et al., 2010)
Longevity of adaptation intervention and effect	**Irreversible adaptation** Measures that cannot be undone once they are implemented regardless of subsequent findings about their effectiveness, necessity or side-effects.	**Reversible adaptation** Measures that can be undone once they are implemented and which may require ongoing or repeated intervention over time in order to be effective.
Direction of adaptation relative to existing practices	**Amplifying adaptations** Adaptation by increasing the effort put into existing practices.	**Dampening adaptations** Adaptation by reducing effort put into existing practices and seeking alternatives. (Cinner et al., 2010)

Cost of adaptation	**Cost-effective adaptation** Adaptation measures that save money (or even make money) by avoiding the larger costs predicted to be associated with inaction.	**Un-cost-effective adaptation** Adaptation measures that cost more than the damage costs they are calculated to have avoided, either because of poor timing, the targeting or management. (Fankhauser, 2010)
Level of adaptation	**Under-adaptation** Adaptation that is less than what is needed to keep up with the degree of climate change, leading to significant impacts.	**Over-adaptation** Adaptation that is more than what is needed to keep up with the degree of climate change and is considered 'excessive' change or anticipatory.
Effectiveness of adaptation	**Positive adaptation** Measures that successfully reduce the likely impact of climate change on the target audience to the desired degree in both the long and short term without creating or exacerbating negative effects on others (across space or into the future) or unduly contributing to further of climate change.	**Negative adaptation** Also known as maladaptation. Measures that do not alleviate, or that actually worsen, the situation to be addressed by adaptation (See Section 2.4 below). (Barnett and O'Neill, 2010)
Goal of adaptation	**Improvement adaptation** Adaptation that aims to improve the world while adapting to climate change.	**Repair adaptation** Adaptation that aims to 'repair' (neutralise or alleviate) the effects of climate change. (Rickards, 2010)

The following four sections of this chapter are loosely based on the key framing questions for climate adaptation decision making and action presented by Fünfgeld and McEvoy (2011)(which are based in turn on work by Smit et al. (2000), summarised in Table 2B. The final section provides concluding comments.

Table 2-B: What is the meaning of adaptation? Framing and operational questions

Adaptation to what?	What climatic hazards exist? What local impacts are likely to result from these hazards, in what time frame? How will climatic hazards be affected by multiple climatic and non-climatic stressors?
What is good adaptation?	What can be deemed successful and efficient adaptation? How can the success of adaptation be measured? How can measures be adjusted to ensure robust adaptation outcomes?
Who or what adapts?	What system(s) will need to adapt to climate change impacts? What system elements are at risk of climate change?
How does	What is the intended outcome of adaptation?

adaptation occur?	What actors and organisations need to be involved in adaptation? What process will be followed to plan climate change adaptation? What concrete adaptation measures will be taken, by whom?

Source: Adapted from Smit et al. (2000)

Key messages: What is climate change adaptation?

- Adaptation is about persisting through change.
- Adaptation to climate change is complex due to the characteristics of climate change and its interactions with pre-existing issues. It requires a holistic approach.
- There are multiple types of adaptation, based on issues like timing and direction.
- The policy environment for climate change adaptation is multidimensional, context-dependent, subjective and uncertain. A systems view is essential.
- Key questions include: adaptation to what? What is good adaptation? Who or what adapts? How does adaptation occur?

2.3. Adaptation to what?

In contrast to a common 'hazard'-based framing of climate change adaptation (see (Fünfgeld and McEvoy, 2011)), adapting to climate change is about more than managing new climatic stimuli. This is for three main reasons:

1. The indirect impacts of climate change (e.g. economic, social, mental and political) are as, if not more, influential than direct biophysical impacts. This includes the intended and unintended effects of our own climate change responses.
2. In practical terms, the effects of anthropogenic climate change are inseparable from natural climate variability, and will enhance rather than decrease the level of variability and extremes we experience.
3. Climate change impacts, and adaptation decisions and actions, do not exist in a vacuum, but within the context of other pre-existing processes, drivers, structures and goals, from which they are also difficult to separate.

For these reasons, the question of what climate change adaptation is in response to is more difficult than it first seems. Identifying climate change impacts requires that we adopt a broad-scale, inter-disciplinary and long-term systems perspective. When we do, three 'orders' of impacts can be

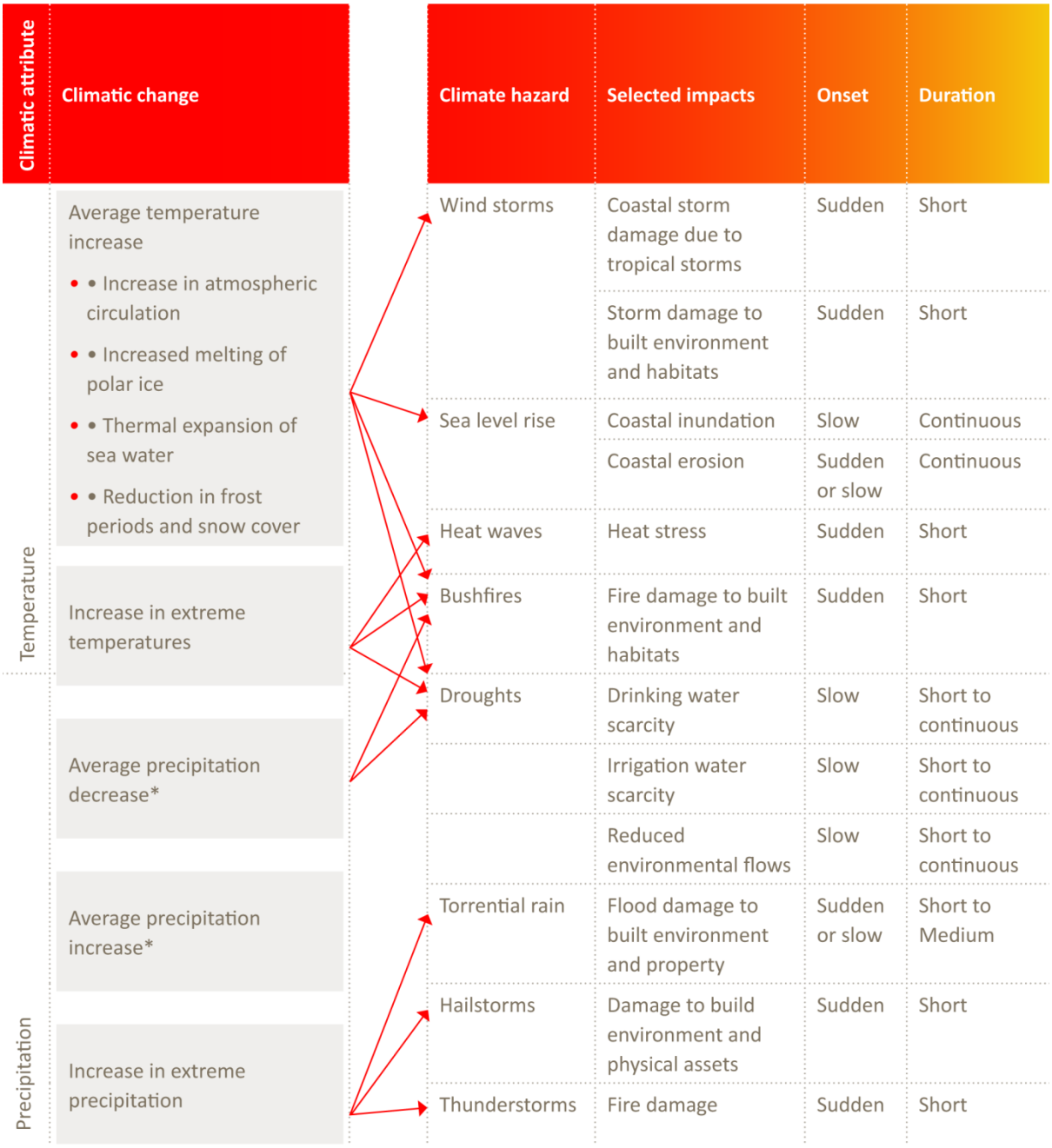
discerned: direct, biophysical impacts; flow-on effects; and the effects of our adaptation actions (Table 2B below).

Table 2-C: The three orders of climate change impacts critical to adaptation decisions

Order of impact	Description	Examples
First	Direct, biophysical effects of climate stimuli	• Changes in plant phenology due to shifts in seasonal temperature patterns • Heat stress on humans during heat waves • Infrastructure damage caused by storm surges.
Second	Flow-on effects of first order impacts and mere existence of climate change, expressed and mediated through economic, political, social and cultural mechanisms	• New planning restrictions in disaster-prone areas • Reduced farm incomes and higher food prices due to poorer crop yields • Longer hospital waiting lists due to influx of emergency cases • Higher electricity prices due to price on carbon • Rise in anxiety and depressions levels due to concern about climate change.
Third	Flow-on effects of adaptation responses, for adaptors and others	• Worsening of other issues neglected due to narrow focus on climate change adaptation • Loss of natural habitat caused by urban relocation or bio-fuel production • Coastal erosion in one area caused by sea defences built elsewhere • Intensification of climate change by carbon-intensive adaptation measures such as desalination.

Most analyses consider only first order impacts (e.g. listed in Figure 2C in contrast to Table 2D), reflecting the extent of integrated assessment modelling to date (Warren, 2011). However, such an approach can severely underestimate the seriousness of the climate change challenge and lead to ineffective and unethical adaptation options. As discussed below, 'good adaptation requires a holistic, systemic perspective that tries to take into account all three levels of impacts'.

Figure 2-B: Overview of some first order climate change impacts for Australia: climatic hazards



Climatic attribute	Climatic change	Climate hazard	Selected impacts	Onset	Duration
Temperature	Average temperature increase • Increase in atmospheric circulation • Increased melting of polar ice • Thermal expansion of sea water • Reduction in frost periods and snow cover	Wind storms	Coastal storm damage due to tropical storms	Sudden	Short
			Storm damage to built environment and habitats	Sudden	Short
		Sea level rise	Coastal inundation	Slow	Continuous
			Coastal erosion	Sudden or slow	Continuous
		Heat waves	Heat stress	Sudden	Short
	Increase in extreme temperatures	Bushfires	Fire damage to built environment and habitats	Sudden	Short
		Droughts	Drinking water scarcity	Slow	Short to continuous
Precipitation	Average precipitation decrease*		Irrigation water scarcity	Slow	Short to continuous
			Reduced environmental flows	Slow	Short to continuous
	Average precipitation increase*	Torrential rain	Flood damage to built environment and property	Sudden or slow	Short to Medium
		Hailstorms	Damage to build environment and physical assets	Sudden	Short
	Increase in extreme precipitation	Thunderstorms	Fire damage	Sudden	Short

** Most but not all parts of Australia are expected to experience a decrease in rainfall.*

Sources: Based on (CSIRO, 2007). Note also that there is feedback between the occurrence, severity and consequences of different types of climate hazards. For example, droughts worsen the risk of bushfires and the erosion damage of windstorms and torrential rain; sea level rise worsens the possible consequences of torrential rain in coastal areas.

Table 2-D: Examples of second order social and economic impacts of climate change

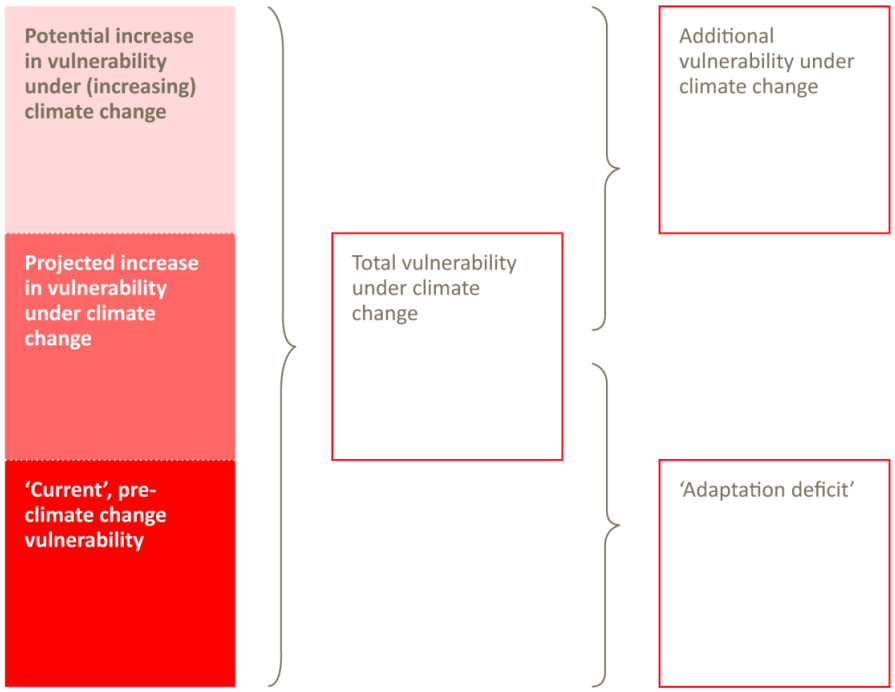
Determinant of social and economic wellbeing	Climate change impact
Social and health inequalities	People with limited income, assets and access to credit have less capacity to avoid climate change impacts and are disproportionately affected by increased prices resulting from climate change mitigation policies.
Work and unemployment	Industries such as agriculture and tourism are particularly vulnerable to climate change impacts. Changes to emissions-intensive industries, such as energy production, transport, mining and heavy industry to reduce greenhouse gas emissions will also impact on employment. There is, however, potential for the creation of new 'green jobs' in industries such as renewable energy and energy efficiency.
Social support	Climate change impacts, such as extreme weather events, displacement, economic restructuring and heatwaves, all require networks of social support to assist individuals and communities to respond and adapt. People who are socially excluded will find it harder to adapt.
Food	Increased droughts and extreme weather events will impact on Australia's local and imported food supply leading to price rises and scarcity.
Water	Climate change will reduce the amount of water available for much of Australia's population. Infrastructure investment to increase water supply raises water costs.
Energy	More extreme weather poses a risk to energy infrastructure. Transforming our energy system to withstand impacts of climate change and transition to renewable energy will increase energy costs.
Transport	More extreme weather poses a risk to transport infrastructure. Higher costs of petrol and public transport due to increasing electricity costs and policies to reduce emissions will make mobility more expensive.
Freedom from violence	Economic instability, resource scarcity and harsh climatic conditions lead to increased stress and risk of exposure to violence.
Cultural participation	Climate change will alter land and seascapes, which are important to the cultural beliefs and practices of many communities. Australia's sporting and outdoor culture is at risk, with some areas already feeling the impact of loss of sports facilities and the use of public space such as parks and gardens due to drought and high temperatures.
Housing	As the climate alters, housing will need to alter to provide adequate protection from heat and extreme weather events. Costs make retrofitting prohibitive for people on low incomes. In some areas, building or maintaining existing houses may not be viable, leading to the need for people (and potentially whole communities) to

	relocate.
Access to health services	Extreme weather events can disrupt access to essential services including health services.
Sense of 'home' and belonging	Climate change is likely to lead to temporary or permanent displacement of communities affected by extreme weather events, coastal erosion, sea level rise or loss of economic viability.

Source: Adapted from (Edwards et al., 2009, pp.83-5)

Taking a systems perspective and tracing the waves of influence from anticipated and experienced climatic conditions through the innumerable dimensions of society is vital in gaining a full appreciation of what climate change entails and, therefore, what adaptation needs to address. While no single change – including shifts in climate – can be attributed 100 per cent to climate change, given that everything is co-constructed by existing conditions, this does not negate the need to adapt to them. This is particularly the case in situations where an individual or group is poorly adapted to existing stressors, including vulnerability to natural climatic factors, leading to what is termed an 'adaptation deficit' (Pelling, 2011) (see Figure 2C). That is, if someone is already struggling to cope with climatic variability, extremes and other stressors, then they are in a poor position to adapt to the new and additional stresses imposed by climate change. As explained below, many climate change adaptation efforts start, therefore, with addressing this issue and building the generic adaptive capacity of vulnerable groups, and across social groups and systems more broadly.

Figure 2-C: Schematic diagram of the 'additionality' of climate change-induced vulnerability



**Note that the diagram is context dependent: different groups face different levels of current vulnerability and different increases in vulnerability under climate change.*

Uncertainty about impacts

Although the existence, cause and general trajectory of climate change is highly certain, the likelihood, magnitude, timing and other characteristics of specific future climate change impacts is highly uncertain, especially at the sub-national scale (IPCC, 2007c). Although some variables affecting future climate trends can be quite precisely estimated, the scale and complexity of the interactions between the multiple variables and drivers involved means that making confident predictions about the implications of climate change for specific localities and regions is very difficult (Hulme et al., 2009). This is further exacerbated by the complexity of interactions with diverse non-climatic processes and drivers, such as economic priorities, regulations and cultural preferences, that will be altered by, as well as alter, climate change impacts. When climate change impact assessments are conducted to inform national, regional and local adaptation decisions a 'cascade' or 'explosion' of uncertainty occurs (Jones, 2000).

Uncertainty surrounding climate change poses a critical challenge to planners, strategists, investors and any decision makers whose choices must pre-empt, prepare and generally 'factor in' its future implications. Uncertainties within current models of global-scale climate change grow exponentially with more detailed spatial resolution. At smaller scales, our limited understanding of physical climate change impacts must incorporate myriad assumptions about social, economic and ecological behaviours, responses, interactions and 'rules of behaviour', both for current and future conditions. This challenge is exacerbated by the highly localised (sub-national) nature of societal adaptation (occurring at the community and regional level), which involves further complexities of capacity, agency and legitimacy of adaptation. Under such conditions, scientific knowledge alone is inadequate for preparing us for the future and conventional 'observe, predict, respond' management approaches aimed at certain knowledge and optimal policies are largely obsolete ((Morgan, 2003); (Hulme et al., 2009); (Morgan et al., 1999)). Alternative approaches, including the use of scenario planning, are needed.

Key messages: Adaptation to what?

- Climate change adaptation is needed in response to/or in anticipation of three orders of impacts: direct climatic impacts; flow-on economic, political, social and cultural impacts; and the effects of our adaptation responses.
- Although the existence, cause and general trajectory of climate change are highly certain, the likelihood, magnitude, timing and other characteristics of specific future climate change impacts are highly uncertain, especially at the sub-national scale. Under such conditions, conventional 'obscure, predict, respond' management approaches are largely obsolete, and so alternative approaches, including the use of scenario planning are needed.

2.4. What is good adaptation?

We need to be clear about the goal of any climate change adaptation effort. Adaptation involves values, assumptions, choices and risks. In the context of limited resources, pre-existing priorities, and uncertainty about impacts, others' actions and outcomes, it involves difficult questions about targets, effort and costs. Even with the most ambitious and effective adaptation, there will always be a level of residual impact and costs to be managed, including the transaction cost of the adaptation process, which exists regardless of the ultimate successfulness of the adaptation outcome.

Adaptation involves negotiating between the interests of many groups and systems (including future generations and non-human species), and attending to feedback loops through which the negative (and positive) consequences of any of our actions will be made apparent. It is therefore critical that we are reflective and transparent about the implicit bounds we put on whether potential adaptation responses are appropriate or possible. We need to ask: what criteria are used to choose between two seemingly desirable (or undesirable) adaptation options? What makes an adaptation option desirable or undesirable? What makes an adaptation *outcome* desirable or undesirable? And how do we know which outcomes actually emerge?

There are a large number of possible criteria by which adaptation options and outcomes may be assessed, including urgency and implementability (Smit et al., 2000). Overall, good adaptation can be thought of as that which maximises benefits to both oneself and others, while minimising costs to the same. This includes transaction and opportunity costs. In particular, uncertainty about how climate change will affect us means we need to keep as many opportunities or pathways open as possible, referred to in the literature as 'robust decision making' (discussed further below). This is also a priority because climate change adaptation choices are often path-dependent (shaped by those made earlier) and path-creating (shape and limit subsequent choices)(Inderberg and Eikeland, 2009).

The definition of benefits and costs is subjective and part of the way in which we frame adaptation. Where one person sees a cost, another may see a benefit, and vice versa. Consultation with stakeholders is needed to get a true sense of the costs and benefits involved in different strategies (Adger et al., 2009a). This requires going beyond purely economic measures, which strongly restrict what is valued.

Costs, benefits and balance between them for any given strategy will shift according to the timeframe we use to assess them. As (Adger et al., 2005) note:

> *Scale affects the criteria defining 'successful' adaptation, and determines the relevance of different factors influencing adaptive capacity: indicators calculated at one scale may hide substantial variations in adaptive capacity at another (p. 76).*

What may seem on balance beneficial or 'adaptive' in the short term may turn out not to be in the longer term, and vice versa. As (Adger et al., 2009b) notes, while in the short term a climate adaptation action may seem positive or desirable, in the long term it may 'decrease resilience, and eventually lead to crisis'. Judgements are needed on the trade-off between short-term gains and long-term costs, if the short-term gain (e.g. converting natural resources into economic capital) is needed to overcome an immediate impact (e.g. during disaster recovery).

The converse of good adaptation is maladaptation – adaptation efforts that are ultimately unhelpful because they are ineffective (depending in part on the time frame considered), inefficient (according to judgements on what costs are tolerable) and/or inequitable (according to whose interests are considered). Focusing on the last of these, Barnett and O'Neill (2010) define maladaptation as:

> *action taken ostensibly to avoid or reduce vulnerability to climate change that impacts adversely on, or increases the vulnerability of, other systems, sectors or social groups' (p.211)*

Maladaptation highlights the critical 'third order' of climate change effects: the effects of our adaptation actions, not only on ourselves, but on our environment and others (including future generations and non-human species). It highlights that the aim of good adaptation is to try to ensure that in the long run we are not worsening the original problem through: (1) emitting greenhouse gases; or (2) increasing others' vulnerability more directly.

The first of these – failure to mitigate emissions of greenhouse gases – is the most serious way in which our current choices limit our future choices (the notion of path-dependency discussed above). By worsening the degree of climate change we will experience, our options for adaptation are rapidly constrained and force a shift in attention from building generic adaptive capacity to simply managing direct climatic impacts (McGray et al., 2007). Incorporating mitigation into adaptation is therefore a crucial part of good adaptation (Eriksen et al., 2011). One potential route to achieving this and other important sustainability goals is the emerging idea of 'ecosystem-based adaptation' (Vignola et al., 2009), which promotes ecosystem services as both a route to adaptation and as a social good we need to protect.

Key messages: What is good adaptation?

- Adaptation policy requires difficult choices. It is essential to be clear and reflective about what is considered to be a good adaptation option or outcome and why.
- Cost-benefit analyses are used to predict or assess the efficiency of different adaptation approaches. The complexity and long time scale of climate change interactions means that a comprehensive systems perspective is needed to properly identify costs and benefits.
- Some adaptation approaches worsen others' vulnerability (including worsening their exposure to climate change through emitting greenhouse gases). This is maladaptation. The goal should instead be low-regrets, multi-benefit adaptation options.

2.5. Who or what needs to adapt?

Adaptation is impact- and actor-specific

The global and multidimensional character of climate change means that adaptation to it is not something that anyone can avoid. In our personal, social and professional lives, we are all part of systems that will be impacted and we will need to adapt in all these realms, often simultaneously.

Any specific adaptation initiative, however, will involve a more limited system and variety of actors. Different actors will be affected to a greater or lesser extent by different impacts, and will have different levels and types of influence over elements of the system that needs changing. The extent to which individuals or groups will be affected by any one or the totality of climate change impacts can be understood as a function of their projected exposure and sensitivity to the impact(s) and their anticipated capacity to adapt to them (Figure 2A above).

Exposure to an impact refers to the likelihood that it will eventuate; sensitivity refers to how consequential it would be for the actor involved if the impact eventuated. Combined, these elements represent the magnitude of the risk that the potential impact represents for the actor in question. While this risk is specific to the type of impact(s) being considered, certain factors are correlated with a wide range of climate change risks. A singular dependence on a natural (e.g. agricultural) or infrastructure (e.g. electricity or water) system, for example, increases one's sensitivity to that system being impacted, which is why resilience theory advocates that we create 'redundancy' and flexibility in our systems.

Adaptive capacity refers to the degree to which an actor can maintain functioning while incurring an impact. It is a function of how much 'capital' an actor can draw upon to adapt, where capital refers to the five capital livelihoods framework developed by Nelson et al. (2008),which usefully directs attention beyond the individual human actor (Table 2E).

Table 2-E: The five types of capital that contribute to adaptive capacity

Type of capital	Description	Example of its role in adapting a family to drier conditions
Human	Individual level capacities (e.g. physical and mental health and knowledge)	Ability to learn about and devise water-saving strategies; ability to tolerate low water quality
Social	Strength of positive inter-personal connections	Support in establishing drought-tolerant gardens or swimming alternatives
Financial	Money, assets	Ability to buy a water tank or other technology; ability to live in a safe place
Physical	Infrastructure, facilities	Availability of recycled water; maintenance of building and road safety on shifting soil
Natural	Quality of environment	Healthy parks resilient to drought; bush land needed to filter water

Source: cf Nelson et al. (2008)

Effective adaptation assessments and response planning demand a strong understanding of the nature, scale and key characteristics of the relevant human and natural systems involved, including

the range of local individual and organisational actors involved, the different ways in which climate change is likely to impact on them, and the different roles they need to play in order to plan and implement effective adaptation strategies. It is also essential to build and communicate understanding of the impacts and implications of climate and non-climate related policies and actions at higher levels of geographical scale and governance, including their influence on others' adaptive capacity.

Adaptation is required by those directly and indirectly affected

Many impacts will be experienced indirectly as well as directly, which greatly expands the number and range of groups involved in adaptation. Based on the three orders of impacts proposed above, we can envisage three corresponding orders of adaptation, plus a 'fourth' order to capture the crucial role of 'enablers': those who can positively influence the adaptation of others.

- First order adaptation – adaptation by those affected by first order impacts (direct climatic impacts)
- Second order adaptation – adaptation by those affected by second order impacts (flow-on effects from the direct climatic impacts)
- Third order adaptation – adaptation by those affected by third order impacts (the consequences of the actions of those directly affected)
- Fourth order 'enabling' adaptation – adaptation by those, such as government, affected to the extent that they are in position to enable the adaptation of others.

It is important to note that this sort of analysis is not static. The effects of impacts flow through systems in ongoing and long-lasting ways, interact with each other, and alter people's exposure, sensitivity and adaptive capacity to original and new impacts.

The role of government

The role of government in climate change adaptation reflects government's pre-existing role, which in Australia is focused on providing public good and acting in other cases of market failure, and the new demands presented by climate change.

The long-term, widespread, uncertain and potentially catastrophic character of climate change means it both threatens many public goods and creates many market failures. Government therefore has a key, legitimate role to play. In particular, government has responsibility for anticipatory adaptation (e.g. planning of various sorts), and transformational adaptation, defined in Table 2A above as that which creates new systems and paradigms. Perversely, transformational adaptation decisions also often require the greatest commitment of resources (Macintosh, 2010), and need to be implemented far in advance of firm knowledge of future conditions (Stafford Smith et al., 2011).This poses a major but unavoidable challenge for government. As Macintosh (2010) writes:

> *More than anything, the most important thing governments can do now is plan for the future. Failure to make conscious adaptation decisions can result in poor unconscious decisions being made. It can also result in poor policy coordination and force adaptation choices upon arms of government that are ill-suited to making them (p.62).*

Adaptation is also a strongly local process. Although all spatial and organisational scales are involved, it is strongly local in that impacts and actions are often locally specific. This means that lower spatial scales of government, namely state and local, are especially important in adaptation. The complex, cross-sectoral and often voluntary nature of adaptation also means that other actors,

namely citizen society, play a critical role and government needs to put particular effort into enabling participatory and collaborative adaptation processes that foster joint understanding and learning.

More specifically, what is it that government needs to do for climate change adaptation? An answer to this question requires consideration of two inter-related questions: How is government directly affected by climate change? How is it affected or implicated by the impact of climate change on others? It is important to recognise that government needs to maintain and indeed improve its capacity to function, as well as responding to the needs of its constituents. Combined with the broad distinction between enabling type adaptation and impact-focused adaptation (regardless of whether those impacts are first, second or third order), there are four main components to the role of government in climate change adaptation (Table 2F).

Table 2-F: Examples of the four main components of the role of government on climate change adaptation

	Inward focus: own adaptation	Outward focus: others' adaptation
Enabling adaptation	• Cross-sectoral and cross-scale coordination and information sharing • Address professional development needs	• Leading and coordinating adaptation direction and efforts • Support of research and development • Adaptation partnerships with business and community • Policies to lift general adaptation capacity, especially of disadvantaged groups • Elimination of perverse incentives
Impact-focused adaptation (for those directly and indirectly affected)	• Wellbeing of rural staff in face of difficult climatic conditions and flow-on effects • Impacts of natural disasters on government infrastructure	• Assistance to disadvantaged groups facing specific impacts • Emergency services • Health and community services • Information provision on risks • Appropriate laws and regulations

The Victorian Government lists forms of adaptation on its climate change website which provide further examples of adaptation options relevant to government:

- Education and training about climate change
- Planning emergency responses for more severe extreme weather events
- Revising planning standards for vulnerable areas
- Developing technical and scientific solutions, such as drought-resistant crops or increasing thermal performance standards for buildings
- Actively managing our environment to improve the resilience of key natural resources like water catchments (http://www.climatechange.vic.gov.au/adapting-to-climate-change).

A further consideration is the extent to which climate change adaptation necessitates change in the function and rationale of government and our entire governance structures and arrangements more generally. There are growing calls for moves to a more decentralised, cross-sectoral system of governance to better enable adaptation (e.g. in Cork (2010)). In particular, there is ongoing research

into the benefits of 'adaptive governance' (e.g. Olsson et al. (2006)) which is the idea that different forms of governance are needed for different types of adaptation problems.

Key messages: Who or what needs to adapt?

- Who needs to adapt depends on what first, second and third order impacts are considered and how different groups are vulnerable to those impacts in terms of exposure, sensitivity and adaptive capacity.
- An actor's adaptive capacity is determined in part by how one is positioned in broader structures, what level of human, social, financial, physical and natural capital they have to draw upon and what sort of enabling adaptation is provided by others.
- Government has a critical and complex role in adaptation. It needs to manage its own and others' adaptation needs, and provide enabling and impact-specific forms of adaptation. It has particular responsibility for anticipatory and transformational adaptation.

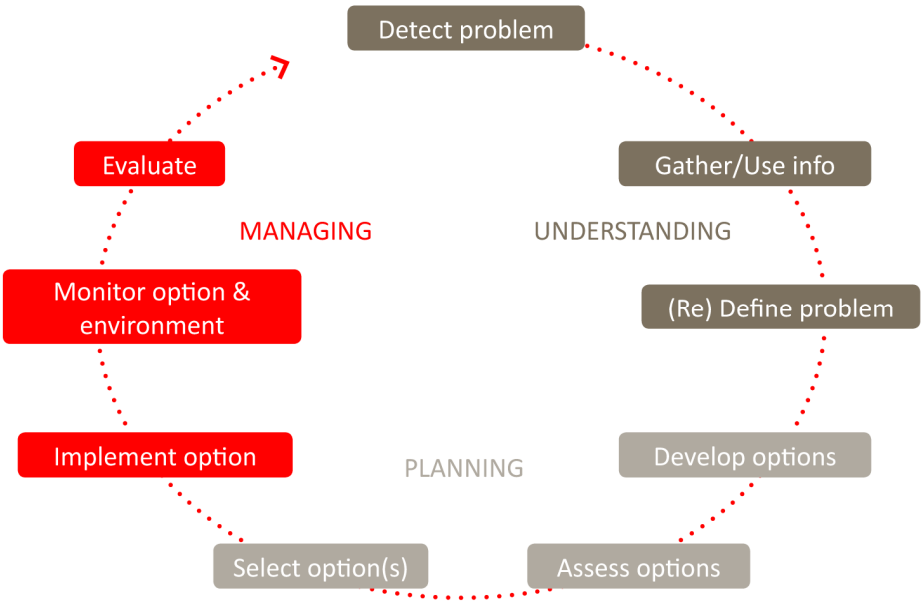
2.6. How should adaptation occur?

Given all of the above considerations about what adaptation is, criteria for good adaptation, what adaptation is in response to, and who needs to adapt, how, then, should adaptation occur? While there is no clear-cut answer, given that like other aspects of adaptation the adaptation process needs to be adaptive, useful frameworks and guidance are emerging. This section focuses on the process of adaptation for those in government (including a recommended risk management approach), the need for robust decision making, and the characteristics of policy for adaptation.

A flexible and iterative adaptation process

At a general level, the actual process of adaptation involves an iterative cycle of decision making, action, observation and learning. It involves determining and acting on: what needs to be done, when it should be done, who will do it and how. Moser and Ekstrom (2010) provide a useful guide to the main phases and sub-phases of the adaptation process (Figure 2D). The first of these – understanding – highlights the importance stressed throughout this chapter of carefully framing (and reframing) the problem of climate change adaptation.

Figure 2-D: Phases and sub-processes throughout the adaptation process



Source: Moser and Ekstrom (2010, p. 22027)

Uncertainty about the broad effects of climate change and adaptation efforts means that all phases need to be reflexive and flexible. Furthermore, climate change adaptation overall is an ongoing process, not a one-off effort, even when a given adaptation action is intended to last for a long time.

A risk perspective on climate change impacts

Potential climate change impacts can usefully be conceived as risks. A risk perspective aligns well with an interpretation of adaptation as a process of reducing vulnerability. As discussed above, the exposure and sensitivity components of vulnerability correlate with the two elements of the 'risk equation': the likelihood and consequences of a risk, which combine to create its magnitude.

There are a number of advantages of adopting a risk perspective of climate change adaptation. Firstly, risk is prospective and so highlights the *potential* character of climate change impacts rather than presenting them as givens in the way predictive approaches tend to do. Second, risk is in part *subjective* and so highlights the role of context and values in determining the potential seriousness of a given climate change impact. Although conventional technical risk management typically overlooks this crucial characteristic of risk, it is supported by a large body of empirical sociological research on different groups' perceptions of specific risks and risk in general. In particular, the perceived consequences of a given risk is strongly subjective (Richardson, 2010) and changes throughout the risk management process (Jones, 2010). Thirdly, risk management is a framework that many individuals and organisations are already generally familiar with and so it provides an accessible starting point for adaptation (Fünfgeld and McEvoy, 2011).

A risk perspective of climate change also has two major weaknesses. The first is that it can perpetuate a reductionist approach in which each individual impact of climate change (however defined) is treated separately and as a definitive list (Oppermann, 2011). Given the number, breadth and uncertainty of potential climate change impacts, such an approach is both impractical and potentially misleading, but is nevertheless one frequently taken in the hazards literature.

Second, a risk perspective can overlook the amplification and distortion of risk that emerges as phenomena interact in a complex system. Risk needs to be treated as an overall or net effect as well

as a discrete impact-specific element. Furthermore, some risks are 'wicked' in that they arise out of a wickedly complex system,[5] and are characterised by conflict about how they should be thought about, measured, and compared to the costs of action (Jones, 2010). Conventional risk management processes typically deal poorly with such wicked risks, and instead presume that risks are 'tame': agreed, neatly bounded and calculable. Given that climate change and adaptation are beset by wicked risks, it is crucial that the risk management approach adopted is itself adapted to cope with such complexity. As discussed in Chapter 4, a creative use of scenarios can greatly assist in this process.

Managing the wicked risks of climate change

Moser and Ekstrom's (2010)tripartite sequence of adaptation above broadly aligns with the generic risk assessment framework which Jones (2010), and Jones and Preston (2010) argue is the most appropriate overarching framework for climate change adaptation (Table 2G) – within which other methods, such as hazards assessments or vulnerability assessments can fit as subcomponents. As discussed above, however, conventional risk management processes need to be adapted to incorporate the challenges of dealing with highly complex 'wicked' risks. Risk assessment needs to be slower, more deliberative and iterative with potential re-application of methods at each stage to improve clarity. In Chapter 4, the way in which different types of scenarios can be used to assist with each stage is discussed. Here, it is sufficient to note that there is a crucial turn from a problem focus to a solutions focus during the planning phase. This shift in orientation is crucial in overcoming the paralysis of action common in the face of climate change and is again something that scenario processes can assist with.

Table 2-G: Recommended phases of risk management-based approach to climate change adaptation

Moser and Ekstrom phase	Risk assessment framework	Description in context of climate change adaptation	Positioning of complementary approaches	Overall orientation (from Jones 2010)
Understanding	Scoping of risks	Establish context of assessment, including criteria for success	Framing adaptation	Problem focus – what is *at* risk? How serious is the situation? Are we willing to adapt?
	Risk identification	Identify type of key risks	Hazards/impacts assessment	
Planning	Risk analysis	Analyse likelihood, consequences and uncertainty of risks	Vulnerability assessment	
	Risk evaluation	Identify and prioritise adaptation and/or mitigation measures	Adaptation assessment	Solutions focus – once we accept we are at risk, what *to* risk doing?

[5] Jones (2010) notes that a wicked system is one in which the limits are difficult to constrain, there are multiple causalities, interdependencies, and instabilities; there is a lack of clarity about the issues involved, responsibilities and the consequences of action; and there is often chronic policy and market failure.

Managing	Risk management	Apply selected adaptation and/or mitigation measures	Adaptation practice	What can we do, and what are we willing to do, to adapt?
	Monitoring and review	Review success of measures, decide whether to continue them, repeat whole risk assessment process	Adaptive management	

Source: Adapted from Moser and Ekstrom (2010) and Jones and Preston (2010)

Robust decision making

To deal with uncertainty and the need to keep options open, climate change adaptation needs to involve 'robust decision making'. This is described by leading experts Dessai et al. (2009):

> *By avoiding an analysis approach that places climate prediction at its heart, successful adaptation strategies can be developed in the face of deep uncertainty. Decision makers should systematically examine the performance of their adaptation strategies over a wide range of plausible futures driven by uncertainty about the future state of climate and many other economic, political, and cultural factors. They should choose a strategy they find sufficiently robust across these alternative futures. Such an approach can identify successful adaptation strategies without accurate and precise predictions of future climate (p. 112).*

In contrast to the conventional 'predict and plan' approach, robust decision making focused on characterising and understanding uncertainty, without necessarily quantifying it (Stafford Smith et al., 2011). While there is growing consensus that robust decision making is a good idea, there is less understanding of exactly what it entails. In particular, there is a need for clarity about the extent to which it refers to robust *decisions* (decisions that need little altering in the face of change) versus robust *decision making* (decision making that is able to persist in the face of change, in part because of an ability to rapidly switch between options).

As discussed further in the next chapter, robust decision making is closely aligned with a scenario-based approach, as both call for an acknowledgement of multiple possible futures. Scenario processes are also able to 'test' the robustness of possible decisions and decision making approaches.

Barriers to adaptation

Innumerable barriers stand in the way of good adaptation (Adger et al., 2007). One of the key tasks of risk assessment and monitoring is to watch for their existence and influence. This is not just about the specific costs involved in any one adaptation option, but about building a general willingness to and ability to adapt.

Barriers to adaptation are especially acute in the case of transformational and anticipatory adaptation of the sort that governments are charged with. As Cork (2010) notes, adaptive capacity needs to include 'transformability' (the capacity to transform and become a new system), as well as 'adaptability' more narrowly defined (the capacity to maintain the current system through

adjustment). More generally, adaptive capacity draws on all of the attributes listed in Table 2H, among others. The role of diverse forms of capital (mentioned above) is evident.

Table 2-H: Attributes of systems indicating resilience, adaptability or transformability

General resilience	Adaptability	Transformability
Diversity (e.g. of skills, ideas (i.e. social capital), functions)	Social capital (leadership, trust, diversity)	Experimentation
Modularity (failure in one part of the system does not cause failure of the whole system)	Human capital (skills, education, health)	Support for change
Awareness of cross-scale processes	Financial capital	Trust (social capital)
Tight feedbacks (early detection of emerging change, effective transfer of information (learning) and rapid and appropriate responses)	Natural capital	Human, built and natural capital
Overlapping institutions	Social and ecological memory and ongoing learning	Cross-scale awareness
Reserves of human and other resources (capital)	Adaptive governance	

Source: adapted from Cork (2010), which is adapted from Walker and Salt (2006) and Resilience Alliance (2009)

Because transformational adaptation involves the greatest degree of change, it can encounter the greatest degree of resistance. There is increasing research into the extent to which crises created by climate change related extreme weather pose a 'window of opportunity' for transformational improvement because there is greater political legitimacy and practical need for such action (e.g. Birkmann et al. (2010); Gelcich et al. (2010)). While under-researched, it appears that whether such adaptation is successful depends primarily on the level of pre-existing preparation undertaken (Moench, 2009), as preparing for and implementing large changes in direction is not feasible in the aftermath of a disaster when resources and capacity are already compromised.

Further barriers stem from each of the framing questions highlighted in this report, which relates to the way in which they also arise in each of the three phases of adaptation identified by Moser and Ekstrom (2010) (Table 2I).

Table 2-I: Common barriers to climate adaptation

Phase and process stages	Barriers
Understanding	
Detect problem	Existence of a signal Detection (and perception) of a signal Threshold of concern (initial framing as problem) Threshold of response need and feasibility (Initial framing of response)
Gather/use of information	Interest and focus (and consensus, if needed) Availability and accessibility Salience/relevance Credibility and trust Legitimacy Receptivity to information Willingness and ability to use
(Re)define problem	Threshold of concern (reframing of the problem) Threshold of response need Threshold of response feasibility Level of agreement or consensus, if needed
Planning	
Develop options	Leadership (authority and skill) in leading process Ability to identify and agree on goals Ability to identify and agree on a range of criteria Ability to develop and agree on a range of options that meet identified goals and criteria Control over process Control over options
Assess options	Availability of data/information to assess options Accessibility/usability of data Availability of methods to assess and compare options Perceived credibility, salience, and legitimacy of information and methods for option assessment Agreement on assessment approach, if needed Level of agreement on goals, criteria, and options
Select options	Agreement on selecting option(s), if needed Sphere of responsibility/influence/control over option Threshold of concern over potential negative consequences Threshold of perceived option feasibility Clarity of authority and responsibility over selected option
Managing	
Implement options	Threshold of intent Authorisation Sufficient resources (fiscal, technical, etc.) Accountability

	Clarify/specificity of options Legality and procedural feasibility Sufficient momentum to overcome institutional stickiness, path dependency and behavioural obstacles
Monitor outcomes and environment	Existence of a monitoring plan Agreement, if needed, and clarity on monitoring targets and goals Availability and acceptability of established methods and variables Availability of technology Availability and sustainability of economic resources Availability and sustainability of human capital Ability to store, organise, analyse and retrieve data
Evaluate effectiveness of options	Availability of needed expertise, data and evaluation methodology Willingness to learn Willingness to revisit previous decisions Legal limitations on reopening prior decisions Social or political feasibility of revisiting previous decisions

Source: Moser and Ekstrom (2010)

Focused especially on the importance of developing a shared understanding of the problem at hand, Ison et al. (2010) note that transformational adaptation within institutions is often constrained by: the history of the situation; the extent to which stakeholders are actively involved in an issue; the institutions and policies involved; epistemological constraints and contestation about the nature of the issue; and how the joint learning processes are facilitated or mediated. They argue that scenario processes can assist in overcoming these barriers by providing an important inquiry-based learning process to counterbalance the conventional evidence-based approaches to policy development. Such counterbalancing is needed not only because evidence-based approaches are constrained by the limitations of prediction under uncertainty, but because of the need to foster social learning as a core element of adaptation.

Policy for adaptation

Given the significant challenges involved in climate change adaptation, policy designed for it needs to have particular characteristics (Macintosh (2010); Cork (2010)):

- *Multidimensionality*: Adaptation policy needs to be cross-sectoral, cross-regional and cross-scale in keeping with the multidimensionality of climate change impacts.
- *Context-dependence*: Adaptation to climate change proceeds from the basis of how well-adapted people are to their present situation (McGray et al., 2007) which is intensely varied across localities and groups. The adaptation needs of each area and group in relation to future climate change are, therefore, equally diverse.
- *Subjectivity:* Concepts central to adaptation such as costs, harm, benefits, risk and uncertainty are inherently subjective, pointing to the fundamentally political nature of adaptation questions and thus adaptation policy.
- *Uncertainty:* Multiple types and layers of uncertainty characterise the pace of climate change, the type, timing, magnitude and interaction of its effects, and adaptation responses, including changes to the policy environment and institutional capacity.

More specifically, Barratt (2010), proposes that a desirable climate adaptation public policy framework should have the following attributes:

- It will still be applicable if matters do not turn out quite as expected. That is, it will 'aim to cover as wide a range of credible outcomes as possible', including second order effects of climate change, such as those on the economy.
- It is supported by the available evidence 'even if there are gaps in our knowledge that we have to fill as best we can with informed judgements' and 'even if this evidence flies in the face of conservative or ideologically held views of the way things are and the way they therefore should remain' (Barratt, 2010, p.147).
- It commands wide public understanding and support – both in terms of an understanding of the need for action, and an understanding of the rationale for the particular scale and approach of the policy response.
- It commands support across a broad range of the political spectrum – such that a change in government does not lead to a radical change in policy and long-term direction is maintained.
- It is practical and can be implemented.
- It is equitable – and understood by the public to be equitable.

Mainstreaming versus prioritising climate change adaptation

A key issue around climate change adaptation is the extent to which it is practical or useful to distinguish such efforts from the 'normal, everyday' adaptation to continual environmental change that is the basis of human development (Hassan, 2010). Whether or not to bracket off *climate change* adaptation as a distinct undertaking is a difficult question for policy. On the one hand, climate change adaptation necessitates *additional* attention and funding and so often needs to be identifiable; on the other hand it is increasingly agreed that the most effective route to climate change adaptation is to 'mainstream' it into existing policies and management actions (Fankhauser and Schmidt-Traub, 2010).

The latter approach has recently gained support. Globally there has been move away from addressing adaptation as a series of impact-specific, discrete adaptation options (e.g. building sea walls) towards a more generic focus on building society's generic capacity to adapt (Preston et al., 2010), including addressing some groups' inability to adequately address current, little less future, climatic impacts (McGray et al., 2007). Because the factors underpinning capacity to adapt to climate change are understood to be aligned with general human development goals, such as poverty reduction and social capital, climate change adaptation actions can create important co-benefits. A further advantage of this adaptation as 'climate resilient development' approach (Fankhauser and Schmidt-Traub, 2010) is that it more closely reflects the messy, integrated way in which adaptation often occurs in practice.

However, there are significant disadvantages to the mainstreaming approach. It can perpetuate a 'business as usual' attitude. In doing so, it can reduce awareness of new, unprecedented and cross-sectoral risks, limit learning and collaboration, and foreclose necessary transformational change, including changes to policy structures. It may also fail to produce effective responses to specific climatic risks. Overall, there is a risk that adaptation may not receive the serious attention it requires, and so be both inadequate in quantum and inappropriate in form.

Key messages: How should adaptation occur?

- The adaptation process is an iterative cycle of decision making, action, observation and learning. A generalised model involves stages of: understanding, planning and managing or implementing.
- A risk assessment framework is consistent with this adaptation process and widely applied. Climate change impacts can be viewed usefully as risks. This highlights that they are prospective and subjective, and need to be managed overall, rather than impact by impact.
- Conventional 'observe, predict, respond' management approaches are ill-equipped to cope with the uncertainty inherent in climate change adaptation. 'Robust decision making' – in which strategies are selected for their ability to cope with a range of possible futures – is an increasingly popular approach for dealing with uncertainty.
- Barriers to adaptation are numerous and emerge at each stage of adaptation. A risk assessment framework can assist in identifying and addressing them. Social learning is needed, in addition to information.
- Policy for adaptation has to take into account the multidimensionality, context-dependence, subjectivity and uncertainty of climate change and adaptation.
- Adaptation is synergistic with many existing policy objectives and can be mainstreamed into existing policy. However, care is needed not to underestimate the degree of change needed.

3. Scenario planning: A tool for decision making under complexity and uncertainty

In this section

→ About this chapter

→ What is scenario planning?

→ Scenario planning methods and variables

→ How can scenario planning improve decision making under conditions of complexity and uncertainty?

→ Limitations of scenario planning

3.1. About this chapter

Chapter 2 provided an overview of climate change adaptation, including the key framing questions, complexities, phases and barriers. This chapter introduces and defines scenarios and scenario planning. It gives a brief overview of the history and evolution of scenario planning as a set of techniques designed to help with strategic decision making in conditions of uncertainty and complexity. It explains several different approaches and methods, and considers the benefits and limitations of using scenario planning.

3.2. What is scenario planning?

The Intergovernmental Panel on Climate Change (IPCC) defines a scenario as '*a plausible and often simplified description of how the future may develop, based on a coherent and internally consistent set of assumptions about driving forces and key relationships'* (IPCC, 2007b). Scenario planning involves the development and use of these 'plausible futures' to inform strategic decision making and planning in a wide range of organisational and policy making contexts (Bishop et al. (2007); Varum and Melo (2010); Chermack (2007)). Some commentators conceptualise scenario planning more broadly as '*the part of strategic planning which relates to the tools and technologies for managing the uncertainties of the future*' (Ringland, 1998).

Box 3A: Scenarios terminology in this report

A **scenario** is a plausible, often simplified description of how the future may unfold, based on a coherent and internally consistent set of assumptions about driving forces and key relationships (IPCC, 2007b).

Scenario planning is used in this report as a catch-all term for the range of ways in which plausible stories of the future are built and used to inform decisions about priorities and actions.

Originating in military and corporate strategy, scenario planning has increasingly been used by private and public sector organisations to identify options and decide priorities in the context of uncertain future conditions and events (Varum and Melo, 2010). This emphasis on informing decision making under conditions of uncertainty distinguishes scenario planning from forecasting, which has a narrower focus on predicting likely futures.

Until relatively recently, long-term decision making tended to be based on a combination of faith and prediction (List, 2005). Since the Industrial Revolution, strategic decision makers have increasingly relied on a mixture of 'expert' opinion and quantitative analysis to define 'likely' futures and take actions based on their implications. Predictions of future trends have commonly been based on extrapolating from historical trends and mental models that assumed 'linear' connections between cause and effect. This has allowed decision makers to identify probable future pathways, threats and opportunities and to develop 'optimal' strategies to address these (List, 2005). This approach has become increasingly problematic as the future becomes more complex and uncertain (Lindgren and Bandhold, 2009).

By the mid-20th century, the increasingly complex global commercial and geopolitical environment was forcing planners to consider methods of strategic planning that relied less on overly linear forecasts and predictions. Scenarios and scenario planning grew out of this period (Peterson et al. (2003); Lang and Allen (2010)). Herman Kahn, who worked at the Rand Corporation in the 1950s, is credited with introducing the term 'scenario', drawing from its use in film-making (Kahn, 1961, Kahn and Wiener, 1967, Chermack and Lynham, 2002, Lindgren and Bandhold, 2009). Kahn developed a technique of 'future now thinking', which involved the creation of challenging, plausible narratives of the future against which decisions could be evaluated.[6] Later, while at the Hudson Institute, he argued for the need to break out of conventional thinking and 'think the unthinkable' about the future as a means of fully understanding the consequences and relevance of strategic actions.

Following Kahn, the use of future stories in strategic planning was adopted and adapted by a number of organisations, notably Shell and Batelle in the 1970s. Shell popularised the use of long-term future scenarios when it used scenario planning to successfully pre-empt and adapt to major global disturbances including the 1973 Arab-Israeli War and the OPEC oil embargo it triggered (Lindgren and Bandhold, 2009, Davis, 2010) (See Box 3B).

Box 3B: Pioneering scenario planning for business strategy development at Royal Dutch Shell

Shell International is widely recognised in international business circles for playing a key role in pioneering scenario planning for strategy development. The global group of energy and petrochemical companies has been using scenario planning for more than 30 years as a means of exploring possible future developments and developing global scenarios, which they use to test their business strategies.

The history of scenario planning at Shell dates to the early 1970s when the work of Pierre Wack and his team in the newly formed department of 'Group Planning', led to scenarios that spelt out the possibility of oil price rises due to the emergent power of the Organisation of Petroleum Exporting Countries (OPEC) in the Middle East. The work of Wack's team to highlight this possibility among Shell management and trigger reflection on decisions they might have to make if this scenario eventuated, has been widely heralded as a key factor contributing to Shell's quick response to the 1973 oil price shock and subsequent growth in company size and profitability (Mietzner and Reger, 2005).

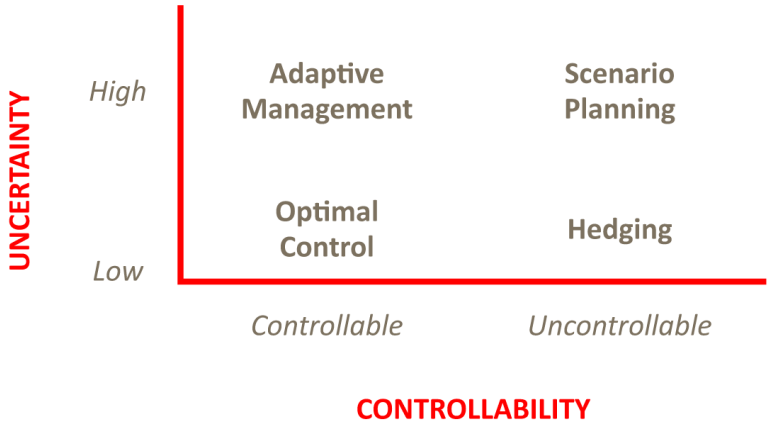
Shell International periodically publishes the results of their global scenario development work. Most recently, they released *Shell Energy Scenarios to 2050*, depicting two alternative futures, which they term 'Scramble' and 'Blueprints'. The group has also produced a range of materials explaining their views on the purpose and intent of scenario building; the outputs of several of their own major scenario-building exercises and step-by-step processes and considerations for those wanting to undertake scenario planning.

View Shell International's Guidebook for scenario planners, *Scenarios: An Explorer's Guide* here:
http://www.shell.com/home/content/aboutshell/our_strategy/shell_global_scenarios/scenarios_explorers_guide/

Scenario planning represents an approach to strategic management and decision making that has developed to guide actions in complex and uncertain conditions. It is a method best applied within highly complex 'turbulent' systems and for exploring long time frames (Ramirez et al., 2010). Peterson et al. (2003) describe scenario planning as ideally suited to conditions of high uncertainty and low levels of control (Figure 3A).

[6] Other organisations (notably DATAR) were also developing scenario type techniques at this time (Davis, 2010)

Figure 3-A: Strategic decision making techniques appropriate for different levels of uncertainty and controllability



Source: Peterson et al. (2003)

Scenario planning methods are more integrated and holistic than many strategic decision making tools. They assume less certainty in contextual environments and look further afield (Parsons et al., 2007, Lang and Allen, 2010, Lindgren and Bandhold, 2009).

Many long-term decision making tools are variations on traditional forecasting methods. As such, they are concerned with defining probable futures and have a narrower scope of exploration than scenario planning. Delphi-analysis, sensitivity analysis and trend analysis are three examples that fall under this banner. Forecasting is designed to predict a likely future by utilising what is known and certain (Wilkinson and Eidinow, 2008). As a result, it has attracted criticism for relying on assumptions that yesterday's conditions reflect the future relatively unchanged; for fostering overconfidence in decision makers; and relying too heavily on quantifiable indicators of the future (List, 2005). In trend analysis, people seek to explore and define a probable future based on the continuity of past conditions (Manetti et al., 2010). 'Expert' opinion is often relied on for producing 'valid' outcomes of high confidence. This is also the case with techniques such as Delphi-analysis, which gather a majority consensus among 'expert' opinions.

The emphasis on creating single, probable pathways and future states from expert agreement reflects a key difference in the philosophy or 'worldview' between forecasting and most scenario methods. While forecasting methods aim to define a single probable future, scenario planning generally involves the creation of multiple plausible futures, none of which have primacy. The value of any one scenario stems from its relationship and comparison with others (List, 2005). Scenario planning is therefore more open to the possibility of radically different futures stemming from unpredictable events and discontinuities in observed trends (Sondeijker, 2009). Furthermore, disparate perspectives are explicitly valued and often deliberately explored in order to define alternative futures. Having multiple futures helps define the futures' plausible bounds, not its 'probable' trajectory. As pioneering scenario planner Peter Shwartz summarises, '*the objective of good scenarios is better decisions not better predictions*' (Dearlove, 2002).

Scenario planning outcomes also differ considerably from those of traditional planning tools as they rarely give definitive answers or solutions to a future dilemma (Lindgren and Bandhold, 2009). This can create challenges for decision makers, who are used to the more concrete recommendations provided by traditional planning tools.

Key messages: What is scenario planning?

- A scenario is a plausible, simplified description of how the future may develop. It is based on a coherent and internally consistent set of assumptions about driving forces of change and key relationships.
- Scenario planning refers to a broader process of building and analysing scenarios in order to inform strategic decision making.
- Scenario planning methods were developed and popularised throughout the second half of the 20th century, particularly in corporate settings.
- Scenario planning is best suited to situations of high uncertainty and where the decision maker has low control over the outcome.
- Scenario planning fundamentally differs from techniques that attempt to best *predict* the future, such as forecasting. It aims instead to help generate good decisions and strategies to navigate through unavoidably complex and uncertain challenges.

3.3. Scenario planning methods and variables

Scenario methods have grown out of practice and in response to the needs of decision makers. Multiple scenario processes, techniques and definitions have evolved separately and largely in the absence of underlying theory (Chermack, 2004). For newcomers to scenario planning, understanding, comparing and selecting methods is difficult. Many terms are widely applied but often with different interpretations – reflecting the experience and philosophy of the individuals and organisations that use them.

To get a quick grasp of scenario planning and the variety of ways in which it is applied, we present a generic overview of the scenario planning process. For simplicity we have chosen to represent a five-stage process, informed by the TAIDA model developed by the Kairos Group (see Figure 3B), which moves through the stages of tracking, analysing, imagining, deciding and acting.

Figure 3-B: A simplified five-stage scenario planning process: The TAIDA model

Source: Lindgren and Bandhold (2009, p.39)

In this process, scenario planning begins with the definition of a problem or aim to be addressed, followed by an exploration of related contextual issues (**tracking**). A prioritisation of issues then occurs, which often involves distilling variables of high uncertainty with greatest influence

(**analysing**). Using these variables as a frame, storylines are then explored, refined and tested for internal logic and consistency (**imagining**).

Once scenarios are tested, their implication for organisational strategies and goals are explored. Depending on how well existing or proposed strategies allow an organisation to navigate future possibilities, organisational responses are proposed. These are then fed back into the scenarios to test their validity, efficacy and consequence (i.e. the future stories are explored once more with organisation adaptations as input material). This process then leads to a refinement of possible strategic orientations and decision options (**deciding**). These are then implemented (**acting**), although implementation is often considered outside the scenario planning process. In reality, there are significant variations in the way this generic process occurs. In some projects, stages may be run discretely, or the process finishes without reaching the 'Action' stage. Furthermore, there are important philosophical differences between the approaches used.

To unpack these alternative approaches we have employed a framework proposed by (Borjeson et al. (2006), who divide scenario planning into three broad categories, each with two 'angles of approach'. Their classification of predictive, exploratory and normative scenarios is particularly useful as it differentiates scenario methods by intention. It also closely follows frameworks proposed by other scenario practitioners (e.g. (Lindgren and Bandhold, 2009)).

Predictive scenarios – exploring 'what is likely to happen'

This approach is based on a perspective that future conditions relevant to decision making can be ascertained with reasonable certainty. Compared to the other approaches, predictive scenario methods rely more heavily on quantitative data, expert advice and assessments of probability. Note that the term 'predictive' here misleadingly implies that scenarios can or should describe with some degree of certainty a future that will definitely eventuate. Within this broad approach, scenarios may develop down two routes:

- as 'forecasts' – which explore probable outcomes based on expected trends. The assumption here is that a (single) scenario developed is the one most likely to occur;
- as 'what if' scenarios – which explore the likely outcomes resulting from a hypothetical trigger or decision event. Resulting scenarios are not seen in terms of likelihood.

Exploratory scenarios – exploring 'what could happen'

Exploratory scenarios describe highly contrasting but plausible future conditions, events and responses. They are not constrained by probability assessments and draw from diverse opinion, knowledge and experience to incorporate novel situations and high levels of uncertainty. They are best applied within conditions of high uncertainty to address high-risk issues and explore implications of long-term strategy. Exploratory scenarios have been popularised by organisations such as Shell and are probably the most widely adopted (and adapted). As a result, they have been divided into various sub-categories that reflect the particular needs, context and philosophy of scenario practitioners. Borjeson et al. (2006) make just two divisions:

- 'external' scenarios – which explore the implications of possible changes in the external environment. These are changes that direct stakeholders cannot influence, only respond to or pre-empt.
- 'strategic' scenarios – which explore the potential consequences and implications of specific long-term decisions or strategic pathways.

Normative scenarios – exploring 'what ideally should happen'

Normative scenarios describe an ideal outcome and the processes, along with the decisions and events leading to it. The aim of this type of scenario is to provoke exploration of the conditions and decisions needed to make the ideal a reality. Two variations are:

- 'preserving' scenarios – which explore goals that can be reached within the 'prevailing structure of the system' (and potential pathways to get there);
- 'transforming' scenarios – which explore goals that cannot be reached within the 'prevailing structure of the system' and require innovative ways to work around that structure or ways to transform it in order to reach the goal.

In practice, distinguishing scenario approaches is difficult because methods are adapted and added depending on the specific context and aims. In many cases, techniques may combine elements from each of the three approaches just described. Issues of concern, timelines, stakeholders, level of resources and personal preferences of scenario practitioners also mean significant deviation in how a single method is used depending on its application. For example, Bishop et al. (2007) claim more than two-dozen different scenario methods exist.

One way to approach this complexity is to see scenario projects as involving a range of contextual issues that influence the practical application of any method. There are a number of ways to define the methodological variables by which scenario processes differ (see for example, van Notten et al. (2003); Lindgren and Bandhold (2009)). Table 3A, adapted from Biggs et al. (2007), identifies 16 variables and indicates the range of variation for each.

Table 3-A: Variables in scenario methods

Dimensions along which scenarios vary	Range of variation	
Purpose	Exploratory, investigate uncertainties and drivers of change	Decision support, test robustness of policies
Motivation	Scientific inquiry	Policy support
Focus	On process: development of storylines	On outcome: implications of storylines for decision making
Inclusion of norms	Normative, e.g., scenarios reflect the desired and 'good' or the 'undesired' and 'bad'	Descriptive, not based on social preferences
Approach	Quantitative, 'hard', formal models: statistical forecasting, trend-impact analysis, cross-impact analysis	Qualitative, 'soft' methods: visioning, intuitive logic, storytelling
Source of information	Formal, rational, scientific observation	Judgment and intuition of decision makers, intuitive, local knowledge systems and world views
Level of uncertainty	Low	High
Number of focal scales	Single scale	Multiple scales

Links between scales	Loosely linked: perspectives, uncertainties, and drivers from each scale partially inform scenario exercises at other scales	Tightly coupled: perspectives, uncertainties, and drivers from each scale strongly inform the scenario exercises at other scales
Number of storylines	One	Multiple (3-9, typically 3-5)
Starting point of storyline	Future, uses backward inference or 'backcasting', deductive	Present, uses future inference, inductive, builds from knowledge of roles and environmental trends
Endpoint of storyline	'Snapshot' at one future point in time	Story of events linked from present to future
Driving forces	Underlying (exogenous, external): hard or impossible to control by stakeholders	Proximate (endogenous, internal): controllable to some extent by stakeholders
Dynamics	Simple	Complex, includes thresholds and feedbacks
Stakeholders as participants	Active participants in construction and evaluation, i.e., participatory scenarios	Passive objects of analysis, i.e., expert-driven scenarios
Stakeholders as audience	No communication strategy in mind	Targeted communication strategy integral to design, e.g., policy briefings, drama, editorials

Source: Biggs et al. (2007)

Key messages: Scenario approaches and methods

- There is a broad, and potentially confusing, array of scenario methods.
- A generalised scenario planning process includes stages of: problem framing and definition; tracking or exploring key related issues; analysing and prioritising critical and highly uncertain issues; imagining plausible scenarios; identifying a range of possible strategies and testing them against the scenarios leading to strategic decisions; and finally, going beyond the scenario planning process to implement these decisions.
- It is helpful to distinguish between three broad approaches to building scenarios which, depending on their underlying intent, may be driven by a desire to determine: 1. What is *likely* to happen? 2. What *could* happen? and 3. What *should* happen?
- It is important to be wary of 'predictive' scenarios.

- There is a wide range of other variables by which scenario methods differ, ranging from broad purpose and scale, to the nature and extent of stakeholder inclusion.

3.4. How can scenario planning improve decision making under conditions of complexity and uncertainty?

Scenario methods can provide policy makers and practitioners with valuable tools to consider and analyse a diverse range of future trends, contexts, risks and opportunities (Wilkinson and Eidinow, 2008). Informed by either quantitative or qualitative evidence, scenarios also have the capacity to illuminate potentially critical 'unknowns', to encourage organisations to think 'outside the square' and to challenge taken-for-granted assumptions about the future (Kahn, 1967). The scenario planning process can help organisations address strategic issues in multiple ways. Benefits arise from the process as much as the final outcomes. Aside from better decision making, scenario planning can improve learning and imagination, and change the way participants think.

Improved capacity to understand, explore and address complex challenges and opportunities

Scenario methods can foster improved learning and imagination at both individual and organisational levels. For individuals, learning and a broader understanding of issues, arise from the exchange of perspectives and expertise during the process of future exploration and scenario creation (Rosentrater, 2010). Scenario planning can also assist decision makers deal with uncertainty by systematically exploring a contextual environment (Ramirez et al., 2010) – providing a process for identifying and analysing complex, interconnected variables and drivers. As a result, participants gain an understanding of the variables and drivers that 'matter', those they have influence over and those that need monitoring (Schoemaker, 1997, van der Heijden, 2005, Wack, 1985).

At an organisational level, the process of future interrogation, scenario creation and strategy development can generate deep shifts in the way organisations operate and 'think' strategically. Scenario planning can help embed a culture of strategic 'future-oriented' thinking and discussion into organisations' everyday operation, as well as build a common understanding of issues and visions (Chermack and Lynham, 2002). The creation of stories can also be useful when illustrating and communicating alternative futures to stakeholders outside the scenario planning process (Miles, 2003).

Challenging and exploring taken for granted assumptions and mental models

While scenario techniques can expand what people know, they can also alter how they know, by strengthening understanding of relationships between key variables and fostering a more 'systems thinking' approach to understanding issues (Chermack and Lynham, 2002). Scenarios can also challenge people's assumptions about the future and about how the world 'works'. This is particularly valuable when organisations are making long-term decisions under high uncertainty. As Davis (2010) explains, 'We all have mental maps – the spectacles through which we see the world and scenarios are designed to challenge those maps because the factors that shape the future will not necessarily be reflected in our own worldview'.

Strategists and scenario practitioners argue that in order to better understand the world in which we make decisions, we must see and break out of our 'constrained thinking'. Scenario planning provides a method for doing this – by illuminating critical unknowns and forcing people to think beyond their normal conceptual environment (Kahn, 1967). Citing Wack (1985), Chermack (2004) notes: 'scenario planning intends to push organisational planners to consider paradigms that challenge their thinking and to think the unthinkable.'

Scenario planning can help people see and acknowledge where their mental models shape their perception of reality (Wack, 1985). For example, Strategis partners (ND) argue that scenarios can help organisations overcome decision making biases such as risk aversion, and by breaking people out of mental frameworks can reduce the risk of 'groupthink' and allow more open acceptance of ideas.

Peterson et al. (2003) also note that scenarios are particularly valuable for reframing how we perceive uncertain futures – showing us that the future is not pre-determined and that more than one possible course of action exists. Braithwaite (2010) makes a similar argument, noting how scenarios enable people to '… move away from the "one future" mentality and expose the inherent and sometimes irrational assumptions that lie behind our vision of the future'.

Improved decision making through testing and rehearsing strategic choices and plans

Scenario planning is commonly used to design and test decisions (Rosentrater, 2010). For O'Brien (2002), scenario planning helps organisations make better decisions by sequentially:

- synthesising information about what is important – understanding future uncertainties and prioritising information;
- creating consistent and plausible descriptions of possible futures through the use of a structured methodology;
- evaluating the implications of these scenarios.

Scenarios provide a way to explore responses to hypothetical events and conditions and by doing so, allow organisations to consider what action they could take (Fahey, 2003, Shell, ND) – answering the question: 'What would we do if this happened?' (Manetti et al., 2010).

Scenario exercises also assist decision making by providing a process to compare multiple choices and improve focus on critical variables (Parsons et al., 2007). Using multiple exploratory narratives to underpin strategy development helps ensure that long-term decisions are 'robust' and viable in a range of potential conditions (Peterson et al., 2003). By allowing groups to anticipate potential futures, scenarios also help them become more attuned to early warning signals of undesirable change (Braithwaite, 2010), improve their preparedness and take pre-emptive action to avoid unwanted outcomes (Fahey, 2003).

In addition to '… visiting the future before it happens …', Chermack and Lynham (2002) note that scenario building can also support and embed the development of 'anticipatory memory' so that organisations become '… better prepared to respond to emergent future variables'. Braithwaite (2010) also notes how stories of the future can help confirm existing strategy – on the basis that it is robust to future change – and identify poorly performing projects or plans – on the basis that they appear too risky against one or multiple future scenarios.

In the majority of cases, scenarios are used as a means to improve responses to change or develop pre-emptive decisions to identified risks. However, they are not all applied in a reactive sense. For example, Tevis (2010) describes how scenarios can be used to imagine and define a desired end state and then identify decision pathways to achieve it. In this case, scenarios act as inspiring change

agents – driving shifts in societal and organisational norms and behaviour (Manetti et al., 2010, Miles, 2003) (see Box 3C). At another level, scenarios can help identify which future possibilities are compatible with an organisation's existing orientation, while also structuring and guiding further explorations of the future (Miles, 2003). Wilkinson and Eidinow (2008) describe how scenarios give policy and decision makers an ability to consider and analyse a diverse range of future trends, contexts, risks and opportunities.

Box 3C: Scenario planning and social change: Mont Fleur scenarios in apartheid South Africa

A scenario planning process undertaken in South Africa in 1991–92, labelled the 'Mont Fleur' project, is widely renowned for its contribution to informing public dialogue in that country and promoting shared understanding of possible future directions at a time of great national turmoil associated with the transition out of apartheid. The 'Mont Fleur' project brought together 22 prominent South Africans, including politicians, activists, academics and politicians, who, importantly, reflected a diverse spectrum of ideological perspectives. The purpose was to stimulate debate, rather than reach any definitive answers, about what might happen in South Africa over the decade to 2002 as the country faced an uncertain future.

The process involved several meetings and the development of a set of four scenarios, ranging from a scenario of failure to achieve a negotiated settlement to the crisis (Ostrich), to a slow and indecisive transition (Lame Duck), to a rapid but unstable transition (Icarus), to a path of inclusive growth and democracy (Flight of the Flamingos). The stories were presented to a wide range of audiences including political parties, companies, civic organisations and disseminated via national media and in a range of formats, including cartoons and presentations by team members.

While the scenario process was clearly not responsible for resolving the crisis in South Africa, the Mont Fleur project has been credited with contributing to widespread common understanding and constructive public debate in what was a very difficult period for the country. Along with substantive messages, and strong connections between those influential South Africans involved in developing the scenarios, a further, intangible yet fundamental, outcome was the contribution the process made to promoting shared language and enabling discussion of phenomena that had previously gone unnamed or unrecognised.

For further information see le Roux et al. (1992) at:
http://www.generonconsulting.com/publications/papers/pdfs/Mont%20Fleur.pdf

Key messages: How can scenario planning improve decision making under conditions of complexity and uncertainty?

Key strengths of scenario planning processes include their capacity to:

- understand, explore and address complex challenges and opportunities;
- challenge and explore taken-for-granted assumptions and mental models;

- improve decision making through testing and rehearsing strategic choices and plans.

3.5. Limitations of scenario planning

A range of commentators have noted that scenario planning still lacks an adequate theoretical and conceptual framework (Chermack, 2004). This often leads to over-simplification and confusion in conflating scenario planning, storytelling and predictive forecasting (Godet and Roubelat, 1996); (Ringland, 1998); (Chermack and Lynham, 2002). As Bishop et al. (2007), Blackman (2007) and Keough and Shanahan (2008) also note, considerable work is still needed to conduct the empirical research required to clearly demonstrate the full value of scenario planning: 'the shortage of research on scenario planning and its influence means that there is limited guidance on how to optimise scenarios, in terms of both outputs and uptake by policy-makers' (European Environment Agency, 2009, p.5).

Rounsevell and Metzger (2010) suggest that the three criteria of saliency, credibility and legitimacy should be used to test the value of a given scenario process. This means asking:

- Are the scenarios relevant to information and decision making needs? (saliency)
- Are the scenarios scientifically sound? (credibility)
- Who developed the scenarios and how? (legitimacy)

The first of these criteria is particularly problematic, with many policy makers continuing to raise questions about the lack of guidance on how, precisely, decision makers should use the outcomes of the scenario planning process to make tough choices between competing policy and investment options (Parsons et al., 2007). Such criticisms are frequently linked to concerns that scenario outputs lack the detail and specificity required by key stakeholders (Rosentrater, 2010). More fundamentally, policy makers puzzle over the best way to utilise scenario outputs that provide a range of potential futures, which are by definition inherently diverse and contradictory. Politicians and policy makers frequently note, for example, their difficulty in dealing with scenarios that point to the possibility of both higher and lower rainfall levels for a particular location.

While there is clearly a need for further work in developing more robust conceptual frameworks for scenario planning and for empirical research on ways of maximising the value of scenario planning for decision makers, it is also important to remain clear about the purpose, strengths and limitations of scenario planning. Scenarios are tools for understanding and considering the range of plausible futures – and for informing the development of robust policy responses to potential risks, threats and opportunities. Scenarios are not silver bullets that can be used to form definitive judgements on how the future will unfold or to determine the optimal set of decisions to achieve an optimal outcome.

As van der Heijden (2005) suggests, one important lesson from the application of scenario planning may be for organisations to question the assumption that strategic planning should be primarily focused on the achievement of singular and optimal objectives through a single, well-defined pathway. A world of increasingly complex and unpredictable intersecting variables and tipping points may in fact call for organisational cultures and processes that are far more capable and skilled in understanding and addressing a variety of possible futures.

Key messages: Limitations of scenario planning

- There are gaps in understanding about scenario planning and, particularly, how to optimise its use by policy makers.
- Three common criteria for testing the value of a given scenario planning process are: saliency (are the scenarios relevant to information and decision making needs?); credibility (are they scientifically sound?); and legitimacy (who developed the scenarios and how?).

4. Scenario planning for climate adaptation: Evolving applications, key variables and three broad approaches

In this section

→ About this chapter

→ The evolving use of scenarios for climate adaptation planning

→ Which adaptation goals and challenges can scenario planning help address?

→ Key variables in applying scenario planning to climate change adaptation

→ Scenarios for climate adaptation: Three broad approaches

4.1. About this chapter

Chapter 2 highlighted the complexity and uncertainty involved in climate change adaptation. To assist with this, policy makers and practitioners are increasingly turning to the tools and techniques of scenario planning. As described in Chapter 3, scenario planning is a catch-all term for a wide range of different methods for developing and using a small set of descriptions of plausible futures.

The aim of this chapter is to synthesise and discuss the different ways in which scenario planning can be used to assist climate change adaptation from the perspective of climate adaptation policy makers and planners operating at state, regional and local levels within a range of different organisational settings. It draws on the literature explaining how scenario planning is being used to meet different goals including, for example, to inform and improve: risk and vulnerability assessments; citizen engagement strategies; policy development and analysis; and program implementation and evaluation (Wilkinson and Eidinow, 2008) (Collins and Ison, 2009).

The chapter begins with a brief overview of the evolving use of scenarios for climate adaptation in the global context. The emphasis has largely been on using scenario methods to better understand physical climate impacts, driven by global institutions such as the IPCC and national scientific bodies. This has seen down-scaled global climate change scenarios widely used as inputs to localised adaptation planning processes such as climate change impact and vulnerability studies or adaptation strategies. More recently, as localised adaptation planning proliferates, what we call tailored or 'do-it-yourself' scenario planning – in which context-specific, 'fit-for-purpose' scenarios are developed – has become increasingly relevant as a method for undertaking adaptation planning.

Given there is a variety of ways to use scenario planning techniques to support climate change adaptation, a major challenge and a key focus of this report is how best to match the use of scenarios with the contextual features of any given adaptation problem. This chapter provides a foundation for addressing that question by clarifying some of the key variables and approaches that distinguish different uses of scenarios for climate change adaptation.

One overarching variable is the organisational context(s) in which the scenario planning process is conceived and carried out. Given the broad audience of this report we assume a variety of organisational settings, including those operating in and between public, private, community and research sectors. A second overarching variable is the particular adaptation challenge or set of challenges under consideration, which depends on how adaptation is framed within the organisational setting in question.

The chapter presents and explains a set of additional variables which characterise any scenario planning process and inform specific choices about methodological design, including: the overall aim or purpose of the scenario planning process; the scale of focus; the complexity of the challenge being addressed; the extent and nature of stakeholder participation in scenario development; the intended audience for scenario outputs and method of communication; and the resources available to undertake the scenario planning process (Biggs et al., 2007).

In this chapter we also introduce three generalised or 'ideal type' approaches that climate adaptation policy makers and planners typically take to scenario planning:

- **Off-the-Shelf** – which entails the use of pre-existing scenarios as inputs into adaptation planning processes;
- **Tailored Exploration** – in which context-specific or 'fit-for-purpose' scenarios are developed and used to explore possible climate futures, impacts and adaptation policy options; and
- **Tailored Visioning** – whereby context-specific or 'fit-for-purpose' scenarios are developed and used to envisage desirable futures and pathways.

In reality, applications of scenario planning to climate adaptation may not fit neatly into one of these three approaches and may involve a combination of different approaches. As 'ideal types', however, they provide a useful way of conceptualising some of the major differences in broad approach. Some of the strengths and weaknesses of each approach are also introduced here and explored in more detail in Chapter 7.

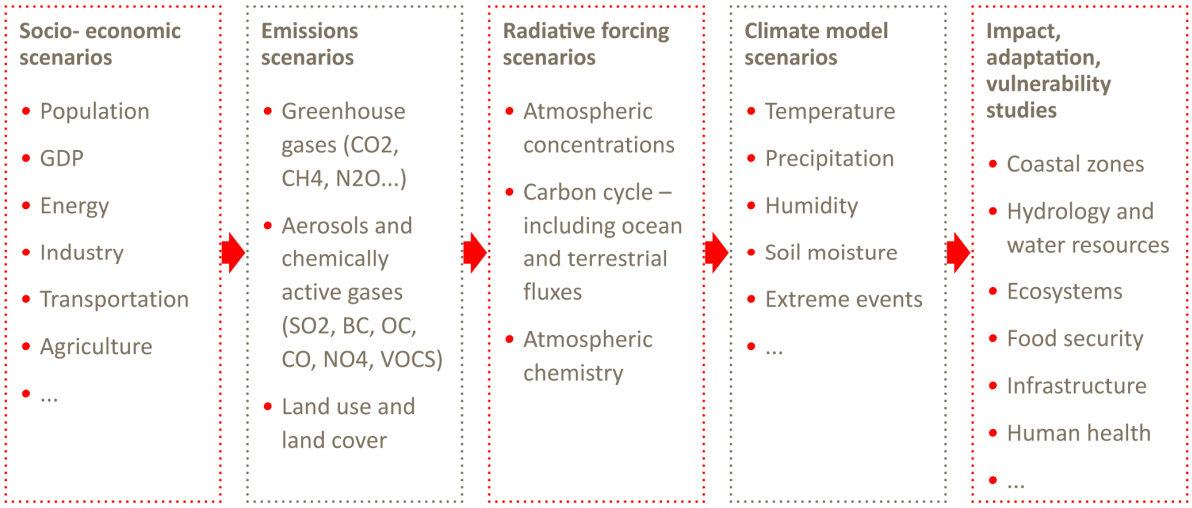
4.2. The evolving use of scenarios for climate change adaptation

While scenario planning has been used to address a wide range of global environmental challenges since the early 1970s (Meadows et al., 1972, Rounsevell and Metzger, 2010), the use of scenarios to inform climate change policy has its origins in the mid-1980s (Rotmans, 1990, Raskin et al., 1998). The initial focus of this work was on the development and use of scenarios to explore the impact of various levels of greenhouse gas concentrations on global climate trends (Rotmans, 1990). The scenario outputs from this work were largely derived from computational models. The resulting projections and predictions have played a significant role in informing public debate about the case for reducing greenhouse gas emissions in order to reduce the growing risks of climate change. Initial development of more qualitatively-based scenario planning methodologies also focused on clarifying and communicating the need for action to reduce greenhouse gas emissions and climate change risks (Raskin et al., 1998).

Over the last 20 years climate change scenarios have also been increasingly employed to inform understanding and debate about the potential social, economic and environmental impacts of climate change (Hulme and Dessai, 2008, Parsons et al., 2007). Much of this work involves down-scaling the implications of scenarios produced at a global scale in order to derive probabilistic assessments of more regional and local impacts (Rounsevell and Metzger, 2010). Down-scaled global climate change scenarios (derived from global climate models[7] or higher resolution regional climate models), often form critical inputs to localised or context-specific adaptation planning processes, which are typically also informed by a wide range of inputs about broader social, economic and environmental trends and drivers. This approach to adaptation planning can be loosely termed 'top-down' (Wilby and Dessai, 2010). The sequence by which 'top-down' approaches to using scenarios to inform adaptation have typically occurred, and the different types of scenarios involved, is depicted graphically in Figure 4A.

[7] A global climate model (otherwise known as a General Circulation Model (GCM)) is a model of the general circulation of the planet's atmosphere or oceans based on mathematic equations representing physical processes. GCMs are widely applied for weather forecasting, understanding the climate, and projecting climate change. (UK Climate Projections – Index: http://ukclimateprojections.defra.gov.uk/content/view/827/690/)

Figure 4-A: Different scenarios as part of a 'top-down' sequence to inform impact, adaptation and vulnerability studies



Source: Moss et al. (2010) as cited in Preston (2010)

As Figure 4A shows, calculations about emissions, radiative forcing and climate model scenarios derive from the development of different global socio-economic scenarios, which inevitably are built upon their own set of assumptions. Perhaps the most influential scenario development processes in recent years, in terms of informing climate change adaptation planning globally, have been the development of global emissions scenarios based on exploration of global socio-economic trends, facilitated by the Intergovernmental Panel on Climate Change (IPCC) (see Box 4A). Importantly, the IPCC is now moving from starting with global socio-economic scenarios to starting with scenarios of greenhouse gas concentrations, which reduces the assumptions embedded into the scenario planning process and allows for more flexible high-level exploration of different adaptation and mitigation policy options (Moss et al., 2010).

Box 4A: IPCC Global emissions scenarios

The most recent global emissions storylines or scenarios were released by the IPCC in 2000 and are described in their *Special Report on Emissions Scenarios* (SRES). Altogether 40 different SRES scenarios were developed stemming from four different storylines or scenario families (A1, A2, B1 and B2), underpinned by different assumptions about how the world will change between the present and 2100. Key divergent factors include the nature and rate of demographic change, economic development and technological change.

- A1 storyline and scenario family: a world of rapid economic growth and the rapid introduction of new and more efficient technologies. Global population peaks by mid-century, then declines. The A1 scenario family includes three sub-groups distinguished by technological change in the energy system: A1F1 (current dominance of fossil fuels is maintained); A1T (non-fossil energy sources); and A1B (a balance across all sources).
- A2 storyline and scenario family: a heterogeneous world characterised by self-reliance and preservation of local identities. Global population increases continuously, economic growth and technological change are more fragmented and slower than in other scenario families.
- B1 storyline and scenario family: a convergent world with emphasis on global solutions to sustainability concerns. Global population peaks and declines and economic structures rapidly move towards a service and information economy with reduced material intensity and more resource-efficient technologies.
- B2 storyline and scenario family: a world with greater emphasis on local solutions to sustainability

concerns. Global population rises continuously at a moderate rate, economic development and technological change are also less rapid than in other storylines with the latter more diverse.

Probability or likelihood is *not* ascribed to individual SRES scenarios. Guidance provided for policymakers clearly notes that 'there is no single most likely, "central" or "best-guess" scenario and recommends that a range of SRES scenarios representing a variety of assumptions regarding driving forces of global emissions be used in any analysis' (Nakićenović et al., 2000).

For its *Fifth Assessment Report* (AR5), the IPCC is changing its approach to scenario development. Previously it facilitated a sequential approach whereby global socio-economic trends formed the starting point for identification of a range of plausible emissions scenarios (as was the case for the storylines described above). The new approach will see the development of climate change projections (based on established 'Representative Concentration Pathways' (RCPs), which depict different projected concentrations of greenhouse gases in the atmosphere), which occur in parallel with the development of emissions and socio-economic scenarios (Moss et al., 2008). For further information see Moss et al. (2010).

The 'top-down' sequence described above in Figure 4A has been extremely important for providing credible scientific information about global and regional climate futures as a key input into localised adaptation planning. In this approach, the focus for national and regional policy makers typically has been on how to generate climate model scenarios that provide the best possible information about climatic trends within the region or locality of interest. Given this imperative, it is critical to emphasise the distinction between climate change *scenarios* and climate change *projections.* Confusion around this distinction is due in part to the fact that improvements in climate science since the 1970s and 1980s have allowed for the attachment of subjective probabilities to different future climate scenarios, 'crossing the line between plausibility and likelihood' (Jones, 2010).

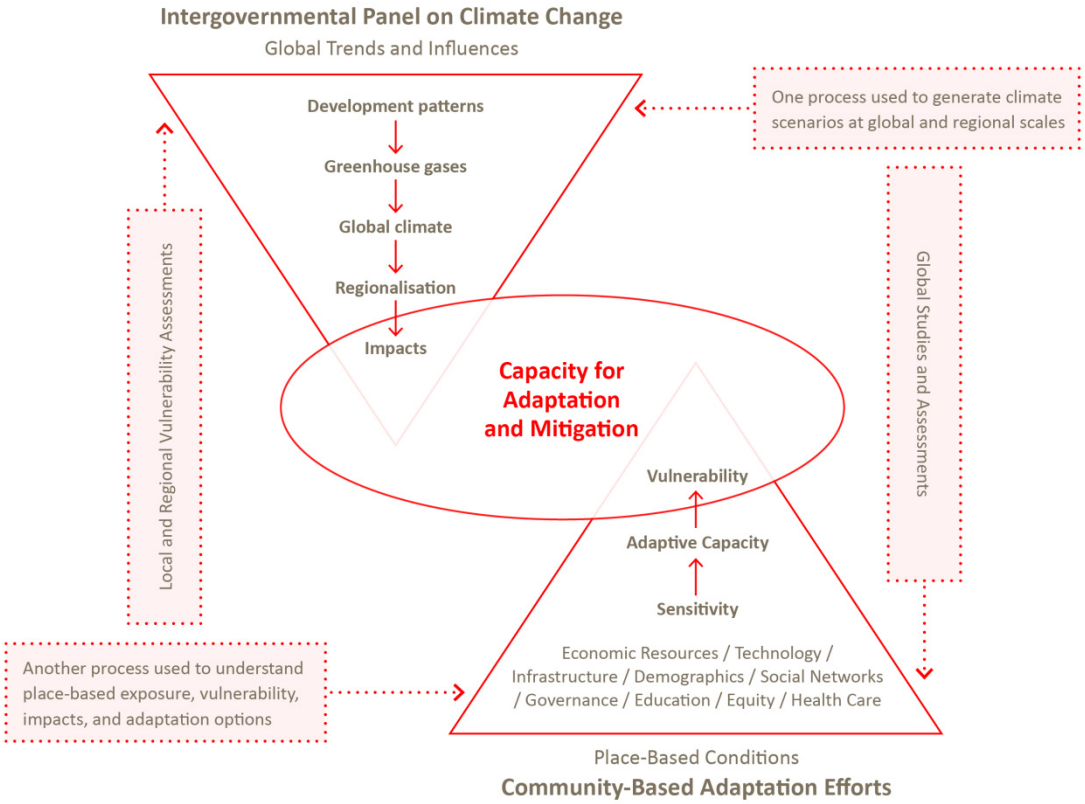
However, single scenarios are not projections and it is critical that no one scenario is treated in isolation. It is the range of scenarios that is of importance. This range 'bounds' uncertainty about the future, but is not able to be more specific than this. Working with a range of possibilities can be challenging in a policy or management environment accustomed to working with more definitive, predictive forms of information, but it is necessary to communicate and subsequently manage for the residual uncertainty we face about the future under climate change.

While climate change scenarios derived via the traditional 'top-down' approach have played a dominant role in adaptation planning to date, they are not the only type of scenarios relevant to local adaptation planners and practitioners. Wilby and Dessai (2010) point to the increasing importance of 'bottom-up' approaches to determining climate risks, which begin by consideration of the factors and conditions that enable successful coping with particular climate threats at individual, household and community levels. These approaches, associated with community-based adaptation or place-based vulnerability, adaptive capacity or resilience assessments, are often triggered by extreme events (e.g. heatwaves in Victoria) (Wilby and Dessai, 2010).

Figure 4B contrasts what could broadly be described as 'top-down' and 'bottom-up' approaches to adaptation planning, emphasising that fundamentally different processes are drawn upon for each. The role of scenarios – the types of scenarios that are relevant, the methods used to develop them, the scale at which they are developed and applied – clearly differs significantly depending on the orientation. The 'top-down' development of global assessments, which has characterised the work of the IPCC to date, generates scenarios derived from global trends, while the 'bottom-up' development of local and regional assessments is focused on understanding place-based

vulnerability and adaptation needs, for which scenario planning techniques are one set of tools that can be employed.

Figure 4-B: Top-down versus bottom-up approaches to adaptation planning



Source: Moss (2010) after Dessai and Hulme (2003) as cited in Preston (2010)

Preston (2010) notes that relatively simple scenarios about future climate change are often all that are needed when considering implications for the local context, as more detailed simulations of the climate are often less important in a local scenario development process than developing a deeper understanding of local vulnerability and opportunities to reduce it.

In line with the burgeoning demand for adaptation planning that draws out the implications and possible responses in local and regional settings, climate adaptation planners and policy makers are increasing making use of more tailored, context-specific scenario planning processes. These 'do-it-yourself' scenario planning processes provide a forum for combining input and advice from experts and stakeholders with experience and knowledge relevant to specific areas, population groups or issues.

Whether or not it is most appropriate to use climate change scenarios down-scaled from global assessments or to create and use local scenarios to assist with local adaptation planning (or, indeed a combination of both), is highly context-dependent. There are strengths and weaknesses of different approaches, as discussed further below and in other chapters of the report.

Key messages: The evolving use of scenarios for climate change adaptation

- The use of scenario planning to inform climate change policy has its origins in the mid-1980s with the development and use of scenarios to explore the impact of different global atmospheric concentrations of greenhouse gases.
- As understanding of climate change challenges and acceptance of the imperative to adapt to unavoidable impacts has increased, there has been growing demand for information about climate change impacts down-scaled to local and regional levels.
- Globally coordinated scenario processes such as the development of global emissions scenarios via the IPCC remain influential in informing adaptation planning at local and regional levels.
- Improvements in climate science and modelling combined with demand for more specific information about climate change trends at local and regional scales has led to an emphasis on creating climate change *projections.* There is a danger in confusing *plausible* futures (scenarios) with *likely or probabilistic* futures, which are associated with contrasting techniques such as forecasting.
- While the use of climate change scenarios has dominated much of the climate adaptation planning work undertaken to date, there is also recognition of the value of developing and using context-specific scenarios.
- There are a range of ways in which 'do-it-yourself' scenario planning processes, drawing on a wide range of social, economic and environmental drivers relevant to local adaptation needs, are beginning to be utilised to inform localised adaptation planning and decision making in different organisational settings.

4.3. Which adaptation goals and challenges can scenario planning help address?

Different scenario planning techniques can help address a wide range of adaptation goals and challenges. Some of the broad areas in which scenario planning techniques could potentially assist with climate change adaptation goals include:

- communicating the case for adaptation;

- deepening understanding or building shared understanding of the implications of adaptation in a given context;
- stimulating new ideas, visions and frames of adaptation, including the need or potential for transformational adaptation;
- informing strategic planning for adaptation;
- informing decision making for adaptation; and
- building capacity for ongoing, reflexive monitoring of adaptation.

Table 4A summarises a variety of ways in which scenario planning is being used at the three main stages of climate adaptation – understanding, planning and implementing – identified by Moser and Ekstrom (2010). More detail is provided below.

Understanding, visualising and analysing climate adaptation trends, impacts and risks

Scenario planning techniques can play a crucial role in identifying and communicating the full range of potential climate adaptation trends, implications and uncertainties by drawing together diverse sources of knowledge and expertise (Rosentrater, 2010, Ramirez et al., 2010, Schoemaker, 1997, van der Heijden, 2005, Wack, 1985). Able to be employed by groups and organisations lacking high-level technical expertise and expensive quantitative analytical tools, integrated scenario planning approaches can also contribute to more holistic exploration and analysis of the interactions between multiple bio-physical, social, political and technological trends and drivers.

Scenario planning also provides tools for breaking out of constrained thinking by illuminating critical unknowns and encouraging participants to 'think the unthinkable' (Chermack, 2004, Strategis partners, ND). Scenario planning methods are being extensively used as a basis for engaging stakeholders in the exploration of diverse assumptions and perspectives about climate change adaptation risks and options and in the development of collaborative plans and strategies. Scenario planning provides a way of opening up discussion about climate adaptation trends and challenges and can encourage consideration of transformational as well as mere incremental change.

A particular way in which scenario practices can assist is in envisaging and planning for the ways in which crises (particularly climatic extreme-based crises) may act as a window of opportunity for improved adaptation and even larger scale, transformative change, including a move to a low carbon economy. As discussed above, such 'windows' only exist if prior preparation has been undertaken to take advantage of the short-term political legitimacy for profound change that often exists in the post-crisis environment (Moench, 2009), and to take account of the reduction in capacity and resources that a crisis can also entail. Scenarios can be used to envisage and explore how appropriate action may unfold once a crisis occurs and/or how to create similar conditions for positive change while avoiding such crises in the first place.

Identifying, considering and prioritising robust climate adaptation policy responses

Scenario planning processes can enable the crystallisation and synthesis of a small number of plausible alternative scenarios, which can be used to test the robustness of potential policy and practice responses (Chermack and Lynham, 2002). Scenario planning can also assist in clarifying the range of values and mental models which decision makers and stakeholders from diverse backgrounds bring to consideration and prioritisation of specific climate adaptation options, including a narrow framing of 'risk' or of what is feasible. Discussion of hypothetical scenarios of the future also offers a relatively 'safe' environment for discussion of politically sensitive issues (Ribot et al., 1996), including those associated with responses to crises discussed above.

Informing and improving climate adaptation implementation strategies and capabilities

Climate adaptation scenarios can be used as a framework for checking, reviewing and evaluating the impacts and effects of climate change adaptation policies. Scenario planning can also be used as a tool to help build a culture of ongoing adaptation, strengthening the capabilities and skills of policy makers, planners, communities and stakeholders to make and implement well-informed climate adaptation decisions. Chermack and Lynham (2002) note the potential for scenario planning to contribute to the embedding of 'ongoing strategic conversations' within organisations leading to an evolving creation of shared visions, and (Lindgren and Bandhold (2009) argue that scenario planning helps 'integrate future trajectories into day-to-day … planning'. They also argue that by integrating exploratory processes with decision making, scenario planning is a form of adaptive management that combines 'left-brain' (analytical) with 'right-brain' (creative) approaches to strategic planning.

Table 4-A: Ways in which scenario planning can assist in meeting key climate adaptation challenges

Key climate adaptation challenge (informed by Moser and Ekstrom 2010)	Key policy and research questions	Types of scenarios and ways in which they can be used to answer questions and meet challenges	Examples
Understanding, visualising and analysing climate adaptation trends, impacts and risks • Detecting problem • Gathering and using information about the problem • Re(defining) problem	Do we need to adapt to climate change? What climate trends and impacts do we need to adapt to? What climate risks do we face? How do these climatic change risks interact with other non-climatic trends, drivers, stressors and risks? Who or what needs to adapt? Who is most vulnerable? How do we raise awareness about climate adaptation risks? How do we engage key stakeholders?	Using down-scaled global and national climate change scenarios to identify range of possible local and regional climatic changes. Using climate change scenarios as inputs to social and economic impact, risk and vulnerability assessments. Developing 'tailored' local and regional scenarios to explore interactions between climate change and other local and regional drivers. Developing local impact scenarios to identify vulnerable people and places. Using or developing local impact scenarios to strengthen shared understanding of need for adaptation. Developing local impact scenarios as a means of engaging citizens and stakeholders in consideration of risks and current vulnerabilities.	**CSIRO: Ozclim: Scenario generation tool for Australia** http://www.csiro.au/ozclim/home.do **IPCC SRES: Global emissions scenarios** http://www.grida.no/publications/other/ipcc_sr/?src=/climate/ipcc/emission/ **Climate Change Adaptation in New Zealand: Future scenarios and some sectoral perspectives** http://www.nzclimatechangecentre.org/sites/nzclimatechangecentre.org/files/images/research/Climate%20change%20adaptation%20in%20New%20Zealand%20%28NZCCC%29%20%28A4%20low%29.pdf **Broadmeadows 2032** ***Victorian Eco-Innovation Lab*** http://www.ecoinnovationlab.com/revisioning-broadmeadows

Key climate adaptation challenge (informed by Moser and Ekstrom 2010)	Key policy and research questions	Types of scenarios and ways in which they can be used to answer questions and meet challenges	Examples
Identifying, considering and prioritising climate adaptation policy responses • Developing policy options • Assessing options • Selecting options	What kind of future do we want to create? What actions are needed to create this future? What climate adaptation options are available? What criteria should we use to assess various climate change options? What climate adaptation options should we take to improve climate adaptation outcomes? How do we engage key stakeholders in identifying, assessing and selecting climate adaptation options	Using local impact scenarios to stimulate creative thinking about possible adaptation options. Developing and using local impact or climate adaptation response scenarios to assist communities and stakeholders identify possible and desirable futures Development of climate adaptation scenarios to show what might happen if different adaptation options are enacted. Using climate adaptation scenarios to test the robustness of different policy options or adaptation measures under different plausible futures. Developing impact or climate adaptation scenarios with a range of stakeholders to build shared understanding of adaptation priorities.	**Scenarios for climate change adaptation in the Hamilton region of Victoria** *RMIT Global Cities Research Institute and Hamilton critical reference group* http://prodmams.rmit.edu.au/cyb31c4gyjn2.pdf **Victorian Climate Change Adaptation Program (VCCAP) South West Region scenario project** *Department of Primary Industries, Victorian Government* http://www.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/climate_vccap **Thames Estuary 2100** *UK Environment Agency* http://www.environment-agency.gov.uk/homeandleisure/floods/104695.aspx **Towards a Post-Carbon Gippsland** *Gippsland Climate Change Network* (See Chapter 5 and Appendix A: VIC22)

Key climate adaptation challenge (informed by Moser and Ekstrom 2010)	Key policy and research questions	Types of scenarios and ways in which they can be used to answer questions and meet challenges	Examples
Informing and improving climate adaptation implementation strategies and capabilities • Implementing options • Monitoring and evaluating outcomes • Building capacity	What is the most effective way of implementing the chosen climate adaptation option? What actions can be taken to improve the capability of organisations and communities to implement climate adaptation policies and programs?	Using scenarios to test and evaluate the ongoing effectiveness and robustness of climate adaptation policies and plans Using scenarios to improve social learning/reflexive organisations	**The future climate for development** ***UK Department for International Development and Forum for the Future*** **-** Project encouraging member agencies to use scenarios in their ongoing strategic planning. http://www.dfid.gov.uk/Media-Room/News-Stories/2010/How-will-the-world-look-in-2030/ **Irrigation Futures** ***Department of Primary Industries, Victorian Government*** **-** Project involving the demonstration of scenario planning methods and sharing the lessons learnt and encouraging use of scenario techniques through development of suite of resources. http://www.land.vic.gov.au/DPI/Vro/gbbregn.nsf/pages/gb_lwm_fwm_irrig_futures

Key messages: Which adaptation goals and challenges can scenarios help address?

- Scenario planning tools and techniques can be used to meet many different goals associated with climate change adaptation, including in general areas of communicating the case for adaptation action, raising awareness and deepening understanding, stimulating new ideas and ways of thinking, building shared approaches, capacity building, strategic planning and decision making.
- Different types of scenarios and scenario planning processes can be used to assist with:
  - understanding, visualising and analysing climate adaptation trends, impacts and risks;
  - identifying, considering and prioritising climate adaptation policy responses; and
  - informing and improving climate adaptation implementation strategies and capabilities.

4.4. Key variables in the application of scenario planning to climate change adaptation

One overarching variable is the organisational context(s) in which the scenario planning process is conceived and carried out. Given the broad audience of this report we assume a variety of organisational settings, including those operating in and between public, private, community and research sectors. The organisational context, incorporating the core responsibilities or objectives of the organisation and elements of organisational culture, clearly influences adaptation decisions required and the ways in which they are approached. Challenges arising from different organisational contexts including, for example, the extent of risk-aversion and the organisation's established strategic planning and risk management practices, are discussed in later chapters.

A second overarching variable in a given application of scenario planning to adaptation is the particular adaptation challenge or set of challenges under consideration. This variable is affected by the way in which adaptation is framed and approached within the particular organisational setting. While we know that adaptation policy makers and practitioners are turning to scenario planning techniques to assist them with complex adaptation challenges, it is important to ask: which adaptation challenges or at what phases of an adaptation planning process do users need scenario planning to assist with? Scenario planning is potentially of use at all stages of the adaptation planning process (see Moser and Ekstrom's (2010) framework of this process in Chapter 2). Crucially, the use of scenario planning at different stages needs to be specifically designed to achieve the different adaptation objectives of each stage. Carefully matching what scenario planning has to offer with the different tasks involved in different stages of climate adaptation allows the value of scenario planning as a tool for climate change adaptation to become apparent.

Recognising that there are major contextual differences relating to the organisational setting and adaptation challenge being addressed, this section introduces some of the important variables of any scenario planning process that need to be considered when developing an appropriate scenario planning approach. These variables (adapted from Biggs et al. (2007) include:

- the **overall aim or purpose** of the scenario planning process (e.g. to explore implications, to support a decision, to develop goals);
- the **scale of focus** for the scenario planning process (e.g. global, national, regional, local);
- the **complexity** of the challenges which the scenario process is addressing (e.g. developing a comprehensive regional adaptation plan, providing specific advice about a short-term, discrete adaptation measure);
- the extent and nature of **stakeholder participation in scenario development** (e.g. highly participatory, expert-driven);
- the intended **audience for scenario outputs** (e.g. general public, a specific decision-maker) and **method of communication** (e.g. publishing and disseminating films or fictional narratives, presenting graphs);
- the **resources** available to undertake the scenario planning process (e.g. time, funding, skilled personnel).

These variables provide a useful framework for understanding the nature and extent of variation in applications of scenario planning to climate change adaptation. Each is introduced below, followed by a brief discussion of the suite of methodological choices which they give rise to. Implications of particular approaches and combinations of variables for designing a scenario planning process for climate adaptation are elaborated on further in Chapter 7.

Whether or not these variables are pre-determined or open to choice and manipulation by different climate adaptation policy makers and practitioners will also differ depending on the organisational context in which they are operating.

The overall aim or purpose of the scenario exercise

Perhaps the most significant variable in any given scenario planning process is the overall aim of that process. This variable, closely linked to the above discussion of climate adaptation goals, relates to the specific objectives and motivation for using and/or developing scenarios. Depending on the context in which the climate adaptation policy maker or practitioner is operating, the objective of a given scenario planning process could place more or less emphasis on:

- the *exploration of trends and dynamics* (drawing out information); or
- *decision making* (requiring the ultimate prioritisation of the most desirable or robust response option).

As already established in Chapter 3, the objective of the scenario development process could be to arrive at *normative* scenarios, in other words, desirable possible futures or, alternatively, simply to articulate *descriptive* scenarios.

Further, the aim of the particular application may lead to more or less emphasis being placed on:

- the scenario planning process (i.e. the steps worked through to develop scenarios); or
- the *outputs* of the process (i.e. the scenarios themselves).

Emphasising the *process* of developing the scenarios can be most helpful if the objective is to work directly and collaboratively with key stakeholders, deepen understanding, stimulate new ideas and ways of thinking, build shared approaches or build capacity for ongoing, reflexive and strategic

adaptation planning. Emphasis on the *outputs* of the scenario planning can be most helpful if the objective is to provide key inputs to robust decision making processes, make a case for a specific adaptation response to decision makers or communicate the case for adaptation action and raise awareness among broad audiences (not participating in scenario development).

Scale of focus and linkage between scales

Another defining feature of a given scenario planning process for climate change adaptation is the spatial scale of interest (e.g. global, national, local) which is typically defined to coincide with the specific level of social organisation or management responsibility of those involved (Biggs et al., 2007). A scenario process can focus on:

- one scale (which does not preclude it from discussing cross-scale influences); or
- multiple scales (loosely or tightly coupled).

A multi-scale scenario exercise occurs where scenario storylines are developed at several scales (e.g. both national and sub-national) and are linked to one another either loosely or tightly (Biggs et al., 2007, p.17). The motivation for the development of linked multi-scale scenarios includes the potential to facilitate communication and engagement between decision makers operating at different scales. Such processes tend to be nationally or regionally coordinated and require significant resources.

The desired degree of cross-scale linkage also depends on the aim of the scenario exercise. Loosely linked multi-scale scenarios are generally more appropriate when the primary aim is to engage stakeholders, whereas tightly coupled cross-scale scenarios (which are more resource- and time-intensive) are more appropriate when the aim relates to understanding interactions between scales and assessing trade-offs between scales.

Complexity of the challenges which the scenario process addresses

While scenario planning processes are almost always used to assist with challenges involving a significant degree of complexity, the extent of that complexity differs dramatically depending on the nature of the challenge being addressed. The degree of complexity that needs to be handled where the objective is to develop a set of multi-scale, cross-sectoral scenarios of climate change impacts and adaptation options for a country or state, for example, is much higher compared to more contained, narrowly defined adaptation problems, such as developing a set of possible response scenarios to address sea-level rise in a bounded locality.

Stakeholder participation in scenario development

Scenario planning processes for climate adaptation can range from being highly 'participatory' in the sense that a wide range of stakeholders actively participate in the development of scenarios to being 'expert-driven', whereby stakeholders are merely passive subjects of analysis. The latter tends to coincide with processes that privilege more quantitative sources of information. Applications of scenario planning to climate adaptation can vary dramatically in the extent to which stakeholder input is sought and integrated at different stages of a scenario-building process and is influenced heavily by the purpose and context, especially the amount of time and resources available.

Participatory scenario planning appears to be growing more prominent as a tool for climate adaptation planning in developing countries (see Appendix A for examples). For some case studies using participatory methods there is a fear that a focus that is too local can downplay critical systemic or higher level trends that locals may not fully understand or give high credence to broader, macro-level and systemic trends (Enfors et al., 2008). Others emphasise the need to counteract the privileging and dominance of 'expert' knowledge over other forms (Gidley et al., 2009). Gidley et al. (2009) argue for participatory approaches to understanding climate change

futures as an important broadening of the dominant methods reliant on empiricist predictive trends and expert-led scenario development. They describe an example of a community-based scenario-building exercise in the Hamilton region of Victoria, Australia, which utilises what they describe as a prospective-participative futures approach. This approach has the potential to 'both increase the empowerment of threatened communities and to enable the kind of social learning that would assist with active, co-evolutionary adaptation (rather than passive adaptation to the 'future-as-given') (Gidley et al., 2009, p.432).

Larsen and Gunnarsson-Ostling (2009) point to tensions between goal-oriented values such as reduced climate impact and process-oriented values associated with the scenario construction, such as legitimacy, learning and participation in the process. Gidley et al. (2009) suggest that it may be possible to mitigate this tension by successfully integrating scientific data into participatory community scenario-building processes.

There is a strong theme within the literature on participatory scenario development that centres on the role and interaction between different forms of knowledge upon which scenarios are constructed. On the one hand, there is scientific knowledge, created by 'experts'. On the other hand, local knowledge is lauded for its importance in increasing the relevance of scenario outputs at local levels and considered essential given adaptation is necessarily local.

Scenario audience and communication

There is also the question of who, other than the scenario development participants, the scenario outputs are ultimately intended to influence or inform? The type of audience could range from a single decision maker or influential leader to a much broader group of individuals, organisations or even the general public. It is clearly important that scenarios be seen as *legitimate*, defined as 'the extent to which key actors, decision makers and the media accept and support the procedure and its outcomes' (Hendriks et al. (2007) as cited in Larsen and Gunnarsson-Ostling (2009, p.262)), in order for them to be most effective. This can be a serious challenge in the conventional evidence-based policy and management environment, where perceptions of what counts as legitimate evidence for policy and planning decisions may create suspicion about the variety of knowledge forms and assumptions embedded in scenarios. Transparency is a major challenge for scenario planning processes and careful choices about the way in which scenarios are presented or communicated need to be made in light of the target audience.

Recent research into perceptions of the future among citizens in the United Kingdom and Italy, and specifically the impact of climate and socio-economic scenarios on those perceptions, highlighted the fact that scenarios can seem 'unworldly' to those not involved in their creation (Lorenzoni and Hulme, 2009). While also reinforcing the strong potential for scenarios as reflexive tools to provoke profound deliberation among citizens in different cultural settings, the study points to the importance of clearly communicating how scenarios were developed in order to promote stronger engagement with them.

Resources required in undertaking the scenario planning process

Another critical variable determining the type of scenario planning process undertaken is the nature of the resources required to carry it out and the availability of those resources. Some scenario planning processes – particularly those with significant stakeholder engagement or substantial commitment to ongoing monitoring and review – are time-intensive and require financial resources. Another consideration is the external expertise that needs to be drawn upon, which can take the form of skilled facilitators or scenario planning practitioners, or expert consultants with modelling or other research and analytic skills.

Methodological choices

In addition to these variables, and to some extent dependent on them, there is a range of choices that need to be made within any scenario planning process about the methodological steps to be taken leading to different characteristics of the scenario outputs developed. These include: the number of scenarios or scenario storylines created; the starting points and endpoints of the scenario storylines; the driving forces considered and represented; the sources of information drawn upon; the series of steps taken to build the scenarios; and the format in which scenario outputs are ultimately presented.

Scenario exercises vary dramatically in terms of the characteristics of the final storylines or 'products' that are produced. There is no limit to the number of storylines that can be created, although typically the number is between three and five and rarely more than nine (Biggs et al., 2007). Depending on the process, the starting point for creating storylines could be the present, in order to build on knowledge of the existing situation, or the future, in preparation for a backward inference or 'back-casting' process (to determine what steps may be required in the present to move toward that storyline of the future). The storyline could ultimately characterise a 'snapshot' at a point in time in the future, e.g. 'A day in the life of a resident in our town in 2030', or it could describe a series of unfolding events linking the present to the future.

There is almost infinite variation in the combinations of different driving forces and possibilities for the future that can be included in the development of the storylines. One critical factor is the extent to which the driving forces considered in the scenario-development process are within the sphere of influence of the stakeholders in question. For example, in the case of a coastal local government, driving forces behind rising sea levels could be considered exogenous or external to their realm of control, whereas local planning schemes and decisions are controllable to some extent and therefore endogenous or internal driving forces.

Any scenario development process is able to combine different sources of information to create the scenarios, whether quantitative, qualitative, 'expert' or scientific analysis, 'local' experiential knowledge, judgement and intuition. Processes vary significantly in terms of the range and types of information drawn upon as inputs. Sources of information drawn upon for a given scenario planning exercise also vary significantly along a spectrum from formal, rational, scientifically rigorous information to much more subjective forms of 'local knowledge' in which judgement and intuition play a role.

Decisions about methodology and sources of information are addressed in greater detail in Chapter 7 and the *Scenarios for Climate Adaptation Guidebook for Practitioners*.

Key messages: Key variables in applying scenario planning to climate change adaptation

- Applications of scenario planning to climate adaptation vary significantly in a number of different ways. In addition to overarching variables such as the context in which the organisation(s) is operating and the adaptation goals in question, some other parameters that help

to shape any given scenario planning process include:

- the **overall aim or purpose** of the scenario planning process (e.g. to explore implications, to support a decision, to develop goals);
- the **scale of focus** for the scenario planning process (e.g. global, national, regional, local);
- the **complexity** of the challenges which the scenario process is addressing (e.g. developing a comprehensive regional adaptation plan, providing specific advice about a short-term, discrete adaptation measure);
- the extent and nature of **stakeholder participation in scenario development** (e.g. highly participatory, expert-driven);
- the intended **audience for scenario outputs** (e.g. general public, a specific decision-maker) **and method of communication** (e.g. publishing and disseminating films or fictional narratives, presenting graphs);
- the **resources** available to undertake the scenario planning process (e.g. time, funding, skilled personnel).

- These variables, or contextual conditions, which may or may not be within the control of those responsible for undertaking the scenario planning work, inform choices about broad approach and more practical choices about the methodological design.

4.5. Scenarios for climate adaptation: Three broad approaches

While there are many ways in which a typology of climate adaptation scenario planning approaches could be expressed, we have attempted to keep this framework relatively simple by distinguishing between three broad approaches.

These represent three generic approaches which climate adaptation practitioners and planners working at local and regional levels may take when considering applying scenario planning to climate adaptation.

A. **Off-the-Shelf**: Applying pre-existing, down-scaled scenarios to specific locations, population groups and policy challenges

B. **Tailored Exploration**: Building and using context-specific scenarios to explore possible climate futures, impacts and adaptation policy options

C. **Tailored Visioning**: Building and using context-specific scenarios to envisage desirable futures and pathways

Approach A involves the adaptation practitioner or planner simply accessing scenarios (e.g. global climate change scenarios, global socio-economic scenarios) that have been developed by others, often using sophisticated quantitative methodologies that require specific scientific and/or

modelling expertise. These scenarios form one input into the particular adaptation planning process being employed. Approaches B and C both encompass much wider variation in application, as they represent approaches through which context-specific scenarios (e.g. local climate impact scenarios, adaptation response scenarios, etc) are developed and used as part of the adaptation planning process. Each of these approaches is explained in greater detail and represented diagrammatically below.

It is important to note that, in reality, applications of scenario planning can involve the combination of more than one of these simplified approaches. The distinction is, however, helpful in understanding the different steps taken and the strengths and weaknesses of each approach, which are introduced below but explored in greater detail in Part III.

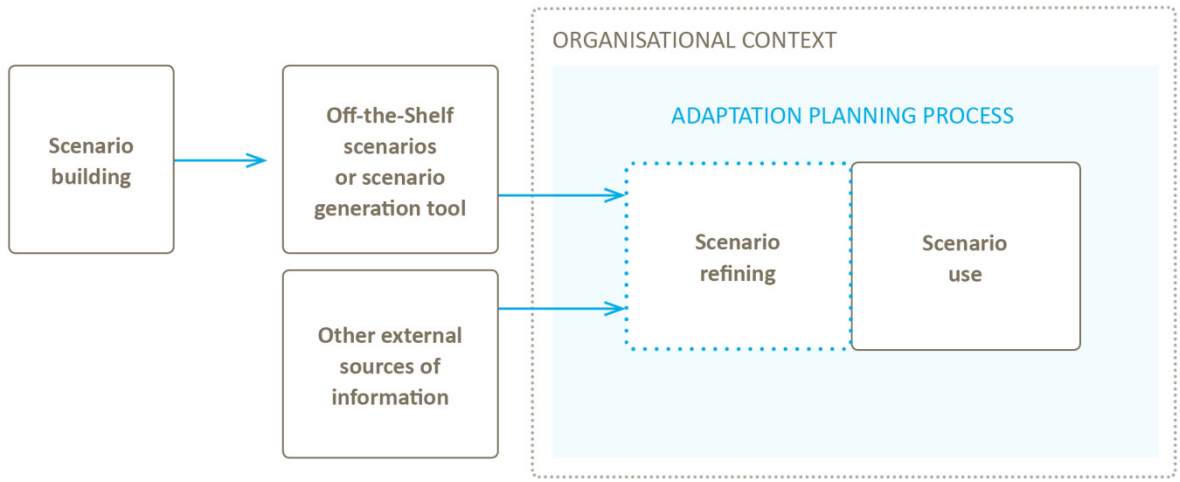
Approach A: Off-the-Shelf: Applying pre-existing, down-scaled scenarios to specific locations, population groups and policy challenges.

Approach A involves the use of pre-existing or Off-the-Shelf scenarios to inform climate adaptation policy and planning in specific localities and/or in relation to specific population groups. As shown in Figure 4C below, scenarios are built externally and made available to the organisation as finished products (e.g. graphs, datasets, storylines) or scenario-generation tools (e.g. web-based interfaces, ready-to-use data, detailed guidelines). Those undertaking the adaptation planning process would then go through the following broad steps:

- Step 1: Access the externally-built scenarios and, if necessary, refine them so that they are in a format of greatest relevance and best suited to the adaptation process being undertaken. This could mean, for example, identifying scenarios that relate to the scale of focus (e.g. region of Australia) or adaptation issue of interest (e.g. water management).

- Step 2: Use the scenarios as either the main input or one of many inputs into the adaptation process being undertaken. For example, analyse the range of possibilities presented, use the scenario outputs to trigger discussion with stakeholders or colleagues about the adaptation implications of the different scenarios.

Figure 4-C: Approach A: 'Off-the-Shelf': Using pre-determined scenarios as inputs into adaptation planning



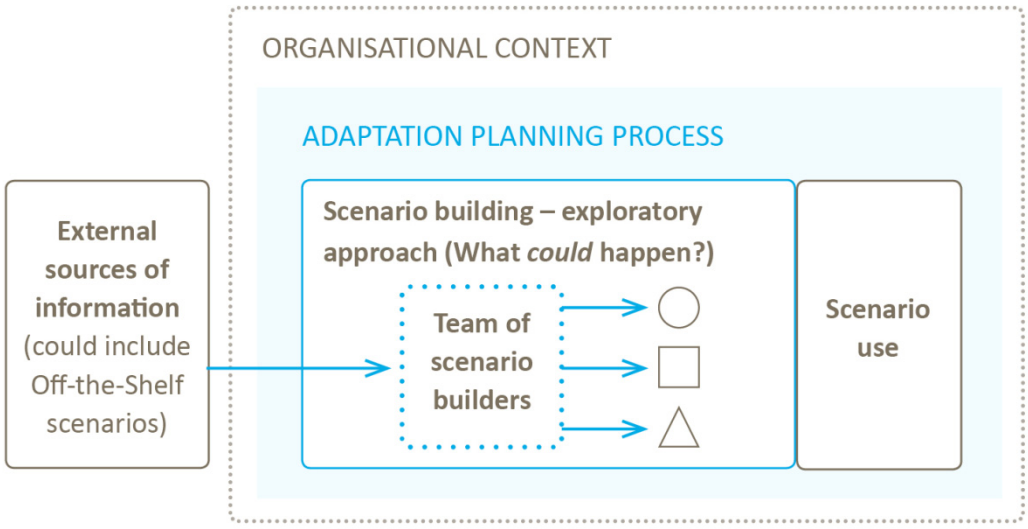
Box 4B: Examples of global, national or regional Off-the-Shelf scenarios and scenario generation tools

Organisation	Name of tool	Scenario outputs	Link
CSIRO (Australia)	OzClim	Australian climate change scenarios	http://www.csiro.au/ozclim/home.do
UK Climate Impacts Programme (UKCIP) (United Kingdom)	UK Socio economic scenarios	A set of four national level socio-economic scenarios developed for use in UK-wide climate impacts and adaptation assessments.	http://www.ukcip.org.uk/ses/
UKCIP (United Kingdom)	UKCP09	UK Climate change scenarios	http://www.ukcip.org.uk/ukcp09/
Tellus Institute (International)	Great Transition	Global socio economic scenarios	http://www.tellus.org/programs/integratedscenarios.html
IPCC (International)	SRES	Global emissions scenarios	http://www.ipcc.ch/pdf/special-reports/spm/sres-en.pdf

Approach B: Tailored Exploration: Building and using context-specific scenarios to explore possible climate futures, impacts and adaptation policy options.

Approach B involves working with relevant experts and stakeholders to develop climate adaptation scenarios tailored to specific geographical locations and/or population groups. The key steps in this process typically involve mapping and prioritising of key trends and drivers, leading to agreement on small number of plausible climate adaptation scenarios. In most instances, identification of climate change drivers (often informed by the use of down-scaled global climate trend scenarios) is complemented by consideration of other relevant social, economic, environmental and cultural trends and drivers. The suite of climate adaptation scenarios generated are then frequently used to explore and test potential policy and practice responses leading to the identification of a robust – rather than optimal – set of climate adaptation decisions and strategies.

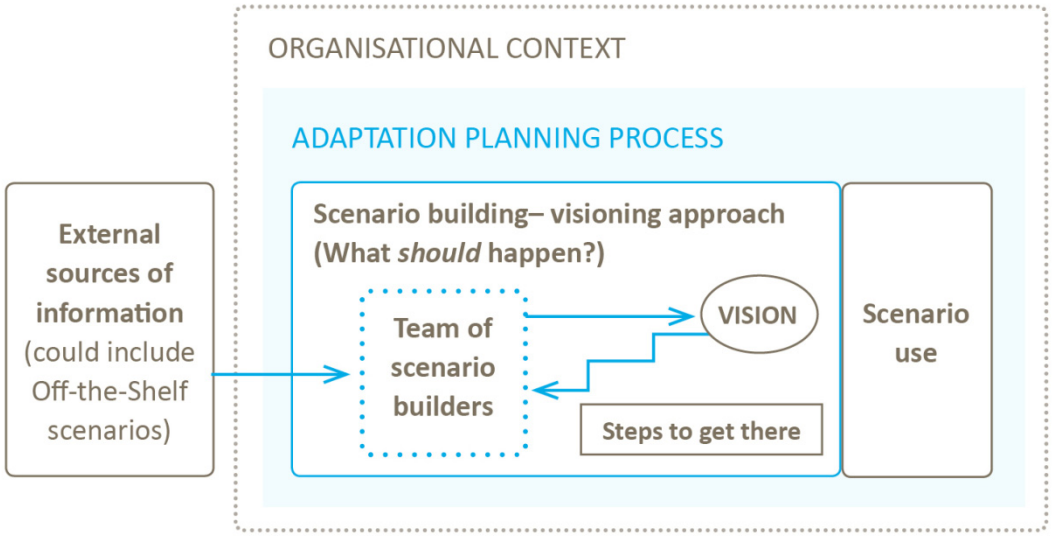
Figure 4-D: Approach B: Tailored Exploration: Building and using context-specific scenarios to explore possible climate futures, impacts and adaptation policy options



Approach C: Tailored Visioning: Building and using context-specific scenarios to envisage desirable futures and pathways

This approach is similar to Approach B, in that relevant experts and stakeholders are brought together to develop and prioritise scenarios relevant to particular localities and/or population groups. However, in this approach there is a more explicit emphasis on using the scenario planning process to identify and agree on the most desirable scenarios and future outcomes. Here stakeholders seek to define a common future they wish to see and then define strategies, pathways and decisions to achieve this. The envisaged future may present an ideal state of adaptability or resilience or a post-climate change condition. Often there is a strong blurring between achieving objectives relating to climate change adaptation and sustainability.

Figure 4-E: Approach C: Tailored Visioning: Building and using context-specific scenarios to envisage desirable futures and pathways



As noted above, it is important to emphasise that these three broad approaches are intended to represent 'ideal types' which draw attention to major differences in common practical applications of scenario planning processes, rather than allowing for absolute categorisation of these applications. Each approach comprises significant variation in relation to the variables previously mentioned (e.g. aims, scale, extent of stakeholder participation etc) and real-life applications often involve a combination of more than one approach (e.g. use of Off-the-Shelf scenarios in a process that also involves the creation of tailored exploratory scenarios). We introduce some of the potential strengths and limitations of the different approaches in Table 4B below.

After exploration of findings about the ways in which scenario planning is being applied to climate adaptation in Victoria (Chapters 5 and 6) we analyse in greater detail the strengths and weaknesses of applying different approaches in different circumstances (Part III).

Table 4-B: Key differences between Approaches A , B and C and potential strengths and limitations of each

	Approach A *Off-the-Shelf*	*Approach B* *Tailored Exploration*	*Approach C* *Tailored Visioning*
Description of approach	Scenarios are not built, just used as inputs into local adaptation processes. Scenarios are typically built by 'experts' at large scales (e.g. global, national) and go through a process of being down-scaled in order to be accessed by local level users. Broad objective is to draw on existing, credible information about plausible futures to inform appropriate strategies and decisions.	Scenarios are both built and used for local adaptation. Scenario-building process can be more or less participatory or expert-driven. Broad objective is to explore the relationships between important drivers of change and articulate a range of plausible futures to inform appropriate strategies and decisions.	Scenarios are both built and used for local adaptation. Scenario-building process more likely to be participatory. Broad objective is to articulate a desirable vision for the future, typically contrasted with other plausible trajectories, to motivate and inform strategies and decisions.
Potential strengths	Pre-existing scenarios are often convenient to access and require few resources by the user. Scenarios created by 'experts' (e.g. national scientific bodies) and built on sophisticated methodologies are considered highly credible to a wide range of audiences.	Recognises and promotes the value of understanding systemic drivers of change and dynamic relationships between them as a foundation for better planning under uncertainty. Scenarios can be built at many different scales and tailor made to suit the problem of interest. Value in learning through the scenario-building process, exploring assumptions and diverse perspectives (including different sources of information). Capacity to consider broad range of futures, including surprises and shocks.	Particularly well-suited to designing proactive strategies and/or discussing transformative adaptation. Value in learning through the scenario/future vision building process, exploring assumptions and diverse perspectives (including different sources of information). Creating desirable visions can promote common goals and shared objectives. Visions for the future are typically solutions-oriented and can paint a powerful and inspiring picture for key audiences.

		Tailor-made scenarios can be made more explicitly relevant to key audiences.	
Potential limitations/ challenges	Scenarios created at large-scale do not always provide relevant information at lower scales (e.g. local towns, regions) and require down-scaling or refining to match the particular area or population group of interest, which can present methodological challenges. Layers of assumptions have been built into pre-existing scenarios, but they are not always fully understood or appreciated by users. Not always seen as legitimate to users and their audiences. Requires understanding and/or trust in methods employed to build the scenarios. Risk that scenarios will be used in unintended ways or without due consideration of caveats (e.g. where one scenario is chosen out of a set intended to be considered as a full set). NB. Important distinction between plausible futures (scenarios) and probable futures. Can neglect 'extreme' cases.	For a given scale, it can be difficult to determine boundaries and ways of factoring in drivers at scales beyond the sphere of influence of those building the scenarios. Possibility for confusion between descriptive and normative approaches (i.e. describing possible as compared to desirable futures). Challenges associated with establishing the credibility of scenarios from the point of view of those not involved in building them, especially getting buy-in from decision makers.	Raises questions about whose idea of the future is being articulated. Can build expectations and fail to deliver. If done poorly, may leave people overwhelmed by the enormity of the challenge and lack of agency.

Key messages: Which adaptation goals and challenges can scenarios help address?

- In order to simplify the discussion of different applications of scenario planning to climate adaptation, three broad 'ideal type' approaches are presented.
- Approach A involves the use of pre-existing or Off-the-Shelf scenarios or scenario generation tools, which are accessed and applied as inputs to a given adaptation process.
- Approach B, referred to as 'Tailored Exploration', involves building and using context-specific scenarios to help explore possible climate futures, impacts and adaptation responses.
- Approach C, referred to as Tailored Visioning, involves building and using context-specific scenarios to envisage desirable futures and pathways.
- Approach A differs from B and C in that scenarios are not built by those who are using them. Typically pre-existing scenarios are accessed in a down-scaled form after being produced at global or national scales through a sophisticated, 'expert-driven' process.
- Approaches B and C involve both building and using processes, each with their own set of steps and variables. They differ from each other in the orientation of the scenarios developed, whether they articulate a range of scenarios about what *could* happen (exploration) or one or more scenarios which represent what participants think *should* happen (visioning).

5. Scenario planning for climate adaptation: Learning from recent Victorian experience

In this section

→ About this chapter

→ Methodology, scope and limitations

→ Why are Victorian climate adaptation policy makers and practitioners turning to scenario planning?

→ Who has been using scenario planning for climate adaptation in Victoria and in what ways?

→ Lessons from practice: Strengths, weaknesses and critical challenges.

5.1. About this chapter

While there is a growing literature capturing lessons emerging from climate change adaptation practice within organisations and communities, there has been little empirical analysis of the utilisation of scenario planning techniques to assist with that practice. One of the central aims of this project was to gather data from adaptation policy makers and practitioners about their understanding of scenario planning and their experiences applying scenario techniques to adaptation challenges.

The project has taken place in Victoria, Australia, and therefore has drawn largely on experiences from within that state. However, some data has also been contributed by adaptation and scenario practitioners in other states of Australia and other countries. It is likely that the findings will have resonance beyond Victoria, especially across Australia, but also to areas with similar Western democratic institutions facing comparable climate adaptation challenges.

This research sought to shed light on the following key questions:

- **What motivations do those working in climate change adaptation have for using scenario planning techniques and what perceptions are held by users or potential users about what scenario planning has to offer?**
- **Which organisations or groups within Victoria have been using or developing scenarios to help meet climate change adaptation goals and in what ways?**
- **What lessons can be shared with those who have used scenarios for climate adaptation about the strengths and weaknesses of different scenario-based approaches?**

This chapter first explains the data collection methods employed and then draws together themed findings in relation to these questions.

5.2. Methodology, scope and limitations

Alongside significant desktop research accessing peer-reviewed literature relevant to scenario planning and climate change adaptation, this project employed a range of data collection methods which are outlined below.

Online survey

An online survey was conducted through September and October 2010 using 'Survey Monkey' software. The target audience was individuals who self-identified as working on climate change adaptation challenges, with or without experience with scenario planning. The survey was distributed via a range of climate change adaptation email lists, online networks and e-bulletins with Victorian, national and some international circulation.[8] Emphasis was given to reaching as many people as possible working in the adaptation policy–research–practice nexus in Victoria, whether in academic, state or local government, private, NGO or community sectors.

[8] Networks through which the survey was distributed included: the VCCCAR contact list; the National Climate Change Adaptation Research Facility (NCCARF) adaptation contact list; RMIT University's Urban Climate Change Adaptation Network "AdaptNet"; the Victorian Greenhouse Alliance coordinators list; the Victorian Government Department of Sustainability and Environment state-wide services sustainability staff; the Victorian Government's 'Adaptation Allsorts' bulletin; and the Municipal Association of Victoria's Environment e-bulletin.

Survey questions were largely qualitative and designed to capture respondents' perceptions about what scenarios are and how they can be used for climate change adaptation, as well as their experiences using scenario-based strategies in practice, including reflections on specific projects. The survey included a mixture of open-ended, multiple-choice and rating-scale-style questions.

The survey elicited 100 valid responses from individuals representing a wide range of policy portfolios and areas of expertise. A majority of survey respondents (60 per cent) had both climate change adaptation and scenario experience. Approximately one third worked on climate adaptation issues but did not have direct experience using scenarios and a small number had experience with scenarios but did not work in the climate adaptation field.

A majority of respondents were based in Victoria (62 per cent), a further quarter came from other parts of Australia and a small number worked in other countries. Most of the survey respondents worked in either state and regional government authorities (39 per cent), or research and education organisations (29 per cent). Other respondents were spread across local government, federal government, private and community sectors.

Case study compilation

A wide range of examples of scenario-based climate change adaptation case studies were identified through the online survey and desktop research accessing both peer-reviewed and 'grey' literature, typically in the form of project reports. Where possible, contact was also made with individuals involved in the identified projects to add further information or make clarifications.

The aim was to collect as many different examples as possible of the use of scenario planning techniques in relation to climate adaptation in Victoria in order to better understand the scope and pattern of usage and to compare key characteristics of the examples. A range of case study examples from other parts of Australia and internationally were also identified, with particular attention paid to projects that highlight relevant lessons or different applications which may not have yet been tried in Victoria.

Altogether survey respondents described 53 different projects, of which 24 took place in Victoria and had enough meaningful data to be included in this report. A further 9 Victorian examples were identified via desktop research. The 33 Victorian examples identified were assessed and categorised based on broad types of scenario application, project scope, objectives, outcomes and lead organisations involved. Section 5.4 below provides a table and discussion of these Victorian examples. An extended list of Australian and international examples is presented in Appendix A.

While the Victorian case study list brings together a wide range of examples of different applications of scenario planning for climate adaptation occurring in recent years it should not be considered a comprehensive list. An implicit challenge, given that this research has aimed to capture the range of perceptions about what is meant by scenario planning for climate adaptation, has been that people using scenarios may not think that the way in which they are doing so is relevant. The limitations of the case study compilation are also particularly relevant to what we refer to here as Off-the-Shelf approaches – using pre-existing scenarios or scenario generation tools – as it was considered beyond the scope of this project to monitor the extent to which such tools are being used. Further limitations arise where organisations are undertaking internal scenario planning, which is either not formally evaluated or not intended for public release.

Key informant interviews

Data was also collected via a series of semi-structured interviews, conducted in two rounds between May and December 2010. The first round targeted senior policy makers and directors at Victorian

Government departments holding climate change adaptation responsibilities. Seven meetings were held in total, with senior representatives at the Department of Premier and Cabinet (Climate Change Unit), Department of Sustainability and Environment, Department of Primary Industries, Department of Planning and Community Development, Department of Health, Department of Human Services and Department of Industry, Innovation and Regional Development. The aim was to broadly understand the challenges and priorities for climate change adaptation as seen by different Victorian Government departments and to discuss ways in which scenarios already have, or potentially could, contribute to adaptation projects or initiatives being undertaken.

In the second round ten scenario planning researchers and practitioners and four climate change adaptation specialists were interviewed. These interviews were intended to test early findings from the literature review and identify areas for further research. Key insights from these key informant interviews are integrated into the discussion below.

Stakeholder workshops

As part of the research process, two half-day workshops were also conducted on 17 and 18 November 2010. Both workshops aimed to present some of the emerging messages from the project to identified key stakeholders of the project and seek their input and feedback in order to maximise the relevance of the final outputs. The two workshops were attended by approximately 60 people in total. The first workshop involved middle- to senior-ranking public servants within the Victorian Government, researchers and scenario planning practitioners. The second workshop involved researchers and professionals from local government, regional alliances and NGOs. All participants had experience working with climate change issues and many had had previous experience with forms of scenario planning.

The workshops generated high-quality discussion and ideas about key barriers to the practical application of scenarios in the work contexts of those involved – including state government, local government and NGO settings. Key messages arising are reflected in the discussion below.

Critical perspectives papers and seminar

To augment the collection of data from key informants and stakeholders, several academic papers were commissioned and produced by members of the project's Technical Reference Group. Three working papers[9] were developed to explore several different critical perspectives on the use of scenario planning for climate change adaptation:

- Rickards, L. (2010) 'Governing the future under climate change: contested visions of climate change adaptation'.
- Jones, R. (2010) 'The use of scenarios in adaptation planning: managing risks in simple to complex settings'.
- Ison, R., Grant, A. and Bawden, R. (2010) 'Scenario praxis for systemic and adaptive governance: a critical review'.

These three papers, and an additional one entitled 'The evolving use of scenarios at the CSIRO', were presented at a public seminar on 11 November 2010 which was attended by approximately 60 people working primarily in public and academic sectors. The content of the papers and discussion generated at the public seminar also helped to inform and enrich this research.

[9] Critical perspectives working papers are available at: http://www.vcccar.org.au/content/pages/resources-scenarios-climate-adaptation-project

Key messages: Methodology, scope and limitations

- Data for this project was collected in a wide range of ways including: an extensive review of key literature; an online survey of 100 climate change adaptation and scenarios practitioners; a case study compilation; a series of 21 key informant interviews; two stakeholder workshops; and a 'critical perspectives' seminar.

5.3. Why are Victorian climate adaptation policy makers and practitioners turning to scenario planning?

The data collected presents a number of insights into the perceptions and expectations of Victorian climate adaptation policy makers and practitioners about what scenario planning techniques can offer.

First, a number of adaptation challenges introduced in Chapter 2 of this report were confirmed. Among survey respondents working on climate adaptation issues, the most commonly cited challenges faced in their work included:

- identifying and prioritising adaptation responses;
- deciding when specific adaptation actions should be taken;
- the fact that adaptation is a young field;
- fear and resistance to change;
- institutional inertia; and
- a lack of trust between people and organisations.

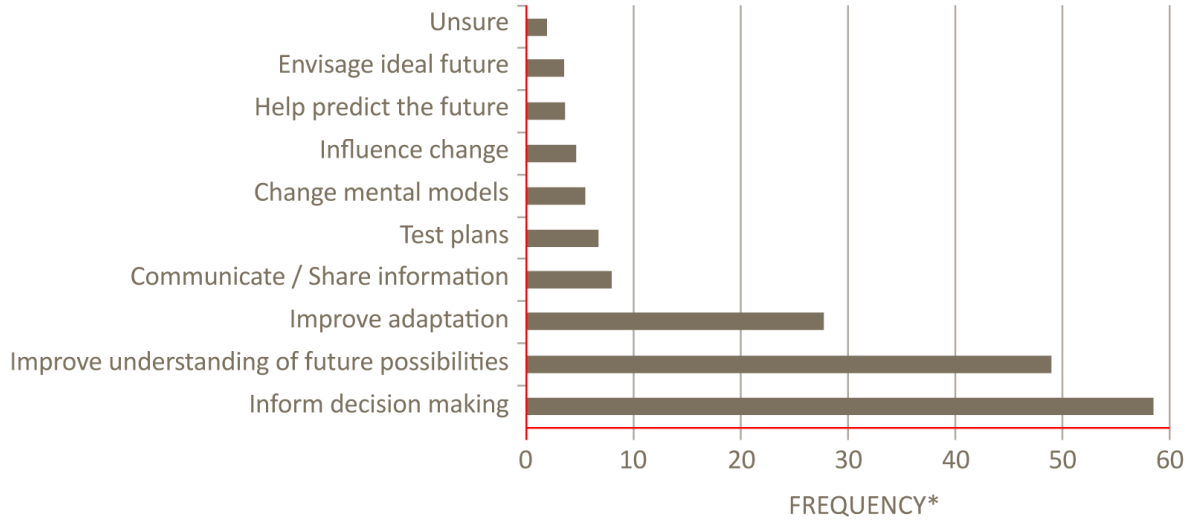
In thinking about the future more broadly, survey respondents recognised that key challenges included a lack of detailed, context-specific information about the future for many locations and the subsequent need to better understand how to process uncertainty in order to make decisions. Several also noted the difficulties associated with breaking assumptions that the future will reflect the past.

The online survey asked that respondents consider what they understood to be the primary focus and purpose of 'scenario-based strategies', defined broadly to include *'any projects or processes that involve using scenarios created by others or developing new scenarios as a means to inform decision making, planning or engagement activities'*.

The majority of survey respondents who had some experience using scenarios (59 per cent, n = 85) recognised scenario-based strategies to be inclusive of both '*probable climate change trends and impacts',* as well as '*possible adaptation approaches and outcomes'*. Several respondents suggested that while probable trends and impacts are the current focus of scenario-based strategies related to climate adaptation, a focus on possible adaptation approaches and outcomes either should be or will become more important over time. A large majority of respondents (70 per cent, n = 85) also noted the dual utility of scenario-based strategies for both '*raising awareness of future challenges and options'* and '*engaging stakeholders in planning for the future'*.

When asked to describe the purpose of scenario-based strategies, the most common themes nominated by survey respondents were '*informed decision making*', '*improved understanding of future possibilities*' and '*improved adaptation decisions*' (see Figure 5A).

Figure 5-A: Perceived purpose of scenario-based strategies – a synthesis of descriptive responses



**Frequency denotes the number of respondents registering each theme as a key purpose.*
Source: Scenarios for Climate Adaptation Online Survey (*n = 78)*

Approximately half of the survey respondents working on climate change adaptation without scenarios experience had previously considered using scenarios in their work. Common explanations for why they had chosen *not* to use scenarios were that they did not have the expertise, or that they had not yet had the chance. Expectations among this group of respondents about the ways in which using scenarios could help them and their organisations address climate change issues, included:

- making the future more tangible;
- improving communication about climate change;
- improving their ability to understand and manage the complexity of climate change issues;
- improving climate change related decision making.

Interview participants within Victorian Government departments also saw significant value in the use of scenarios as a way to progress adaptation in highly varied situations. Examples of where scenarios were noted to be most useful or appropriate as a tool for those working in government included:

- highlighting trajectories of 'business-as-usual ' and thus identifying which drivers may need to change, how, by whom and by how much;
- helping achieve better integration of different government policies and responses through promoting better internal coordination and understanding;
- as a forum for interacting with key stakeholder groups and building consensus positions;
- providing timeframes for change and identifying potential policy decision points;
- generating a range of options for adaptation action at regional and place-based scales;
- clarifying regional vulnerabilities in relation to natural resources;
- being able to illuminate changing relativities of the value of ecosystem services under a carbon constrained and water-stressed future *(Interviewee, Victorian Government)*

One senior Victorian Government policy maker commented that:

If well targeted, scenarios provide a good 'interactive' educational tool for engagement ... [however, they] must be regionally relevant. [Scenarios are] potentially very powerful particularly if [they] explicitly clarify the societal values in formulation (Interviewee, Victorian Government).

Key messages: Why are Victorian climate adaptation policy makers and practitioners turning to scenario planning?

- Responses to the online survey by climate adaptation practitioners confirmed the nature of challenges related to climate adaptation and thinking about the future more broadly.
- Survey respondents acknowledged the broad scope of scenario-based strategies for climate adaptation, in particular, that they are not just useful for understanding climate change trends and impacts, but are also being used to explore adaptation responses and engage stakeholders in planning processes.
- The most common responses to the perceived purpose of scenario-based strategies related to informing and improving decision making, understanding future possibilities and improving adaptation in general.
- There is a wide range of ways in which scenarios are seen to provide value to survey respondents and Victorian Government staff undertaking climate adaptation, and high expectations of scenarios among those with and without experience in using them in an adaptation context.

5.4. Who has been using scenarios for climate adaptation in Victoria and in what ways?

Data collected via the interviews, online survey and case study compilation all support the notion that scenario planning is being used widely in Victoria among policy makers and planners working on climate change adaptation challenges. This includes those working in different Victorian Government departments and other statutory authorities, local government, research bodies and NGOs, particularly regional climate change alliances. There was, however, significant variation in the methods or ways in which scenarios are being used.

Thirty-three Victorian case study examples of scenario planning for climate adaptation were identified through the survey and case study compilation processes. While this is not a comprehensive list of all applications of scenario planning techniques to climate adaptation in

Victoria in recent years, it does draw attention to the wide range of different organisational settings, goals and approaches being taken and provides a basis for exploration of some key lessons to emerge from recent practice.

Table 5A below provides a full list of the identified Victorian applications of scenario planning to climate adaptation. It shows how they differ by sector, scale, broad objectives and the types of stakeholders involved. The table also indicates which of the three approaches outlined in Chapter 4 – A. Off-the-Shelf; B. Tailored Exploration; and C. Tailored Visioning – best characterise the process undertaken. For further details of each identified example see Appendix A.

Of the 33 example projects, the majority took place within or at the behest of a Victorian Government department or agency. The Department of Sustainability and Environment, and the Department of Primary Industries were each involved in multiple different examples, with other state authorities, including Melbourne Water, the Earth Resources Development Council, Planning Panels Victoria, Department of Health, Gippsland Coastal Board and EPA Victoria, also represented. Six examples described were led by research institutes, four were driven by regional climate change or sustainability alliances, three took place in local government settings and one example was led by the Australian Council of Social Service.

The majority of examples took a particular region within the state of Victoria as their focal scale. Seven examples considered scenarios covering the whole of Victoria; three focused on one or more local government areas, and five took place with a particular town, suburb or port area in mind.

Table 5-A: Identified Victorian applications of scenario planning to climate change adaptation

No.	Title and lead organisation(s)	Sector driving project	Geographic scale	Categorisation of primary aims	Types of participants	Categorisation of broad approach: A: Off-the-Shelf B: Tailored Exploration C: Tailored Visioning
VIC1.	**Future Coasts** *Department of Sustainability and Environment*	State Government	**Region** (Victorian Coasts)	Inform development of guidelines, tools and policy recommendations; build stakeholder capacity	CSIRO researchers; DSE staff	A
VIC2.	**EPA internal climate change risk assessment** *Victorian Environment Protection Authority (Victoria)*	State Government	**State** (Victoria)	Deepen understanding; inform strategic planning	EPA staff	A & B
VIC3.	**Coastal Climate Change Advisory Committee** *Planning Panels Victoria, Department of Planning and Community Development*	State Government	**Region** (Victorian Coasts)	Strategic planning; test response options	Members of Advisory Committee; other key stakeholders	A & B
VIC4.	**Development of water supply-demand strategies** *Department of Sustainability and Environment*	State Government	**State** (Victoria)	Long-term strategic planning; integrated state-wide and regional planning	State government agencies; rural & urban water corporations	A & B
VIC5.	**Resilient Agribusiness for the Future of Sunraysia** *Department of Primary Industries*	State Government	**Region** (Sunraysia, Victoria and NSW)	Build stakeholder capacity; inform decision making; strategic planning	Horticultural & agri-business industry groups	B

No.	Title and lead organisation(s)	Sector driving project	Geographic scale	Categorisation of primary aims	Types of participants	Categorisation of broad approach
VIC6.	**Melbourne Water Sewerage Strategy** *Melbourne Water*	State Government	**Region** (Greater Melbourne)	Strategic planning	Melbourne Water staff	B
VIC7.	**Melbourne Water Climate Change Study** *Melbourne Water, CSIRO*	State Government	**Region** (Greater Melbourne)	Strategic planning	CSIRO researchers; Melbourne Water staff	A
VIC8.	**Future Directions for Public Land** *Department of Sustainability and Environment*	State Government	**State** (Victoria)	Stimulate new ideas; build capacity for strategic thinking; inform strategic priorities	DSE staff; Land managers	B
VIC9.	**DSE Climate Change Forum Gippsland** *Department of Sustainability and Environment*	State Government	**Region** (Gippsland)	Deepen understanding; explore possible futures; communicate a case for action	DSE staff; Representatives from other State and local agencies	B & C
VIC10.	**Irrigation Futures** *Department of Primary Industries*	State Government	**Region** (Goulburn-Broken Catchment, Northern Victoria)	Explore possible futures; inform policy; strategic planning; build stakeholder capacity; demonstrate scenario use for replication	Wide range of government, industry, education & community members and groups	B

No.	Title and lead organisation(s)	Sector driving project	Geographic scale	Categorisation of primary aims	Types of participants	Categorisation of broad approach:
VIC11.	**Victorian Climate Change Adaptation Program (VCCAP) South West Region Scenario Project** *Department of Primary Industries*	State Government	**Region** (South West Victoria)	Explore possible futures; inform policy; demonstrate scenario use for replication; build stakeholder capacity; build shared understanding	Primary producers & associated industries; local government; regional bodies; community groups	B
VIC12.	**Boom or Bust: Possible Futures for Victorian Brown Coal in a Carbon Constrained World** *Earth Resources Development Council, Victorian Government*	State Government	**State** (Victoria)	Explore possible futures; discuss possible and desirable adaptation response options; build stakeholder relationships and capacity	State government; scenario planning experts; energy sector professionals; industry peak bodies; environment groups; unions	B
VIC13.	**Scenario planning exercise as part of 'Scoping climate change impacts on population health and vulnerabilities'** *Department of Health*	State Government	**Region** (Bendigo and Mildura)	Deepen understanding; explore possible futures; build stakeholder relationships and capacity	State & local government; police, Red Cross; ambulance; local & regional health services providers	B
VIC14.	**Options for Adapting to Climate Change on the Gippsland Coast – Future Scenario Exercise for 2032 and Beyond** *Gippsland Coastal Board*	State Government	**Region** (Gippsland)	Explore possible futures; discuss possible and desirable adaptation response options; build stakeholder capacity	State & local agencies; regional bodies; researchers; consultants; key community leaders	B & C

No.	Title and lead organisation(s)	Sector driving project	Geographic scale	Categorisation of primary aims	Types of participants	Categorisation of broad approach:
VIC15.	**Scenario Planning in the Grampians region** *Department of Sustainability and Environment (Integrated Regional Sustainability program)*	State Government	**Region** (Grampians)	Raise awareness; develop ongoing networks	Local government; State government agencies	C
VIC16.	**Scenario planning in the Loddon Mallee region** *Department of Sustainability and Environment*	State Government	**Region** (Bendigo and Loddon Mallee)	Build shared understanding; deepen understanding; integrated regional planning	State & local agencies; Country Fire Authority; education & financial institutions; community groups	B
VIC17.	**Energy Futures** *Department of Sustainability and Environment (Mildura)*	State Government	**Region** (Mildura)	Deepen understanding; build shared understanding; strategic planning	Education & financial institutions; all levels of government; community groups; politicians; Regional Development Australia	B
VIC18.	**Lower Murray Landscape Futures** *Land Technologies Alliance*	State Government	**Region** (Lower Murray, Victoria and South Australia)	Deepen understanding; inform strategic planning; build stakeholder relationships and capacity	Victorian & South Australian government agencies; CSIRO; University of Adelaide; regional stakeholders	A & B
VIC19.	**Future Air Scenarios** *EPA Victoria*	State Government	**State** (Victoria)	Inform strategic planning	EPA staff; CSIRO researchers; State Government departments	B

No.	Title and lead organisation(s)	Sector driving project	Geographic scale	Categorisation of primary aims	Types of participants	Categorisation of broad approach:
VIC20.	**Adapting to a low water future** *North Eastern Greenhouse Alliance*	NGOs, alliances or community sector	**Region** (North East catchment, Victoria)	Directly inform adaptation action plan	Local government; water authorities; North East Catchment Management Authority	A
VIC21.	**Adaptation for community service organisations** *Australian Council of Social Service*	NGOs, alliances or community sector	**State** (Victoria)	Demonstrate scenario-based approaches to addressing climate adaptation; build stakeholder capacity	Community service organisations	B & C
VIC22.	**Towards a Post-Carbon Gippsland** *Gippsland Climate Change Network, Department of Sustainability and Environment (Integrated Regional Sustainability program), Global Foresight Network*	NGOs, alliances or community sector	**Region** (Gippsland)	Strategic planning; communicate a case for action	Alliance member organisations (state & local agencies, business, community)	C
VIC23.	**Future Wimmera Mallee: Wimmera Mallee Sustainability Alliance Strategic Foresight Program** *Wimmera Mallee Sustainability Alliance, Department of Sustainability and Environment, Global Foresight Network*	NGOs, alliances or community sector	**Region** (Wimmera and Southern Mallee)	Explore future possibilities; deepen understanding	State & local agencies; Industry; diverse community members & groups	B & C
VIC24.	**Ballarat Regional Sustainability Alliance Strategic Foresight Program** *Ballarat Regional Sustainability Alliance, Department of Sustainability and Environment, Global Foresight Network*	NGOs, alliances or community sector	**Region** (Ballarat and Central Highlands)	Explore future possibilities; deepen understanding	State & local agencies; industry; diverse community members & groups	B & C

No.	Title and lead organisation(s)	Sector driving project	Geographic scale	Categorisation of primary aims	Types of participants	Categorisation of broad approach:
VIC25.	**Visualisation tools for Lakes Entrance, Loch Sport and Anderson Inlet** *Monash University and Gippsland Coastal Board*	Research	**Region** (Gippsland)	Produce tools; community engagement	Researchers; State government representatives	A
VIC26.	**Scenarios for climate change adaptation in the Hamilton region of Victoria** *RMIT Global Cities Research Institute and Hamilton critical reference group*	Research	**Region** (Hamilton)	Explore future possibilities; strategic planning; community engagement	Community members; State & local agencies	B
VIC27.	**Port of Hastings expansion and climate change impacts** *RMIT Global Cities Research Institute and Western Port Greenhouse Alliance*	Research	**Port** (Port of Hastings, Melbourne)	Explore possible futures; explore diverse perceptions of the future; deepen understanding	State government representatives; community members; local NGOs; people working in the Port	B
VIC28.	**VEIL/VicHealth Food Supply Scenarios project** *Victorian Eco-Innovation Lab, University of Melbourne*	Research	**State** (Victoria)	Explore future possibilities; explore systemic interactions; inform strategic planning; develop innovative scenarios methodology	Researchers, State government representatives; consultants	B
VIC29.	**EcoCity (EBD) Visions** *Victorian Eco-Innovation Lab, University of Melbourne*	Research	**Site** ('E-gate', north of Docklands, Melbourne)	Explore and help people visualise possible futures	Design professionals, academics & students; local government	C

No.	Title and lead organisation(s)	Sector driving project	Geographic scale	Categorisation of primary aims	Types of participants	Categorisation of broad approach:
VIC30.	**Broadmeadows 2032** *Victorian Eco-Innovation Lab, University of Melbourne*	Research	**Suburb** (Broadmeadows)	Explore and help people visualise possible futures; innovative strategic planning approaches; community engagement	Design professionals, academics & students; local government, State government agencies; community groups and residents of Broadmeadows	C
VIC31.	**Rural local government in a climate of change** *North Eastern Greenhouse Alliance, Alpine and Towong shire councils*	Local Government	**Multiple council areas** (Alpine and Towong shires)	Deepen understanding; strategic planning; integrated regional planning	Local government	A
VIC32.	**Integrated planning for a sustainable Shepparton community** *RM Consulting Group*	Local Government	**Council area** (City of Greater Shepparton)	Integrated regional planning	Local government; State government agencies	A
VIC33.	**Climate change adaptation strategy and action plan** *City of Melbourne*	Local Government	**Council area** (City of Melbourne)	Directly inform adaptation action plan	City of Melbourne staff	A

The applications of scenario planning projects to climate adaptation listed in Table 5A reveal a variety of different emphases in relation to broad objectives. There is substantial cross-over between categories and typically more than one related objective for each example. In general, the aims of these scenario applications closely reflect and confirm the relevance of the list provided in Chapter 4 of the following different adaptation aims which scenario planning techniques could help address:

- Communicating the case for adaptation.
- Deepening understanding or building shared understanding of the implications of adaptation in a given context.
- Stimulating new ideas and new ways of thinking about adaptation actions.
- Informing strategic planning for adaptation.
- Informing decision making for adaptation.
- Building capacity for ongoing reflexive monitoring of adaptation.

In the majority of applications shown in Table 5A, project aims fell into one of two general categories, and sometimes fell into both:

- Approximately three-quarters of applications aimed to explore the implications of climate change for a location, community or organisation, with an emphasis on objectives relating to community engagement, including improving awareness about climate change and identifying critical risks, stakeholder learning and capacity building.
- Approximately half of the applications aimed to inform decisions, either taking place in a particular regional or organisational strategic planning context, providing input to a government policy process or resulting in an organisational adaptation action plan.

The three broad approaches described in Chapter 4 allow for further categorisation of the applications identified. Classifying by these approaches gives an indication of the type of process carried out, although, as the table suggests, real-world applications of scenario planning to climate adaptation can adopt a combination of more than approach.

A. Off-the-Shelf – scenarios used as inputs into climate change adaptation planning

Seven examples are shown in Table 5A. Typically, climate change scenarios are chosen and down-scaled or refined by experts (consultants or researchers) to provide the most useful information for the scale and issue of interest. These then form an input to adaptation planning processes such as those prescribed by the Commonwealth Government or ICLEI, for example. Comments by survey respondents about why this type of approach was chosen for particular applications focused on the desire to ensure scenarios used were consistent with those being used by state and Commonwealth agencies, or pointed out that the process followed was dictated by funding agreements, such as the Commonwealth Government's Local Adaptation Pathways Program.

A and B Combination of Off-the-Shelf with Tailored Exploration

Four examples are shown in Table 5A. This is a combination of Off-the-Shelf with Tailored Exploration. Climate change scenarios are combined with other trend-based data, e.g. socio-economic projections, water, food, electricity demand/supply projections etc., to produce more context-specific scenarios which can then be analysed or used as an input into adaptation planning processes.

B. Tailored Exploration – building and using context-specific scenarios to explore possible climate futures, impacts and adaptation response options

Thirteen examples are shown in Table 5A. Tailored exploratory scenarios are built through a process of understanding and prioritising a wide range of drivers of change. Different interactions and systemic relationships are better understood by considering how they could play out in different

futures. Reasons given by survey respondents for choosing to build and use exploratory scenarios highlighted a desire to actively engage stakeholders, develop a baseline of shared understanding, broaden their thinking and make sure they were better prepared for the unexpected. One survey respondent, commenting on why the exploratory approach was taken, stated that:

> *Reductionist science and modelling cannot provide the diversity and uncertainty that is part of the real world. The project was directed to exploring a plausible possible future not predicting the future (Survey respondent).*

B and C. Combination of Tailored Exploration with Tailored Visioning
Five examples are shown in Table 5A. This is where Tailored Visioning scenarios are built through an exploratory process which leads to the identification of a range of futures, some of which are considered more desirable than others by participants. Identifying desirable futures may not be the intention of the process, but they may arise as a result of the process of exploring drivers that are leading to unsustainable or untenable future conditions.

C. Tailored Visioning – building and using context-specific scenarios to envisage desirable futures and pathways
Four examples are shown in Table 5A. Tailored Visions are built through a process of setting a goal for the future (e.g. 'a sustainable, carbon neutral community by 2050'. This is then used as the starting point for back-casting and exploring ways of achieving this vision.

The following case study boxes provide more detail about the different aims, approaches and steps taken for five different example applications of scenario planning to climate adaptation.

Box 5A: Case study: *Scenarios for strategic visioning: Towards a post-carbon Gippsland*

With funding from DSE's Integrated Regional Sustainability program, the Gippsland Climate Change Network (GCCN) ran a strategic visioning process in April/May 2010. Two scenario-building workshops contributed to the visioning and strategic planning process, which was facilitated by the Global Foresight Network. The workshops consisted of 'future possibility' conversations, enabled by a number of exercises in which participants:

- considered the future drivers for Gippsland in each of three different specified 'transition' pathways;
- developed three scenarios to understand how these drivers may play out;
- assessed each scenario using a 'five capitals' framework (natural, manufactured, human, social and financial) to identify issues;
- explored one scenario – the post-carbon society – using an integral systems approach to better understand the changes to thinking and to current systems that may be required to realise that scenario;
- identified some initial concepts for catalytic projects that the GCCN may choose to pursue.

The workshops involved approximately 20 members of the GCCN, which includes the six local councils of Gippsland, several Victorian Government departments and agencies, and a range of community groups, local businesses, education providers, unions and NGOs of the Gippsland region. A report was produced which presented the three scenarios – 'Locked In', 'House Divided' and 'Riding the Next Curve' – as well as narratives or fictional accounts of lived experiences associated with each scenario.

The methodology reflected a desire to strengthen conversation and advocacy for a different future for the region, with a specific focus on the possibilities and practicalities of a post-carbon Gippsland. A report was

produced after the workshops which suggested that a sense of the need for a new narrative for Gippsland emerged from the process. Aside from helping to shape the strategic direction of the GCCN the three scenario narratives created are also intended to be utilised as a community engagement tool by GCCN members.

Approach to building and using scenarios:

***Scenario Building*:** This project fits most closely with the 'Tailored Visioning' approach. Although it could be considered to have 'exploratory' elements, the process of exploring different possible futures for the region was a precursor to the identification of a 'desired' scenario.

***Scenario Using*:** The chosen scenario was then analysed in greater depth in order to identify important dynamics and steps that GCCN could take to help move the region toward the desirable vision. In this way the scenarios themselves and the scenario building process informed strategic planning of the GCCN. Most likely there were additional social and organisational learning outcomes for GCCN members. There is also the potential to use the scenario descriptions and narratives to communicate to broader audiences.

Find out more:

- McAllum, M. "Towards a Post-Carbon Gippsland: A Strategic Foresight Report for the Gippsland Climate Change Network" March 2010
- Gippsland Climate Change Network website: www.gccn.org.au

Box 5B: Case study: *Scenarios for regional planning and consensus building: Irrigation Futures of the Goulburn Broken Catchment*

The Goulburn Broken Irrigation Futures project used a multi-stage, participatory scenario planning methodology to explore and plan for the future of irrigation in the Goulburn Broken Catchment to 2035. The region, known as the 'food bowl' of Australia, is highly significant in terms of agricultural production, much of which is reliant on irrigation.

The project, which ran from July 2003 to June 2007, was a regional initiative funded by the Goulburn Broken Catchment Management Authority, Goulburn-Murray Water, Victorian Department of Primary Industries, Victorian Department of Sustainability and Environment, the National Action Plan for Salinity and Water Quality, the Cooperative Research Centre for Irrigation Futures and the National Program for Sustainable Irrigation.

The scenario planning approach involved the following key stages:

1. **Project development:** Detailed project planning and efforts to secure key stakeholder commitment;
2. **Capturing community perspectives:** An extensive stakeholder engagement program involving a series of four full-day 'Irrigation Futures Forum' workshops repeated in six different locations with 120 participants in total, as well as interviews with business leaders. The workshops involved techniques such as building both a 'history wall' (to explore the history of the region and how change had been managed in the past) and a 'future wall' (to explore aspirations and develop future stories).
3. **Conducting analysis:** Development of a set of four scenarios – 'Moving On', 'New Frontiers', 'Pendulum' and 'Drying Up' – by the project team and a skill-based Technical Working Group. The full scenarios, created by integrating stakeholder contributions with other sources of knowledge, describe the interplay between external driving forces, responses of individuals, businesses and organisations and the social, economic and environmental wellbeing of the region. The team also developed a suite of regional strategies to help build adaptive capability in the region, which drew on quantitative systems analysis and modelling of consequences of the different scenarios;
4. **Enabling change:** Targeted communication activities and work with organisations to incorporate the learning from the project into their business and strategic plans. A suite of reports and tools were created to communicate the project findings to regional businesses and organisations. The project

team also collaborated with key regional stakeholder groups in their strategic planning processes.

Approach to building and using scenarios:

Scenario Building: This project fits most closely with the 'Tailored exploration' approach. The project collected and integrated a wide range of information – both qualitative and quantitative – in building the set of four scenarios. A broad range of future scenarios – including discussion of aspirations for the future – were explored through the Irrigation Futures Forums. A small team of 'experts' then analysed and refined this information, adding in other data sources, to develop the four full scenarios.

***Scenario Using*:** The set of scenarios has been communicated and used in many different ways as part of the fourth stage of the Irrigation Futures project, ranging from publication of reports to partnering with key stakeholders in strategic-planning exercises exploring scenario implications. The project had a strong emphasis on development of methodological tools and resources, so that the scenario planning approach could be understood and replicated.

Find out more:

- An extensive range of documents is available, explaining, analysing and evaluating the project. See: http://www.land.vic.gov.au/DPI/Vro/gbbregn.nsf/pages/gb_lwm_fwm_irrig_futures#final

Box 5C: Case study: *Scenarios and adaptation action planning: City of Melbourne Climate Change Adaptation Strategy*

Several climate impact scenarios were created as part of the development of the *City of Melbourne Climate Change Adaptation Strategy*, released in June 2009. The strategy was partly funded by the Australian Government's Local Adaptation Pathways Program and prepared for the City of Melbourne by Maunsell Australia.

The strategy applied an integrated risk assessment methodology drawing on climate change projections from *Climate Change in Port Phillip and Westernport* – a report produced for DSE based on CSIRO down-scaling to identify regional implications of several IPCC emissions scenarios. The report draws on regional climate change projections derived from the IPCC's A1B emissions scenario for 2030 and A1F1 emissions scenario for 2070.

Based on the information presented in the CSIRO/DSE report, four scenarios representing different combinations of climatic events for which Melbourne should be prepared were created and described in the adaptation strategy. These are: 'drought and reduced rainfall'; 'heatwave and bushfires'; 'intense rainfall and storm event'; and 'sea level rise'. The scenarios are presented as simplified ways of considering some of the major events for which the City of Melbourne should be prepared and which, taken as a full set of scenarios, encapsulate the most relevant climate change implications for the area.

A 'systems thinking process' was applied to the four scenarios of major events, helping identify particular risks relevant to the sensitivities and characteristics of the City of Melbourne. Diagrams of 'cascading consequences' are presented for each.

Approach to building and using scenarios:

***Scenario Building*:** The City of Melbourne's climate change adaptation strategy used Off-the-Shelf scenario products (DSE/CSIRO's regional projections based on the IPCC's A1B and A1F1 emissions scenarios). A set of scenarios were also built by those involved in the internal adaptation planning process by taking several climatic extremes viewed as most relevant to the City of Melbourne.

***Scenario Using*:** The four scenarios were then explored using a systems approach to analyse the

consequences, prompt adaptation response options and prioritise them into high value and low value options.

Find out more:

- Maunsell Australia (2008), *City of Melbourne Climate Change Adaptation Strategy – June 2009* online : http://www.melbourne.vic.gov.au/AboutCouncil/PlansandPublications/strategies/Documents/climate_change_adaptation_strategy.PDF

Box 5D: Case study: *Scenarios and planning for sea-level rise: Victoria's Future Coasts Program*

The Victorian Government's Future Coasts program was initiated by DSE in 2007 to assess the physical vulnerability of Victoria's coastline to climate change and develop guidelines to help coastal communities plan and adapt to projected changes. A key part of the program is the Victorian State-wide Coastal Climate Change Assessment, which, building on the methodology used for the National Coastal Risk Assessment, aims to provide greater detail about the impacts of sea-level rise and storm surges on Victoria's coasts and identify areas with greatest exposure to impacts such as erosion and flooding.

The assessment methodology involves the compilation of data about the physical nature of the coastline. It draws on prior work to develop sea-level rise implications from the Fourth Assessment of the Intergovernmental Panel on Climate Change, specifically choosing the A1F1 emissions scenario, which implies a sea-level rise scenario of at least 0.8 metres by 2100. The CSIRO was engaged to model extreme sea levels along Victoria's coastline accounting for storm surges, the highest tides and sea level rise associated with the A1F1 scenario. The CSIRO employed computer models and statistical techniques to consider the implications to different parts of Victoria's coastline under the A1F1 scenario as well as higher sea level rise scenarios derived from more recent reports.

Information from the state-wide assessment will be made available online, so that coastal managers can access and begin to consider the data in decision making. The assessment will also inform further stages of the program, including the selection of particular locations in which to undertake local coastal assessments involving local planning practitioners and decision makers. Scenario planning is likely to be a key method recommended for development of localised coastal adaptation responses.

Approach to building and using scenarios:

***Scenario Building*:** The Future Coasts program has effectively drawn on Off-the-Shelf scenario products (the IPCC's A1F1 emissions scenario) and commissioned CSIRO modelling of extreme sea levels (involving both the use of pre-existing scenarios and the creation of localised coastal impact scenarios) as technical inputs to inform the development of state-wide coastal planning.

***Scenario Using*:** The results of CSIRO modelling (based on particular assumptions about future climate change scenarios) will be accessible online and will inform future work of the program, to develop policy and facilitate local coastal adaptation planning in Victoria.

Find out more:

- "Future Coasts" www.climatechange.vic.gov.au/futurecoasts
- McInnes, K. L., Macadam, I. and O;Grady, J. (2009) *The Effect of Climate Change on Extreme Sea Levels Along Victoria's Coast*, CSIRO, online: http://www.climatechange.vic.gov.au/__data/assets/pdf_file/0005/77936/CSIROReport_VictorianCoast.pdf

Box 5E: Case study: Designing future communities: Broadmeadows 2032

In 2009 the Victorian Eco-Innovation Lab embarked on a project to explore visions of transformation to a sustainable future in 2032 in the rapidly developing suburb of Broadmeadows, located in the City of Hume, north of Melbourne. The project brought together academics, design professionals, students and people working across a range of departments at Hume City Council to address local resource and sustainability challenges through a series of workshops, design projects and events.

Researchers at VEIL began by drawing on existing data and engaging Hume City Council staff to identify priority challenges in the Broadmeadows community and trends in resource use, climate change and peak oil implications and so on. Architecture and design students were engaged in developing projects that delved deeper into challenges and possible design solutions across different local sites and systems. Visioning workshops were held with Hume City Council staff, State Government representatives, VEIL researchers, Italian design expert, Ezio Manzini and a number of Melbourne-based design professionals. These workshops explored opportunities and helped to identify key potential 'eco-acupuncture' points – places at which visionary interventions could help trigger positive change – in the Broadmeadows community. Many participants also visited various sites and talked to local residents in the Broadmeadows community to gather further input into the development of futuristic designs.

Designs presenting a wide range of sustainable opportunities for the local area for 2032 were showcased at two separate exhibitions in Broadmeadows. The first, opened by the mayor of Hume City Council was held in March 2010 at the Hume Global Learning Centre and the second, larger showcase of the design work arising from the project took place in July 2010 at the former Ericsson factory. The public exhibition was visited by hundreds of community members.

Participants in the project have noted that the Broadmeadows 2032 project has contributed to greater cooperation among Hume council staff particularly in urban design and strategic planning areas. Particular attention has been given to bicycle networks as urban catalysts and on redesigning community-based sustainable food initiatives.

Approach to building and using scenarios:

Scenario Building: The *Broadmeadows 2032* project is clearly best considered a Tailored Visioning approach. In this case a range of 'visions' were created by designers – both students and professionals – as a result of a collaborative exploration of local sustainability challenges specific to Broadmeadows. The visions took the form of maps and images of creative design ideas featuring local sites and built around knowledge of community needs and trends.

***Scenario Using*:** The researchers and Hume council staff used the visions for Broadmeadows in 2032 as part of a series of public exhibitions in order to showcase the possibilities for different future design of urban environments and systems of relevance to the local community.

Find out more:

- Broadmeadows 2032: http://www.ecoinnovationlab.com/revisioning-broadmeadows
- Broadmeadows 2032: Workshops: http://www.ecoinnovationlab.com/design-workshops/261-broadmeadows-workshop
- Broadmeadows 2032 - Exhibition: http://www.ecoinnovationlab.com/exhibitions/354-exhibition-vision-broadmeadows-2032

Key messages: Who has been using scenarios for climate adaptation in Victoria and in what ways?

- Data collected for this project suggests that scenario planning techniques are being used widely by policy makers and practitioners working on climate adaptation challenges in Victoria.
- Thirty-three Victorian examples of scenario planning for climate adaptation were identified, driven by a variety of organisations including state government departments and agencies, NGOs and regional alliances, research institutions and local governments.
- The examples show variation in geographic scale from a state-wide or regional focus to a suburb or site-specific focus. They also reveal a diverse range of aims and types of stakeholder groups taking part.
- Categorisation of the examples according to the broad approach taken to scenario planning - Off-the-Shelf, Tailored Exploration and Tailored Visioning – reveals a spread of examples indicative of different approaches, including combinations of more than one approach.

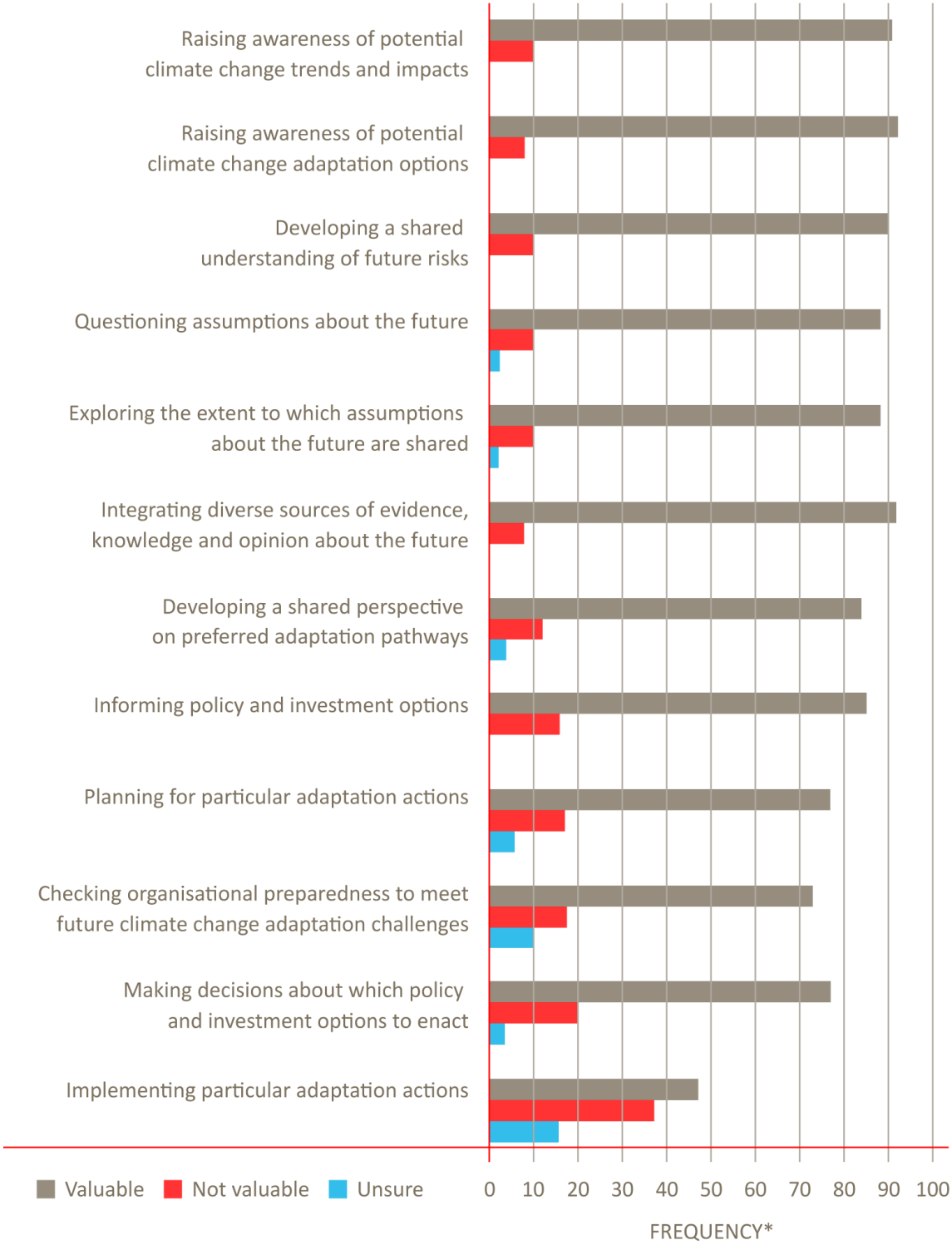
5.5. Lessons from practice: Strengths, weaknesses and critical challenges

Data collected through the survey revealed high levels of general satisfaction with the effectiveness of scenario planning techniques in practice. For example, almost all survey respondents who described specific experiences with scenarios suggested that the particular project described had achieved its purpose. In addition, a striking 93 per cent of survey respondents with experience using scenarios (n = 51), either totally or partly agreed that scenario-based strategies they had been involved in had made a valuable contribution to improved decision making about climate adaptation. However, survey questions that sought further detail about respondents' experiences with scenario-based climate adaptation projects, including reflections on their relative strengths and weaknesses, revealed a number of critical challenges. These are discussed below.

Perceived value, strengths and weaknesses of scenario-based strategies for climate adaptation

Figure 5B shows how valuable survey respondents believe scenario planning is for a variety of different climate adaptation goals.

Figure 5-B: Perceived value of scenario-based strategies for different climate adaptation goals



**Frequency denotes the percentage of respondents falling into each category: valuable; not valuable; unsure.*
Source: Scenarios for Climate Adaptation Online Survey (n = 50-52)

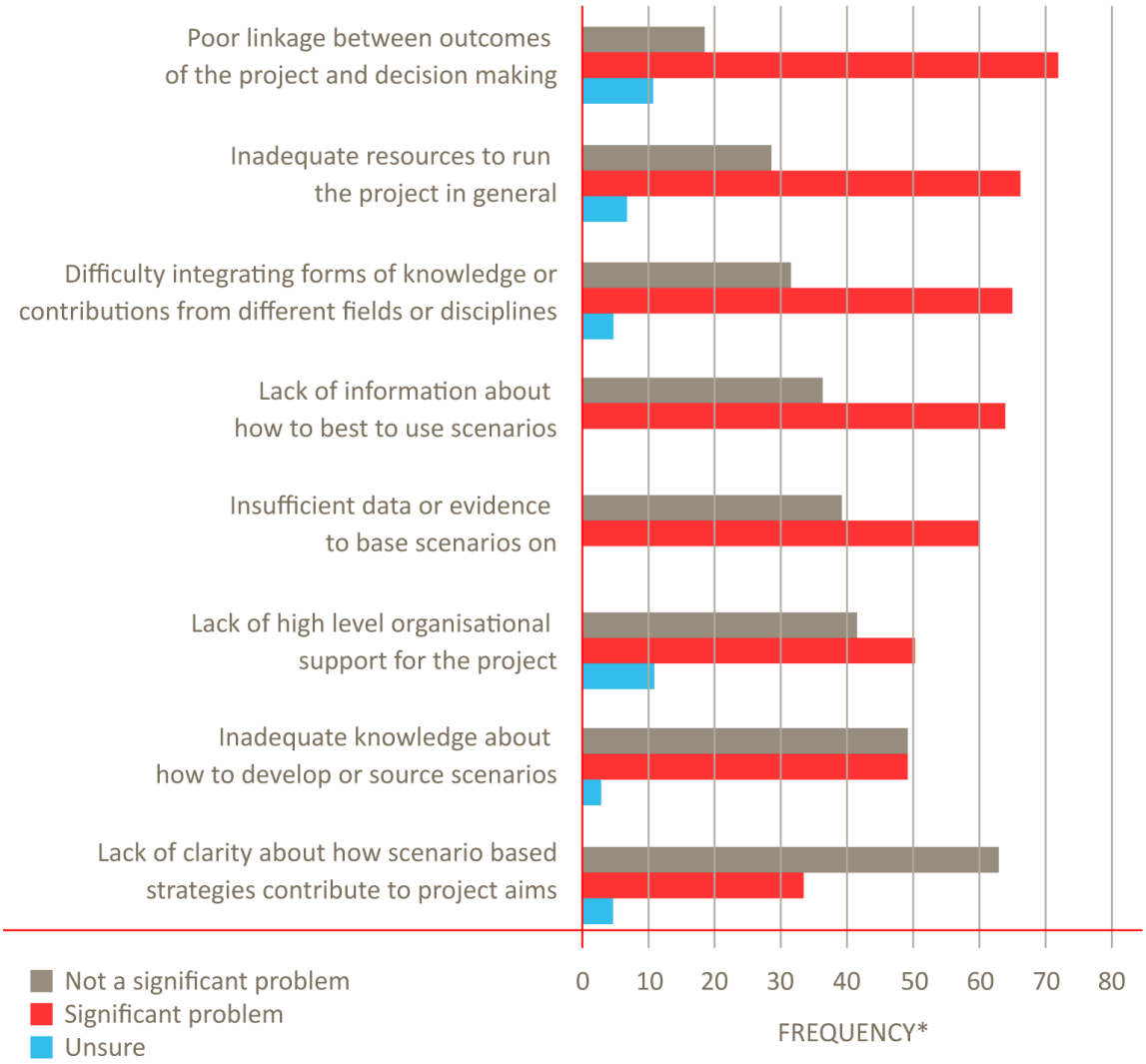
The results further confirm that scenario-based strategies are seen as highly valuable for a range of objectives particularly associated with raising awareness of climate change trends, impacts and adaptation options, helping to integrate diverse knowledge and opinion, bringing people together to build shared understanding and in questioning or exploring participants' world views. Survey

respondents were much less clear on the value of scenario-based strategies for implementation of particular adaptation actions.

Survey respondents also identified a range of technical-, contextual- and capacity-related challenges facing the scenario-based strategies (see Figure 5C). Among the issues seen as most problematic to survey respondents were:

- poor linkage between outcomes of the project and decision making;
- inadequate resources to run the project in general;
- difficulty integrating forms of knowledge or contributions from different fields or disciplines;
- lack of information about how to best use scenarios;
- insufficient data or evidence on which to base scenarios.

Figure 5-C: Perceived significance of different problems with scenario-based strategies for climate adaptation



**Frequency denotes the percentage of respondents falling into each category: not a significant problem; significant problem; unsure.*
Source: Scenarios for Climate Adaptation Online Survey (n = 49-52)

Critical challenges for scenario planning in practice

As noted above, the data collected suggests that scenario planning is being applied effectively as a tool for exploring climate change and improving understanding of the issues, risks and adaptation options that exist. However, respondents' experiences suggest that this is as far as most scenario-based strategies develop as scenario outcomes can rarely be shown to have a clear impact on adaptation decisions made and enacted. The challenge of translating scenario planning outcomes into concrete decisions was one of the key overarching challenges identified.

A number of contextual and practical challenges were reinforced and elaborated on in the stakeholder workshops and interviews with expert scenario practitioners. Below is a list of some of the main challenges identified, grouped into two interrelated themes: (i) challenges associated with design and implementation of the scenario planning process; and (ii) challenges associated with organisational context.

i. Challenges associated with the design and implementation of the scenario planning process

The following challenges arise either from flaws in the design or inherent difficulties in the practical implementation of a scenario planning process.

Not embedding scenario planning in specific strategy or decision making contexts

Several scenario practitioners emphasised the importance of designing scenario planning processes to feed directly into specific strategy or decision contexts. One interviewee noted that some organisations see scenario exercises as just a 'single-step' process preceding the more important stage of strategy development. The scenario-building and analysis stages are therefore too short, leading to shallow outcomes that lack content and impact. A corollary of underestimating the depth of the scenario planning process is that organisations may not dedicate the time, resources and personnel to it.

Not allocating appropriate time for the scenario planning process

A major challenge, particularly where tailored scenarios are being built with a range of stakeholders, is the under-estimation of time involved. Often scenario processes take much longer than anticipated.

Difficulties in thinking systemically and thinking about the future

Another challenge for effective use of scenario planning is overcoming a lack of familiarity among participants in a scenario-building process with thinking about the future (particularly the distant future) and at seeing issues from a 'systems perspective'. One interviewee suggested that people tend to put one level of complexity upon another, seeing and responding to issues as if they were comprised of multiple isolated problems. There is a danger that participants will get overwhelmed by complexity rather than see issues as integrated. Effective scenario planning relies on people having the ability to see issues in a holistic way, but the process can also help people develop this ability.

Failure to effectively incorporate non-status quo thinking

A common theme in the scenario literature also reiterated by interviewees and workshop participants is the tendency for people to focus on forecasts and put too much emphasis on the need for accuracy when thinking about the future. Related to this is the inability of participants to question and move beyond their existing frameworks or 'mental models' of how the world works. As one scenario practitioner put it 'if you start having [strategic] conversations within existing paradigms, almost always it's a waste of time'. Implications of this can include: participants not

knowing what to do with scenarios once they are built or a set of scenario narratives of the future that deviate little from an extension of the status quo. As a result they are not 'extreme' or varied enough to best inform robust strategies and decision making.

Two case study examples described by survey respondents, both of which suggested that the objectives of the project they had experience with had not been met, also highlighted this point. One noted that the scenario planning process was limited as participants were prevented from being too exploratory, and another noted that after scenarios were created, 'reality intervened showing our worst imagination wasn't as bad as reality'.

Failure to gain 'buy-in' and engage the right people in the process

Scenario planning can fail to result in clear directives, strategies and decisions because the wrong people are involved in the process. Interviewees noted that lack of trust is a common problem in scenario planning exercises, with many people having a problem with scenario 'credibility'. The process for gaining buy-in or support from key decision makers and stakeholders will vary depending on the context. One interviewee noted that: 'the simplest way to get trust in scenario planning is to involve the people that need to use them in the process'. In some contexts, however, those who wish to use scenarios to make decisions may trust a group of external experts to generate the scenarios for them.

Poor definition and/or lack of agreement of the problem to be explored

Another challenge in designing an effective scenario planning process is to ensure there is both clarity and agreement among participants around what the defining question, issue or aim is.

Failure to incorporate the most detailed and/or most appropriate information

Given the many diverse sources of information that could be drawn upon to build scenarios, another major challenge is ensuring the information drawn upon is accepted and trusted by those involved in scenario development.

Poor dynamics among participants and/or failure of participants to understand key concepts

Particularly relevant to processes involving large and diverse numbers of participants in the development of scenarios, poor dynamics in can create difficulties.

ii. Challenges arising from organisational context

It was noted that in some cases scenario planning processes led to excellent scenarios and very good strategic directives, but then face difficulties where organisations are unwilling or unable to apply those directives. To get the most out of scenario planning, the implications of scenarios for organisational structure and decision making processes also need to be explored.

The following are some of the challenges that arise from the organisational setting and culture in which scenario planning is being considered or carried out.

Short-term thinking

One barrier to scenario planning highlighted by workshop participants and scenario practitioners is an organisational culture that is restricted to short term thinking. In order to be most effective, scenario planning needs to be applied in an organisational environment that is supportive of thinking about the long-term future, whether or not it is in a position to take immediate action. Scenario planning is unlikely to be valued or to result in strategic decisions being taken where organisations are limited by short planning timeframes.

Risk aversion

It was noted by workshop participants that some organisations are more risk averse than others when it comes to processes that seek to explore and uncover a wide range of future possibilities, including potential future shocks. Risk aversion among managers and decision makers was seen to be a challenge, especially where organisations hold statutory responsibilities, as the outcomes of scenario planning processes may face public and media scrutiny and create political risks. One example put forward related to a local government setting where apprehension towards scenario planning was driven by a fear that scenarios, once developed, might attract media attention which would reflect badly or be twisted to highlight the unpreparedness of the particular local authority to deal with a worst-case scenario or range of plausible future events.

Lack of acceptance of the value, legitimacy and robustness of scenario planning

Several workshop participants suggested that a lack of acceptance of the legitimacy and robustness of scenario planning techniques, particularly by people in management and leadership positions, constitutes a major barrier to seeing scenario outcomes directly influence decisions. One workshop participant working in the public sector suggested that a quantum shift in language and strategy is required, along with leadership to acknowledge that change is needed in the way we plan for the future. Another common point made was that in most organisational settings there is still a lack of understanding, familiarity or experience about *how* to undertake scenario processes in a way which can result in, and be shown to lead to, robust decisions and outcomes.

Lack of stewardship and structure for scenario planning within organisations

It became clear during the stakeholder workshops that typically there is not a designated individual, team or unit within an organisation responsible for maintaining training and application of scenarios for climate change within one organisation. A scenario planning process is often initiated as a special 'one-off' project or driven by someone with prior experience or a specific interest in trialling a scenario planning process. This means that barriers typically exist to integrating scenario planning processes with existing planning processes, decision making frameworks or traditional risk assessment and cost-benefit tools.

Failure to recognise the value of qualitative outcomes

As already acknowledged, much of the value of scenario planning applications arises from the social learning that takes place during the building phase, and the process can be useful for raising awareness, developing the capacity of participants for strategic thinking, building shared understanding of goals, stronger relationships and so on. Many of these outcomes are not easily quantifiable and can be undervalued in some organisational contexts.

Problems with scale and jurisdiction

Discussion at the stakeholder workshops reflected differing views about the most appropriate organisational settings (e.g. level of government, government as opposed to NGO) in which scenario planning is best placed to influence adaptation planning. Related to this is the issue of how scenario planning for climate adaptation can best link up, given different planning processes across different scales. Different models were put forward, including, for example, a process whereby scenarios could be developed at local levels with state-wide coordination and commitment to ensuring local scenario outcomes were considered and fed into state government decision making processes.

Challenges unique to the public sector

Workshop participants and interviewees with experience working in government departments and agencies (at state and local levels) noted the unique challenges when operating in a public sector setting. While short-termism associated with politicians' electoral cycles was noted, it was also pointed out that government has significant capacity for long-term strategic planning and is already

well practised in this field. One participant suggested that while there was acute attention to the need for governments to 'take the community with them' there was also a need for strong leadership from politicians in order to achieve this. Another participant noted that scenarios can be perceived as 'subversive'.

Key barriers to the use of scenario storylines on policy arenas include:

- short-term timeframe and nature of the policy cycle;
- difficulty individuals have in imagining different futures;
- limited documentation of the scenario storyline development process;
- lack of clarity about the purpose of a scenario exercise;
- limited relevance to specific policy details.

Contrasting approaches taken by two different local governments using scenarios as inputs into adaptation risk management planning process were put forward as an example by one workshop participant, illustrating the challenges associated with operating in a political setting. The two local government adaptation planning teams differed in their approach to whether they should focus on the IPCC's A1F1 emissions scenario in their planning process. The A1F1 emissions scenario represents the highest global greenhouse gas emissions trajectory considered by the IPCC, which has been shown to be a slower rate of global emissions growth than what has actually been observed in recent years. The response of one council planning team was: 'this is so critical that we want to present it to council', while the other team's response was: 'the implications of this are so big that we don't want to take this to council'. In another case reported on in the survey, the design of a scenario planning project was swallowed up by the announcement of a new and broader policy.

While the many challenges identified here should not be underestimated, there are also ways in which they can be addressed and minimised when undertaking a scenario planning project. The next two chapters provide constructive guidance on how to plan for and go about running a scenario planning project in the context of climate change adaptation issues, including suggestions for overcoming challenges.

Key messages: Lessons from practice: Strengths, weaknesses and critical challenges

- Survey results indicated that scenario-based strategies are considered highly valuable by climate adaptation policy makers and practitioners, particularly for objectives such as:
  - raising awareness of climate change trends, impacts and adaptation options;
  - helping to integrate diverse knowledge and opinion; and
  - bringing people together to build shared understanding
- However, data collected also highlighted the difficulty in translating scenario planning outcomes into concrete adaptation-related decisions

and actions as a key overarching challenge and identified a range of related practical and contextual challenges.

- Examples of challenges associated with the design and implementation of scenario planning processes include: embedding scenario work in a specific decision or planning context; time and resource constraints; difficulties thinking systemically, futuristically, and 'out-of-the-box'; gaining buy-in from the right stakeholders; and managing the steps and dynamics between participants.
- Challenges associated with the organisational context within which scenario planning work takes place can include: a culture of short-termism and/or risk aversion; lack of acceptance of the value and legitimacy of scenario planning techniques; failure to set up stewardship for the scenario work within the organisation; and fundamental issues about scale and responsibilities of different types of organisations.

6. Towards guiding principles for improving the effectiveness of scenario planning for climate adaptation

In this section

→ About this chapter

→ To what extent is the potential of scenario planning to assist climate change adaptation being met?

→ Key principles to maximise the potential of scenario planning to support climate adaptation decision making

6.1. About this chapter

As discussed in Chapter 5, scenario planning is being extensively used in Victoria to support climate adaptation policy making and practice. However, maximising the full potential of scenario planning will depend on improved clarity about the aims and scope of climate adaptation and of the ways in which scenario planning can be applied in specific organisational contexts.

This chapter builds on the findings presented above and additional information provided by climate adaptation and scenario practitioners to address two key questions: To what extent is the potential of scenario planning to assist climate adaptation being met? And, what are the guiding principles which should inform improvements in the use of scenario planning for climate adaptation?

6.2. To what extent is the potential of scenario planning to assist climate adaptation being met?

Analysis of the recent experience of Victorian policy makers and practitioners suggests that scenario planning processes and outputs are frequently and effectively being used as tools for engaging stakeholders and for building shared understanding of climate change risks, challenges and priorities. This use of scenario planning is particularly common in the early stages of climate change adaptation planning, and can play a valuable role in assisting stakeholders and decision makers:

- explore and develop shared framing of the complex and multifaceted nature of climate change trends and impacts;
- heighten awareness of the need for robust adaptation responses – including ongoing action to reduce the threat and risk of runaway climate change;
- highlight the importance of human agency and choice (as opposed to passive acceptance of pre-determined future pathways and drivers);
- stimulate and inform discussion about climate adaptation assumptions, values, goals and priorities;
- identify and consider a broad range of climate adaptation policy and practice options.

There is also a range of positive examples of the use of scenario planning to strengthen the capability and resilience of organisations and communities.

The use of scenario planning as a tool for deciding on and implementing specific climate adaptation policy options and investment pathways remains more problematic. The ‘holy grail’ for many policy makers continues to be the ability to make firm, confident predictions about the likelihood of future climate trends and impacts. This commonly leads to a preference for scenario planning approaches at the more predictive end of the spectrum, often combined with other modelling, cost benefit and forecasting techniques. The risk however is that policy makers will place too much faith in the predictive capacity of such techniques, leading to erroneous or maladaptive policy and investment choices.

Problems and limitations frequently encountered in using scenario planning for climate adaptation include the following:

- Lack of shared framing of the aims and scope of climate adaptation. This includes the challenge of ensuring shared understanding of aims and assumptions at all levels of the organisations involved.

- Lack of shared framing of the aims and scope of scenario planning, particularly the distinction between predictive forecasting and scenario planning.
- Lack of clarity about the aims and outcomes of the specific scenario planning project.
- Failure to gain initial buy-in and support from all relevant decision makers and stakeholders.
- Limited organisational preparedness to allow or encourage broad engagement with the full range of scenario drivers and pathways.
- Constraints on developing or incorporating 'out-of-the-box' perspectives.
- Problems in designing and implementing scenario planning processes. This includes problems in effectively engaging all relevant stakeholders, decision makers and audiences.
- Problems in ensuring that the range of scenario drivers and outputs are sufficiently broad.
- Problems in accessing and analysing relevant data, including data and evidence needed to inform development and prioritisation of scenario drivers.
- Difficulty in integrating knowledge from different fields or disciplines.
- Problems in downscaling and applying pre-existing scenarios.
- Problems in ensuring scenario planning processes and outputs are effectively integrated into decision making processes.

6.3. Key principles for maximising the potential of scenario planning to support climate adaptation decision making

The following principles for developing and using scenario planning for climate adaptation are informed by the learning from recent Victorian policy and practice experience, as well as relevant research literature on the use of scenario planning in other Australian and international jurisdictions.

1. ***Maximise clear, shared framing of climate change adaptation challenges and aims***

The threshold decision as to whether to employ scenario planning methods – and the choice of particular scenario planning approaches – will be crucially affected by the particular geographical, political and organisational context, and by the extent of shared understanding about the scope and shape of climate adaptation challenges and responses. At the same time, it is also crucial to enable an open conversation about the range of preconceptions and assumptions that organisers and participants bring to the scenario planning process.

2. ***Maximise clear, shared understanding of the strengths – and limitations – of scenario planning***

Scenario planning is best seen as a learning tool to support more informed and reflective consideration of climate adaptation risks and options rather than as a 'silver bullet' capable of delivering predictive forecasting. Scenario planning can also provide a strong platform for increasing the robustness of climate adaptation choices, leading to decisions that proactively and effectively address a range of possible futures, rather than aiming for an optimal response to one single pathway. While quantitative modelling of climatic trends – and of other social, economic and environmental drivers – can be a useful input in scenario building, the real value and power of scenario planning lies in its emphasis on plausibility rather than probability; multiple rather than singular futures; and out-of-the-box surprises rather than linear trends.

3. ***Maximise clear, shared understanding of the primary goals of the specific scenario planning process***

Scenario planning has the potential to make a useful contribution in meeting a range of key climate adaptation challenges, including understanding key trends and impacts; identifying and selecting

options and implementing and evaluating strategic policies and plans. Like any process that engages multiple stakeholders it is important that those involved in building and using scenarios are clear about the objectives and expected outcomes they are working towards.

4. *Maximise high-level support for the scenario planning process from key internal and external stakeholders and champions*

Maximising high-level support from internal and external 'champions' at an early stage in the scenario planning process is likely to significantly increase the likelihood that outcomes will usefully inform decision making. High-level buy-in is also likely to strengthen the potential for scenario planning to have an ongoing positive influence in developing an organisational culture and community of practice capable of dealing with high levels of complexity and uncertainty.

5. *Invest time and resources in planning, preparing and ensuring the right mix of skills and knowledge*

Successful scenario planning processes require a significant investment of time and resources, with careful consideration given to the choice of specific approaches and methodologies – and, commonly, the employment of skilled scenario planning facilitators.

6. *Draw on a broad range of relevant experience, expertise and evidence*

The encouragement of a broad and inclusive approach to sources of advice about key drivers and possibilities is an essential basis for avoiding 'group think' and for identifying and exploration of unexpected, out-of-the-box possibilities.

7. *Deliberately encourage the identification and consideration of the full range of plausible drivers and pathways*

The robustness of climate adaptation strategies and policies will be significantly influenced by the robustness of the range of drivers and scenarios identified and considered.

8. *Create scenarios that are sharply defined and capable of effective communication to key audiences*

Lindgren and Bandhold (2009) note the following key characteristics of good scenarios also include:

- consistency – the stories, processes and events must all fit an internal logic;
- differentiation – they must be structurally diverse, not deviations around a common base;
- memorability – scenarios must be easily represented, communicated and stick in peoples' minds after they have been heard;
- challenge – scenarios must challenge people's perception of the future and how the world works.

9. *Give careful consideration to ways in which outcomes of scenario planning processes are to be integrated with strategic planning and decision making*

The commonly cited gap between scenario planning and effective inputs into specific decision making processes and outcomes partially reflects the larger challenge of strategic planning and decision making under conditions of uncertainty and complexity. Careful consideration of the actions needed to integrate scenario planning with specific decision making challenges and tasks is, however, a key precondition for bridging this gap.

10. *Embed scenario planning as an ongoing driver of organisational culture and decision making processes*

The value of scenario planning is likely to be maximised when the process and outputs are integrated and when relevant decision makers are fully involved in all steps of the scenario

development process. In practice, many organisations only take the process halfway, creating scenario narratives without applying a systemic approach to using narratives to inform and shape decisions or to embed learning within organisational decision making processes.

There is increasing evidence that the most effective climate adaptation strategies are not discrete, one-off initiatives but rather those that involve the creation and maintenance of an ongoing organisational 'state' of continual learning and capacity building that fosters flexibility, innovation and resilience.

7. Towards improved use of scenario planning for climate adaptation: An integrated methodology

In this section

→ About this chapter

→ Phase 1: Preparation

→ Phase 2: Scenario Building and Refining

→ Phase 3: Using Scenarios

→ Embedding scenario planning in organisational practice

7.1. About this chapter

This chapter outlines a methodology for applying scenario planning to climate change adaptation. It draws on case studies, climate change adaptation literature and well-established scenario methods. The process described is a suggested path for individuals and organisations to improve their understanding of climate change implications, explore strategic responses, imagine inspiring futures and help to embed an organisational culture of reflexive learning. As earlier chapters have described, there is no right or wrong process when it comes to scenario planning, but some practices and pitfalls are better known and more widely tested. This chapter has tried to bring together much of this learning.

The methodology presented here involves 16 sequential steps across three phases:

- **Phase 1: Preparation**
- **Phase 2: Scenario Building and Refining**
- **Phase 3: Using Scenarios**

The methodology has been written with a lead organisation in mind; which can be thought of as a group of individuals with some interest, capacity and responsibility to define and seek to understand or address a common climate change adaptation challenge. In practice, this lead organisation may take many forms from a formal strategic planning team operating within one organisation, to an informal network of people operating within or across different organisations. The methodology has tried to take this variability into account. For this reason, some of the 16 steps may not be applicable to all scenario-based climate change adaptation projects.

The three broad approaches to scenario planning for climate adaptation introduced in Chapter 4 are used here as a framework for describing the 16-step process in more detail. Depending on whether a lead organisation takes an Off-the-Shelf, Tailored Exploration or Tailored Visioning approach, some steps may be applied quite differently and with varying levels of detail. Key differences are explained using three hypothetical case studies or archetypes[10], designed to clarify differences between the three approaches, although it is important to note that, in practice, distinctions may be less clear. The hypothetical case studies, described in Box 7A, include: Longwater Bay Coastal Protection Strategy, City of Hollum Strategic Plan, and Cocklebiddy Vision 2040. They reflect the Off-the-Shelf, Tailored Exploration and Tailored Visioning approaches respectively. Each case study is used to explain each of the 16 steps.

Box 7A: Three hypothetical case studies

Longwater Bay Coastal Protection Strategy	City of Hollum Strategic Plan	Cocklebiddy Vision 2040
Longwater Bay is a small fishing port-cum-holiday and retirement town with a seasonal population ranging from 5,000 to 20,000. The local council has been worried for some time about	Predicted to house a population in excess of 300,000 in 2035, the City of Hollum is seen as a litmus test by the State Government and other local councils. How Hollum handles the multiple pressures it faces will set the standard for	Cocklebiddy is a town on the Murray River with a district population of around 5,000. The idea of using scenario planning to help Cocklebiddy better adapt to climate change came after a record drought and back-to-back

[10] These case studies are purely fictional and are included as a learning tool to help illustrate different pathways and decisions that may be taken in different hypothetical contexts.

multiple environmental pressures it attributes to climate change. In particular, over the last 15 years there has been an increase in the frequency and height of storm-surges. These surges are linked to the premature undermining and collapse of low sandstone cliffs on which a large number of homes and a retirement village have been built. The council is concerned about what it should do and has sought guidance on its options.	other councils and provide valuable lessons on how to embed climate change adaptation within the council operations across the broader region. Planners and policy makers understand climate change to be one of a handful of major stress factors that need to be prepared for.	one-in-100 year floods. Members of the local irrigators' association had met with the local mayor and suggested that the community take stock and consider how it might best respond to the damage done. It was also concluded that there would need to be some thought put into how the community might adapt if the recent extreme events were indicative of more permanent changes in weather patterns.

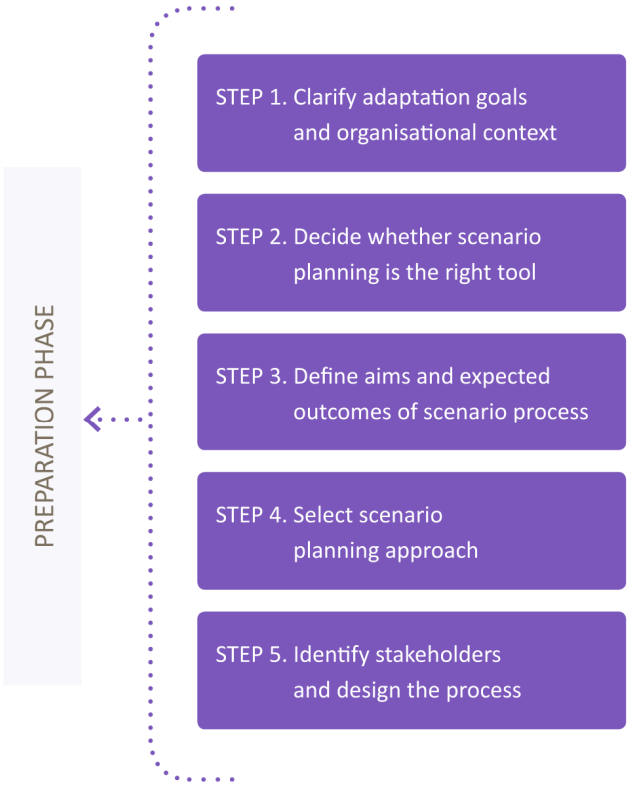
The chapter concludes with some reflections on the task of embedding or institutionalising scenario planning in organisations as a way of strengthening capacity for reflexive strategic planning for climate change adaptation. While all organisational contexts are different, there is clearly potential for many to benefit from building stronger understanding and skills and supporting more integrated and coordinated applications of scenario planning techniques.

7.2. Phase 1: Preparation

The Preparation phase lays the groundwork for successful use of scenario planning for climate change adaptation. Here, people define the adaptation challenge(s) they face, clarify if and how scenario planning can assist, select an approach that will best match people's objectives, and identify and address potential problems that participant organisations may face.

As noted in earlier report sections, people can have very different expectations of what climate change adaptation and scenario planning entails, and what effective outcomes will look like. Scenario planning can take considerable time and may be undermined by the participants involved. People may dismiss the 'soft' analysis involved in scenario planning processes and de-value process-related outcomes such as awareness raising and shared learning. These problems can be minimised by preparation – forewarned is forearmed. There are five steps in the Preparation phase as shown in Figure 7A.

Figure 7-A: Phase 1: Preparation



STEP 1 – Clarify adaptation goals and issues relevant to your organisational context

Step 1 requires the lead organisation to recognise and have a general understanding about why climate change (along with any other driver of change) may require an adaptation in activity, strategy or operation. This step can simply involve key personnel in an organisation or network defining a need, dilemma or critical threat characterised by uncertainty. Detailed knowledge about climate change is not required. An organisation may suspect that climate change will affect its' operations and require a revision of (or change in) overall strategic direction or a particular policy or investment decision. In other cases, climate change may appear as a significant, but unknown change factor posing potential risks and opportunities that need exploring. Box 7B shows how adaptation challenges are defined for our three hypothetical case studies.

Box 7B: Three hypothetical case studies: Step 1 – Clarifying adaptation goals

Longwater Bay Coastal Protection Strategy	**City of Hollum Strategic Plan**	**Cocklebiddy Vision 2040**
Those responsible for asset management at the local council identified the main challenge as how to address a growing problem posed by storm surges and coastal erosion and, in particular, what to do if climate change exacerbates this problem. The project was considered an internal planning exercise to help council	At the City of Hollum there were many different perspectives on what the adaptation challenge was. However, overriding issues related to how the council and relevant state government agencies could cope with providing services to a much larger Hollum population when	In Cocklebiddy, members of the irrigators' association and the local council saw the challenge as a community-wide crisis of identity brought on by multiple environmental and economic shocks. The broad feeling was one of

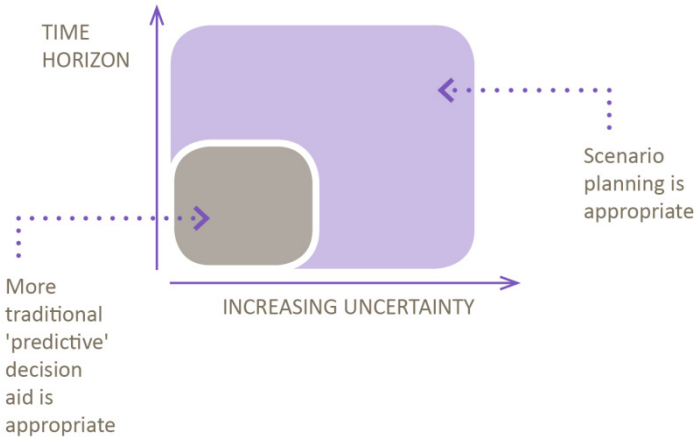
have a better idea of their options for Longwater Bay although there was some thought given to exploring perceptions of the local community at a later stage.	also facing pressures from climate change, rising oil prices and economic uncertainty.	uncertainty – what do we do from here?

STEP 2 – Decide whether scenario planning is the right tool

This step involves an assessment of whether scenario planning is the right tool for the task. Determining the suitability of scenario planning requires careful consideration of both the adaptation challenge in question and the organisational context in which the scenario planning process will take place.

Maximising value from scenario planning outcomes requires significant organisational commitment in time, personnel and (often) financial resources. Therefore, it is important to know when scenario planning is and is not appropriate. Generally speaking, climate change adaptation challenges that can benefit most from scenario planning are those involving decisions or dilemmas under highly complex and uncertain conditions, often spanning decades (see Figure 7B).

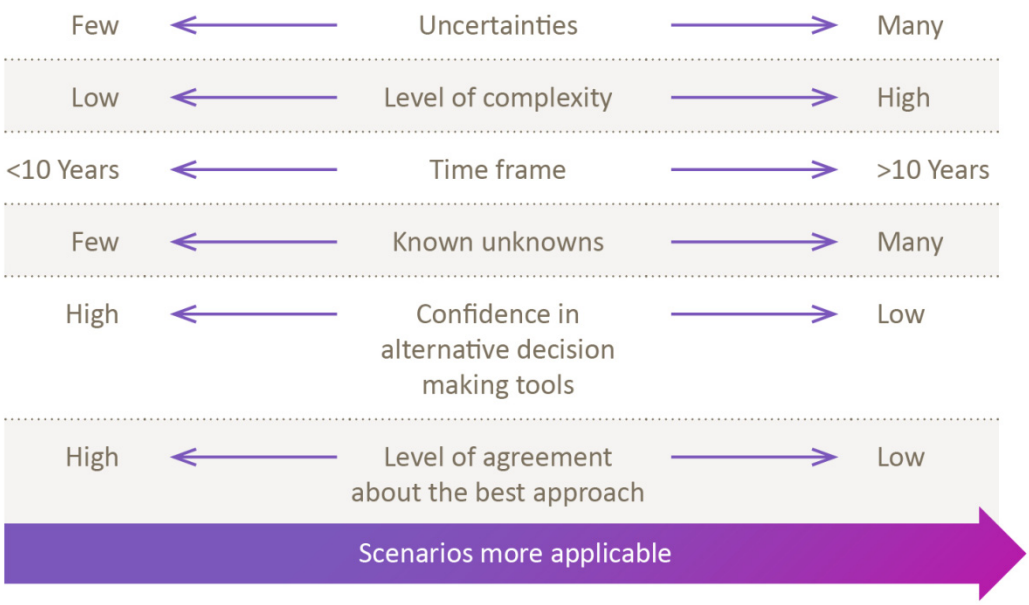
Figure 7-B: When is scenario planning most appropriate?



Scenario planning is probably the right tool where:

- the focus issue involves many complex variables and uncertainties;
- relevant information is lacking or highly questionable;
- key variables may exist but are unknown or unforeseen events may occur;
- decisions will have major implications for decision makers in 10 years or more;
- multiple views conflict on what strategic approach should be taken;
- there is a lack of confidence in the value of other decision making tools to help.

Figure 7-C: Factors affecting the appropriateness of scenario planning



If most of the above statements do not apply, other tools and methods should be considered. Even if scenario planning looks like the tool for the job, poor organisational context can undermine its success. When done well, scenario planning will draw out and challenge pre-conceived ideas about how the world operates and how adaptation can occur. Organisations need to have a culture and senior management that can support (or at least tolerate) this type of challenging exploration.

Where the scenario planning process is unlikely to be supported by key people in an organisation, effort may be best spent building the case for scenario planning or helping others better understand the limitations of traditional decision making tools. [Ralston and Wilson (2006) offer useful advice in this respect].

A scenario planning approach is probably worth pursuing if:

- lead organisations have at least one month to invest in the process;
- senior management and critical decision makers are supportive and committed;
- a culture exists of trying new ideas and listening to novel points of view;
- key participants have experience with strategic planning on complex, ambiguous problems;
- key organisational decision makers lack confidence in traditional decision making tools to assist their climate change adaptation planning.

There are likely to be individuals in participating organisations who are dismissive of scenario planning processes and outcomes. A negative attitude may stem from a lack of understanding or scepticism about the need for climate change adaptation or about what scenario planning is or can achieve. Problems will occur if people who do not accept the legitimacy of the process end up being responsible for implementing outcomes or have the possibility to undermine the process. Where these risks exist, attention should be given to the question of how best to work with people who could undermine the process. Better long-term outcomes may result from involving these people early rather than trying to shut them out of the process.

Box 7C: Three hypothetical case studies: Step 2 – Deciding whether scenario planning is the right tool

Longwater Bay Coastal Protection Strategy	City of Hollum Strategic Plan	Cocklebiddy Vision 2040
It was initially unclear whether scenario planning was necessary to address sea level rise concerns at the council and mixed ideas about what a scenario-based approach would involve. Some saw a scenario development process as an indulgence that wouldn't add anything to the straightforward problem of managing risks of coastal erosion. For others, who were more familiar with climate change science, it was clear that using scenarios about the future was almost unavoidable given that information about sea level rise was not clear-cut. There was also some understanding among a few key decision makers (including the CEO) that a scenario-based approach may be a way of fostering learning across the local council about emerging risks from climate change and trialling approaches to decision making that seemed to accommodate higher amounts of uncertainty. The CEO thought that building a more thorough exploration of the risks relating to coastal erosion was a form of insurance – an investment in risk management that would build new skills and knowledge of the future.	The decision to use scenario planning was driven by the lack of any alternative tool that would enable a holistic exploration of the future challenges and adaptation options. Furthermore, key personnel saw the benefits of undertaking a scenario planning exercise in-house as a way of building and retaining knowledge.	Stakeholders that had initiated discussions with the council were strongly of the opinion that they wanted a vision to guide community development – created through some form of consultation process. They were also clear that any external assistance should be minimal and restricted to guiding the process, ensuring any vision developed had wide community support. A scenario-based approach was seen as offering a systematic method to do this – one that could be managed by a number of appropriately skilled people in the district.

STEP 3 – Define aims and expected outcomes of the scenario planning process

Once the lead organisation accepts that a scenario-based approach to climate change adaptation is the best way forward, the next step involves defining what can be achieved from using scenario planning for climate change adaptation. The aims and expected outcomes defined at this step will determine the most appropriate approach and help design the following steps. Aims and outcomes should be defined with an understanding of the adaptation challenge being explored, the level of commitment and resources that can be used to address that challenge, and the organisation's particular needs. The following list reviews several objectives relevant to climate change adaptation that may be achieved through scenario planning:

- Development of tools such as visualisations and narratives useful for communicating the case for adaptation.
- Deepening or building a shared understanding of context-specific climate change impacts.
- Stimulating new ideas and new ways of thinking about climate change and possible adaptations.
- Informing and shaping strategic planning for adaptation.
- Informing and shaping adaptation decisions.
- Testing the efficacy of existing strategies and decisions against potential impacts of climate change.
- Building the culture and organisational capacity for continual learning, adaptation and openness to novel future possibilities.

Box 7D: Three hypothetical case studies: Step 3 – Defining aims and expected outcomes of the scenario planning process

Longwater Bay Coastal Protection Strategy	City of Hollum Strategic Plan	Cocklebiddy Vision 2040
The CEO and council managers responsible for coastal protection and asset management were clear that the current Coastal Protection Strategy needed an upgrade to factor in the increased frequency and intensity of coastal erosion. The possibility that climate change was behind this increase required a good look at the latest scientific projections. However, the CEO and key councillors were hesitant to make plans too far into the future. It was strongly felt that the State Government was ultimately responsible for any long-term changes in coastal planning that might stem from climate change. Because of this, the council felt they should wait for higher leadership on any planning extending beyond a couple of decades. At the end of the day, the asset manager wanted a clear idea of what implications coastal erosion would have for infrastructure located on or near the cliffs, a set of guidelines on what actions were needed to deal with possible impacts and enough detail to begin costing any adaptation measures.	Strategic planners at both local and state government level were well aware of the many challenges that the Hollum region faced. A key problem was prioritising the challenges and figuring out how they could be tackled. After discussions with people across different departments, it was soon realised that a strategic plan was needed, but it had to incorporate climate change adaptation and go further than any previous plan in developing a coherent approach to addressing multiple stressors and contingencies. While there was agreement that the strategic plan should be the main outcome of the process, there was a strong desire that all departments and key stakeholders involved should gain from the process of creating it. In particular, increasing their understanding about emerging risks and challenges posed by issues such as peak oil, climate change and an ageing population and, where possible, building a more adaptive approach to governance. While there were differing perspectives on the degree to which the strategic plan should consider the possibility of radical change and 'left-field' events, it was widely accepted that any process would require a broad approach, take time and need to challenge the status quo approach to strategic planning and decision making.	People leading the discussion around using scenario planning methods were eager to foster new ideas and replace the current pessimistic view of the future for the shire with a positive one. At the same time, there was strong agreement that any process should involve the community and be grounded in locals' understanding, values and skills. It was clear from recent experiences that ideas coming from external consultants were not likely to be appreciated or listened to. The conclusion reached at this stage was to create a community-led vision that could inspire people in the town, and potentially in surrounding parts of the shire, but also provide guidance on a collective path of positive action.

STEP 4 – Select a suitable approach: Off-the-Shelf, Tailored Exploration or Tailored Visioning

This step sees the lead organisation assess and select the best approach to achieve the aims and outcomes defined in Step 3. Three broad approaches are suggested. Each corresponds to differences in the types of outcomes sought and can also reflect different perspectives on how change and adaptation occur. Despite these differences, the three approaches are not mutually exclusive. They require some steps to be conducted differently, but in general share similar processes.

Each of the three approaches is described as follows, with a summary of the types of situations in which they are most applicable and their main advantages and disadvantages. These should help guide organisations to select the approach most suitable for them.

Approach A: Off-the-Shelf
Typically the shortest of the three methods, an Off-the-Shelf approach relies heavily on existing climate change scenario model outputs to define the context from which organisations develop strategies and base decisions. This approach is typically used to shape strategies or decisions, not ideas. It also prioritises climate change as the main 'driver of change' shaping the decision making context.

An Off-the-Shelf approach is more suitable to adaptation challenges where uncertainty is relatively low. For example, where the time frame over which decisions are seen to be important may be relatively short (5–15 years), or where high-quality data is available and assumptions are well understood. Compared to alternatives, an Off-the-Shelf approach is more suited to a decision making culture that: is less accepting of ambiguity; is used to relying on 'trusted' quantitative data for certainty; and typically sees the future as a general extension of historical trends. Outcomes (particularly implications for strategy and decisions) from this approach are more likely to be accepted and adopted by organisations sceptical of the need to plan for multiple 'ambiguous' futures.

A reliance on existing climate scenarios means this approach can save time and is more easily replicated than other approaches. Because 'source' data (such as CSIRO or IPCC models) is easily referred to and widely respected, outputs and recommendations derived through an Off-the-Shelf approach may have more credibility. However, because much of the input data is derived externally, scenario planning participants must accept both the data and the assumptions upon which they are based. In addition, quantitative input scenarios or models are often created with too broad a scale to be directly applied to context-specific adaptation challenges. Often they must be adapted and down-scaled – requiring specialised skills and amplifying the uncertainties built into the models. Furthermore, by accepting external data largely 'as is', strategies and decisions based on them are likely to ignore the possibility of unexpected or low-probability, high impact events often excluded from quantitative climate models. This potential creation of blind spots within Off-the-shelf scenario outputs is a major disadvantage of this approach.

Approach B: Tailored Exploration
Typically the most lengthy and involved approach to scenario-based climate change adaptation, Tailored Exploration brings together diverse contextual information and creates multiple future scenarios to better understand climate change implications and adaptation options. Unlike an Off-the-Shelf approach, Tailored Exploration relies on diverse knowledge and input data to explore the future and define possibilities. It is an approach best able to integrate and consider complex interacting elements - internal and external to the organisation. Climate change may be just one of multiple key 'drivers of change' that will shape the adaptation decision making environment. A Tailored Exploration approach can vary in method and output. It can be applied through a largely qualitative lens; where intuitive or 'soft' analysis is used to understand interactions between contextual drivers or through a quantitative perspective, where quantitative modelling is used to support qualitative scenario storylines.

The Tailored Exploration approach is suitable in circumstances where the level of uncertainty is higher and/or where the potential impact of decisions and events is also high. It is best applied to understand and shape organisational strategy over long time frames, in environments subject to complex and ambiguous systemic interactions, and where the implications of unforeseen events

must be acknowledged. For this reason it is more suitable within organisations open to new ideas and novel possibilities. Because of the level of detail and analysis involved, the Tailored Exploration approach can be particularly demanding on organisational time and resources.

Compared to an Off-the-Shelf approach, Tailored Exploration is more participatory and better able to integrate diverse opinion and different forms of knowledge. Outcomes are more likely to include new learning and the creation of shared understanding between participants. Outcomes are also more likely to identify and foster adaptation to unforeseen impacts of climate change, including secondary and tertiary impacts stemming from complex technical, biophysical and social system interactions.

Tailored Exploration can be vulnerable to a lack of organisational follow-through and poor alignment with organisational culture. A typical problem from this approach is the generation of outputs that lack relevant detail and fail to translate into clear recommendations for strategy and decisions. This often arises because organisational commitment is not maintained over the whole processes or because outputs don't identify a single optimal solution.

Approach C: Tailored Visioning

This approach defines a strategic direction based on a common positive vision of a future state. It is typically a highly participatory process, able to incorporate diverse perspectives and knowledge and relies on participants agreeing on a single ideal vision.

A Tailored Visioning approach is used in circumstances where defining and communicating an ideal future is more important than exploring 'what could happen'. This could be a situation where inspiration is perceived to be a more powerful motivator of change than an understanding of risk.

A Tailored Visioning approach does not require a detailed understanding of climate change science or complex system interactions and can involve a diverse set of participants. Provided care is taken to involve a wide range of stakeholders, outcomes can be widely supported by scenario audiences. However, the positive momentum created by people envisaging a common future can abate quickly once the process moves to the task of creating that future. Expectations may be let down by reality. If the process and participant selection are opaque, outcomes can be highly vulnerable to a lack of legitimacy.

Figure 7D below provides a set of questions that can help guide decisions about which scenario planning method is most appropriate.

Figure 7-D: Matching the approach to the objectives

APPLICABLE? Definitely ● Maybe ● Rarely ●

Is your intention…	Off-the-Shelf	Tailored Exploration	Tailored Visioning
To define an ideal future and a pathway to get there?	○	○	●
To produce scenarios that will act as communication tools?	○	●	●
To explore highly uncertain, catastrophic and non-linear events?	○	●	○
That outputs be quantitative and 'definitive'?	●	●	○
To assign a level of probability to output scenarios?	●	○	○
To use a process that relies on publically accessible data?	●	●	●
That the process be expert driven?	●	●	○
That the process be participatory?	○	●	●
To communicate the potential impacts of climate change?	●	●	○
To incorporate diverse knowledge and opinions?	○	●	●
To emphasise learning from the scenario process?	●	●	●
To develop a clear strategic direction or decision recommendations?	●	●	●
To avoid criticism for being 'unscientific'?	●	○	○
To get buy-in from traditional decision makers?	●	○	○

Box 7E: Three hypothetical case studies: Step 4 – Selecting a suitable approach

Longwater Bay Coastal Protection Strategy	City of Hollum Strategic Plan	Cocklebiddy Vision 2040
After initial discussions the core team decided that the starting point for their planning would have to be the existing information available from the scientific community about climate change and sea level rise. They therefore decided to pursue an Off-the-Shelf approach to a scenario-based adaptation process – which meant that they would take information available from the CSIRO about different likely possibilities and use that information as a building block for local scenarios. They knew this information took account of a range of global emissions scenarios which would see different effects on the climate and oceans and was the most rigorous and credible information on the topic. Their reasons for taking an Off-the-Shelf approach to scenario-based adaptation planning included that they wanted to stay focussed purely on flooding and coastal erosion which they had identified as the most significant risk from climate change faced by the council and its constituents. The council also felt that looking at what might happen along the coast as a result of climate change was likely to be very sensitive with powerful stakeholders and might open a 'can of worms'. It was therefore seen as important that any recommendations be easily backed by highly credible data that any interested stakeholder could access. The council also did not feel it had the time or resources, at least at this stage of the project, to conduct a more intensive investigation process which might involve canvassing community views on sea level rise implications and what council should be doing.	A Tailored Exploration approach was seen as the only method that would allow the stakeholders to synthesise the complex and interconnecting factors shaping the region and do it with enough rigour to result in a strategic plan with a clear set of directions for planning and action.	The Tailored Visioning approach was clearly the most appropriate since it would deliver a positive future vision – one of the initial proposals. It was also seen as a process that could explore community needs and met the widely held desire for a bottom-up approach that would result in an inspiring picture of the future.

STEP 5 – Identify stakeholders and design the process

Once an approach has been chosen, the lead organisation can begin designing the process. At this step practical issues, such as setting time frames, allocating resources and developing team composition, are formalised. This step is clearly highly context-specific and will depend on the aims and approach chosen, the resources available and the type of stakeholders that need to be involved. The following issues are important to consider when designing the process.

Numbers of participants: There is no formula for the ideal number and type of people involved in any scenario planning process. Successful scenario planning exercises have been conducted with as few as six and as many as 50 or more participants (Lindgren and Bandhold, 2009). In most cases, a small core group of participants will be involved throughout the process. This group may be three to eight people who retain most of the institutional learning throughout a scenario planning process. They will gain the most from participation and are best placed to translate learning from the scenario process into their own organisations. The core scenario team typically consists of people from the leading organisation(s) and the facilitator(s). They do not need to be the most important decision makers, but they do need to be supported by their organisations. The core team may draw

on experts, decision makers and key stakeholders for input and support at various stages throughout the process.

Participant diversity: Contrasting opinion, knowledge and opinion is central to maximising the value of scenario processes and outcomes. It is essential in a Tailored Exploration approach. Diversity of perspectives helps challenge understanding of the future and avoid 'group-think' among participants in scenario development. Diversity should be promoted early in the process by ensuring participants reflect a range of world views, roles, ages and cultures.

The role of experts and lay-persons: The mix of participants involved will also influence the legitimacy and quality of outcomes – though there can often be a trade-off. Where scenarios can affect the public (e.g. by shaping government decisions), broad public involvement can help minimise political risks and ensure outcomes are accepted by the community. However, maximising public buy-in through broad participation can undermine the value offered by expert opinion. Where 'lay' people dominate scenario-based adaptation exercises, recommended actions and strategies that result can echo short-term or individualistic needs more than experts' opinions on the extent of adaptation changes required. By contrast, where scenario planning is dominated by experts or partisan groups, [groups?] may better reflect scientific reflections of climate change risk and adaptation but produce recommendations that lack public legitimacy (Larsen and Gunnarsson-Ostling, 2009).

Key stakeholder 'buy-in': Whichever approach is taken, it is important for senior decision makers within key organisations to be highly supportive and involved in the process where possible. If scenario planning needs to inform and shape an organisation's strategies or decisions, people with responsibility to advocate, sign off or implement outcomes must be involved. This does not mean the CEO or key executives must be present at every meeting. Their presence can be limited to key points throughout the scenario planning process, while a core project group is engaged throughout. Understanding who key stakeholders are and where they need to be involved is an important part of laying the groundwork. 'Buy-in' from a wider group of participants (including key stakeholders and decision makers) is likely to be crucial where: aims and expected outcomes are defined (Step 3); drivers of change are whittled down (Step 9); final scenario trajectories are selected (Step 10); and strategic orientation and decisions are being made (Steps 13 and 16).

Process-related outcomes: Because the scenario planning process involves considerable opportunities for co-learning through engagement and exchange (Wang et al., 2007), it can provide a valuable environment for building bridges and understanding between important (and/or conflicting) stakeholders. Participant selection should therefore involve reflection about what stakeholders are likely to gain from the process and from interactions with each other.

Facilitation: unless your organisation has strong in-house skills in leading scenario planning, we recommend using a professional facilitator. Scenario planning processes need to be led by people who have well-honed skills, including in: keeping people on track without shaping opinions; fostering new ideas; managing debate; ensuring outcomes are achieved and adequate records are kept.

Further guidance on process is available in scenario planning handbooks such as those listed in Appendix B.

Box 7F: Three hypothetical case studies: Step 5 – Identifying stakeholders and designing the process

Longwater Bay Coastal Protection Strategy	City of Hollum Strategic Plan	Cocklebiddy Vision 2040
A core group of three people were chosen to take direct responsibility for the project – a project officer in the asset management group, the manager for Coastal Protection and the council's environmental planner. In addition, it was negotiated that the council CEO, the secretary of the Coast Care group, the head of the regional development board (a local resident) and two shire councillors would participate at key stages of the project. The asset management project officer was given responsibility to investigate similar processes that had happened at other councils and, as only the environmental planner had a scientific understanding of climate change, it was agreed the council would need to pay for specialist climate change expertise.	It became clear early on that a chief problem would be to manage all the organisations which believed they should be involved. Given the potential that the outcomes would be of great significance, a number of discussions were needed to clarify responsibility for the project and who would lead the process. A core team was identified, headed by a council strategic planner with scenario planning experience. Four others from across the council's planning, environment and community development areas were also involved, as were three state government representatives from planning, environment and industry development. It was agreed that external input would be sought from a scenario planning facilitation consultant and specialists in climate change, futures and strategic planning. Key organisational stakeholders and influential individuals were also identified including at least one councillor notorious for their antagonism to climate change issues. The core team also mapped relevant key decision makers within their respective departments and from these identified 12 people who would need to be involved at different stages of the process.	While the number of enthusiastic supporters was not a problem, finding the people with the necessary time and skills was tricky. Most of the people who initiated the discussions felt they did not have the knowledge or skills to do what they wanted. However, through a number of discussions at various community group meetings, five people were identified who had the skills and willingness to coordinate the process. It was also clear that a few members of the initial group were willing to provide in-kind support however they could. The mayor ensured public facilities would be free for the group to use and indicated a willingness to help fund any communication that would be required through council grants. While people involved felt a sense of urgency, no clear deadline was set. It was believed the quality of the outcome would depend on the widest possible discussion within the community and this would take time to build.

Key messages: Phase 1: Preparation

- Thorough preparation and careful design is critical to running an effective scenario planning process.
- It is important to be aware of the ways in which adaptation is framed and understood by organisations and key stakeholders involved in the scenario planning process, and the primary goals of the organisation

with respect to adaptation. Where possible, this should be clarified and made explicit.

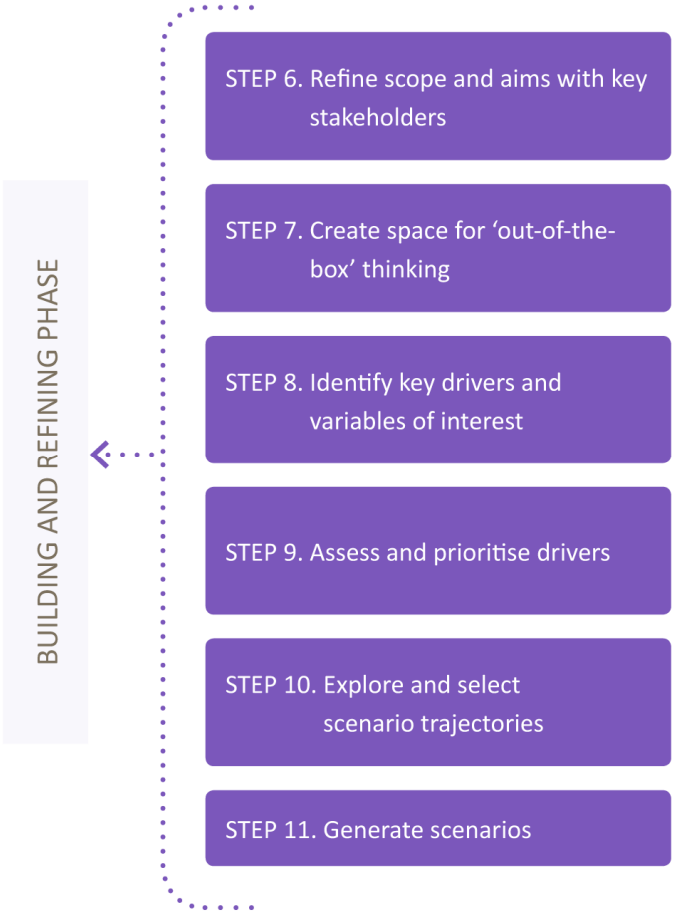
- The preparation phase provides a chance to assess whether scenario planning is an appropriate tool given the adaptation goals and organisational context. Scenario planning is particularly suited to situations involving highly complex and uncertain conditions, over long time frames.
- The aims of the scenario planning process need to be specific and clear.
- Different aims and organisational contexts lend themselves to different broad approaches to scenario planning and different design decisions.
- Elements to consider in designing a scenario planning process include: the number and diversity of participants; how key stakeholders will be involved and the roles they will play; and gathering a team of people with appropriate skills and experience to facilitate stages of the process.

7.3. Phase 2: Scenario Building and Refining

The Scenario Building and Refining phase is where scenario narratives are created. It involves the most widely recognised, practised and described stages of scenario planning. In this phase, key issues are explored and information is gathered, integrated and synthesised into coherent descriptions of the future. While this phase does not involve developing adaptation strategies or providing information directly applicable to decision making, it can deliver critical outcomes. It is during the Scenario Building and Refining phase that participants' understanding about the future and climate change can be fundamentally challenged and important learning occurs.

Figure 7E below shows the six steps in the Building and Refining Phase:

Figure 7-E: Phase 2: Scenario Building and Refining



STEP 6 – Refine scope and aims with key stakeholders

The aim of this step is to distil the general need or concern clarified in Step 1 of the Preparation Phase into an aim or decision question to be explored. The aim or question defined here frames: a) the contextual environment and geographical setting in which to explore climate change implications; b) the time frame over which issues need to be explored; and c) Where the boundaries for exploration exist. Being too narrow can mean some contextual factors are not taken into account and important issues may be missed. Being too general can mean outcomes from the Building phase have little relevance to decision making. The aim defined here can be adjusted later but must be understood and agreed on by all key stakeholders and participants.

At this step the objective, aim or decision question defined within a Tailored Exploration will be broader and less specific than one needed in an Off-the-Shelf approach. In the former, the time frame will be longer, the number of uncertainties higher and complexity greater. A very specific question or aim is therefore unlikely to add value as a frame for exploring contextual issues and will fail to capture the complex interactions between contextual drivers of change. Within the Off-the-Shelf approach the scope can and should be more specific.

Within the Tailored Visioning method, this step can be relatively short. It is intended to ensure all participants are aware of the type of future they are seeking to define. This may be expressed as an objective. However, the same issues about scope, time frame and specificity apply as for the other methods. Participants should consider who (or what) the vision encompasses and what time frame it

should describe. The trade-off here is in finding a scope that is broad and ambitious enough to inspire participants and scenario users, but not too ambitious that achieving that vision lies completely outside the scope of participants to influence (or even understand). Selection of time frame is also important; too long a time frame and the vision can lose its relevance for current decision making, too short a time frame can limit imagination. Many organisations set a time frame of around 30 years. This gives people the 'freedom' to pose and ponder ambitious change without feeling too limited by the contemporary context and apparent realms of possibility.

For Off-the-Shelf and Tailored Exploration approaches, Ralston and Wilson (2006) suggest interviewing all relevant decision makers, and those with the responsibility for supporting those decision makers. What is important for them? What do they need to know? What is relevant and what is not?

An 'Issue Tree' process can be used here to explore and refine the critical issue that should become the focus of exploration (see e.g. (Waverley Management Consultants, 2007). An advantage of this process is that it helps identify issues 'above' and 'below' the ideal scoping question. Doing this gives participants a way of tracking how closely they are sticking to the main issue of concern.

Box 7G: Three hypothetical case studies: Step 6 – Refining scope and aims with key stakeholders

Longwater Bay Coastal Protection Strategy

The core team began by reviewing their initial concern about whether climate change was affecting coastal erosion. They decided that a more refined definition of aims was needed to shape the investigation. After discussion they defined a question they felt refined the scope of investigation and would help them to ensure that outcomes were relevant and detailed enough to shape council decisions: *How can we best protect council and residents' assets from flooding, storm surges and coastal erosion over the next 15 years*? In this case, the question helped frame the investigation that followed by setting the timeframe and focussing on climate-related impacts to assets owned by the council and residents. Investigation was limited to only those climate impacts

City of Hollum Strategic Plan

At the City of Hollum a key problem was that many issues needed attention. The core team began by conducting an 'Issues Tree' exercise, first among themselves and then by asking people within their respective organisations to contribute. This helped identify the strategic concerns key personnel were worried about and felt were not being addressed. It became clear that two types of outcomes would be needed from the scenario planning process. Firstly, decision-makers saw climate change, population growth, urban sprawl, and resource and economic insecurity as building into a 'perfect storm' that people struggled to understand. Secondly, people working in the council and state governments wanted to know what preparations could be made (particularly in the spatial planning, infrastructure and community development areas) to ensure the wider community could be as prepared and resilient as possible.
From this exploration, the core scenario team identified two objectives:

1. *To ensure all relevant department heads and strategic planners were aware of the issues and implications posed by this 'perfect storm'; and*
2. *To develop a strategic plan that would include a list of priority areas for action and a list of recommended actions.*

Cocklebiddy Vision 2040

At Cocklebiddy, the five project members decided that the objective of the exercise should be as broad as possible and decided on a simple open-ended question to shape their work and trigger community discussions: *"In 2040 I want Cocklebiddy to be ..."*

A 30-year period was chosen specifically because it allowed people to think openly about the future but was close enough to ensure most suggestions would be based on a

relating to sea level rise (for example, they did not include fire, drought or heatwave risks).	At this step it also became clear that the second objective was more important for the City of Hollum than the State Government departments. It was discussed that while the State Government supported the development of a new strategic plan and would assist, it was not so interested in determining what specific actions should be taken within the council.	sense of reality.

STEP 7 – Create space for 'out-of-the-box' thinking

Much of the value in scenario-based adaptation lies in the exploration of 'new territory' and the fostering of new thinking and ideas. Without input from new ideas, scenario planning offers little value for adaptation under conditions of uncertainty. Tailored Exploration and Tailored Visioning approaches are particularly dependent on participants' creativity and their ability to step beyond 'normal' bounds of thinking (which are often created by social norms rather than physical reality). Novel thinking is important but not vital in the Off-the-Shelf approach because scenario conditions and assumptions are largely pre-defined.

Because people find it difficult to think the unthinkable, eliciting fresh ideas and perspectives requires preparation. People need to be coaxed out of their typical modes of thinking and acting. While involving diverse participants will increase the potential for an exchange of diverse opinions and ideas, specific exercises can be used to break people out of familiar thinking frameworks. One useful example is the STEEP Exercise (Waverley Management Consultants, 2007).

Box 7H: Three hypothetical case studies: Step 7 – Creating space for 'out-of-the box' thinking

Longwater Bay Coastal Protection Strategy	City of Hollum Strategic Plan	Cocklebiddy Vision 2040
The explicit need for out-of-the-box thinking was not considered by the group at Longwater Bay. However, the asset management officer had been looking at other examples of scenario processes and suggested the idea of stimulating thinking about the future by gathering a number of older residents who had grown up in the community to come and talk about their experiences of a few major storms and floods in the	Many of the people who would be involved in the scenario project at various stages were professionals with strong opinions about what needed to be done to address future challenges. The scenario team saw this as both a strength and a risk. They wanted to avoid any exploration of the future being overly influenced by the people seen as 'experts' in particular areas, which they felt might risk missing new ideas and revelations that different people and perspectives could bring. It was agreed by the scenario team that a failure to identify major unknown threats posed a bigger risk than failing to deeply understand known ones. A series of exercises were used to get people thinking in different ways and to appreciate the world as a complex system. A role-play was used where people were asked to swap their normal professional roles and act out a public meeting	The scenario team took the perspective that there was little risk of ideas lacking imagination provided participation involved the whole community and that people were clear on the types of ideas needed. To garner interest and provoke discussion, a few in the team photo-shopped an image of the town to include a number of space-age floating buildings and stuck posters of these

past. This was a useful opportunity to 'broaden the horizon' of the younger and newly recruited people in the team about the area and the history of flood problems.	on a chosen issue – the aim being for people to explore the issue from a perspective other than their own. Another was a 'postcard story' exercise where individuals were asked to draw causal links between small collections of random pictures and then discuss with others how explanations differed.	around the district with contact details and the question "How do you see Cocklebiddy in 2040?"

STEP 8 – Identify key drivers and variables of interest

This step is required to identify all variables relevant to the objective or question of concern defined in the previous step. The question that needs to be answered for all methods here is 'what forces and contextual drivers of change could influence the problem, issue or vision in focus?' It is critical at this step for participants to be uninhibited in their exploration of important factors. These should be identified at different scales and both within and outside stakeholders' influence.

There are many techniques for exploring the contextual environment. Some begin by exploring historical conditions. This helps identify issues of relevance and their past scale of volatility (e.g. (Lindgren and Bandhold, 2009, Shwartz, 1996). Others begin with the question of concern and then explore factors of influence at ever increasing scales. The key is to not get trapped into thinking that issues identified from the past will be the same as those in the future, or by missing influential issues that exist at a higher or lower scale.

In the Tailored Visioning approach, this step is focused on identifying the important elements of a desired future. This exploration should be framed by the objective identified in Step 6, but should not be constrained by expectations and assumptions of the future. This can be an important stage for engaging with the wider population of stakeholders and ensuring that relevant people and organisations are aware of the exercise and have a stake in its outcomes. Participants and stakeholders should be asked to imagine and identify any aspect of their desired future – through simple brainstorming and short-story techniques or more creative processes. Magazine pictures and even key words can be used. Try to ensure that the future is explored from multiple angles – covering key areas such as people and community, place and identity, business and employment, environment and leisure. This should not lead to the creation of whole stories; the idea is just to make sure no big gaps have occurred in people's imaginations. Prompts may be required. Once a thorough exploration has been conducted, the ideas generated should be sorted to see what themes arise.

Within the Tailored Exploration and Off-the-Shelf approaches, the idea is to identify the various elements that may define future risks and require pre-emptive or adaptive measures, but not to explore those risks or adaptations (at this stage). As a Tailored Exploration approach will have defined a broader issue of concern, uncertainties need to be more deeply explored and should be identified from different perspectives. Quantitative climate change data can be used, but this will not inform all the relevant contextual issues. Information about emissions trajectories and climate change impacts may not even be the main area of uncertainty. The limitation of quantitative data should also be acknowledged. Bear in mind that interacting uncertainties can multiply exponentially. Qualitative assessments, expert and local knowledge, diverse opinion and historical events should also be considered.

In the Off-the-Shelf approach, even though an exploration of contextual conditions will be more tightly confined, a short scoping exercise will help to identify any key drivers relevant to the issue that could otherwise be overlooked. You may wish to look at historical events and find out what happened, interview relevant experts or play with relevant quantitative models (if possible). Bearing in mind that this approach is best applied to shorter term and less complex issues, the scoping exercise would typically not identify more than half a dozen drivers (at the most) that would directly relate to the issue. So, if flood risk is a main concern, drivers may include topography, rainfall variability, urban growth patterns and the existing water management regime. If too many drivers are appearing relevant, then the scope may be too broad or the wrong approach may have been chosen.

Of particular concern when an Off-the-Shelf approach is being applied, and also relevant for Tailored Exploration, is the scale and quality of available quantitative data. In many instances, climate change projections will not reflect a level of detail specific enough for the area of focus. There may not be context-specific data in some fields at all. If this is the case there are several options: where data exists at a coarser scale this can be down-scaled – remembering that climate changes depicted in models at a coarser scale are both projections and averages. Taking average climate change statistics and adjusting local data by a similar magnitude can provide a reasonable basis for further exploration with the caveat that average change can mask significant variability. Local conditions can be orders of magnitude different from regional averages. Drawing on local knowledge or getting expert assistance at this stage should be considered. Another approach is to find data that exists for a similar region and apply it to the focus area. The same challenges apply with adequately capturing local variability.

Box 7I: Three hypothetical case studies: Step 8 – Identifying key drivers and variables of interest

Longwater Bay Coastal Protection Strategy	City of Hollum Strategic Plan	Cocklebiddy Vision 2040
The scenario team accessed CSIRO reports and climate projection data focussing on projected rates of sea level rise and storm surges. With the help of the climate change specialist they were able to refine this information to better understand the range of possibilities for sea level rise in their region over the timeframe they were concerned with. It became clear that there was no modelling or existing information at the level of detail they required that would allow them to comfortably plan for one particular local sea level rise scenario. They derived two main scenarios of what they considered 'high' and 'low' sea level rise in their region over the next 15 years that they thought would be useful to help them understand the kinds of decisions and options they should consider. While the climate change specialist was sure to remind them that new scientific reports were emerging about more extreme sea level rise scenarios than that of their 'high' scenario they felt unable to bring those reports in given it was unclear how they could say with any authority what this would look like in	At this step, scenario participants were asked to begin identifying all the drivers that would influence the council operations over the next 20 years. They began with a short analysis of historical drivers of change. A STEEP analysis was then used to systematically cover the five areas of influence specified in that framework (Societal, Technological, Environmental, Economic and Political). Finally, participants used a form of layered analysis to understand and order the drivers identified so far (and identify new ones), depending on their origin	At this step, participants in the Cocklebiddy Vision 2040 project used a brainstorming session with groups of community members to identify characteristics of a desired future. These became a diverse collage of key words, ("resilient", "vibrant", "drought-proof"), small descriptions ("a growing population of

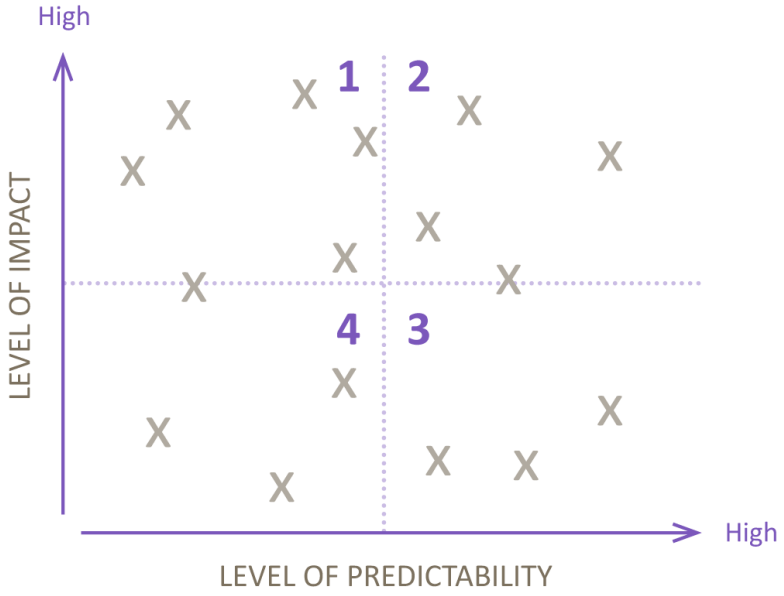
Longwater Bay in 2025. In order to get a better idea of council adaptation options, they then began brainstorming all the factors they thought were relevant to the flood and storm surge issue. They looked at local historical records and topographical maps of the area and also considered drivers that lay outside the immediate focus area (like land management in upstream catchments, rates of coastal migration and zoning laws) that could influence the flood risk. A layered analysis was also used to help frame the scale or source of the drivers.	relative to the organisation. Drivers were identified at various scales ranging from within the council itself to global spheres. Because some drivers were not well understood, the scenario team also conducted research to support this step.	under 25-yr olds", "a regional centre for excellence in agriculture") and even pictures that people thought best represented the Cocklebiddy they wanted to see.

STEP 9 – Assess and prioritise drivers

At this stage the drivers defined in Step 8 are ordered based on their level of influence on the issue of concern and their degree of uncertainty. Because scenarios are built on a small number of variables distilled and chosen in this step, the process of prioritisation strongly influences the rest of the scenario planning process.

For the Tailored Exploration and Off-the-Shelf approaches this step is concerned with identifying the variables and drivers of change that will most likely determine the success or failure of any climate change adaptation decision. The main choice here is how many variables to focus on and whether to select and explore those high-impact variables considered to be most predictable or most uncertain, i.e. a focus on factors in quadrant 1 or quadrant 2 in Figure 7F below.

Figure 7-F: Plotting predictability and impact



The advantage of prioritising variables of high predictability (quadrant 2) is that scenarios developed from them are easier to justify to external audiences and they provide greater certainty to decision makers. However, the predictability of any single climate change impact is highly contested – particularly as you begin to explore secondary and tertiary impacts. Developing scenarios exclusively

on these types of variables risks that strategic decisions will fail to account for possible high-impact developments characterised by greater uncertainty.

In contrast, a focus on the known unknowns (in quadrant 1) will allow scenarios to present a greater range of uncertain conditions that may prompt greater awareness of risks and adaptation measures. The downside of this approach is that the process of scenario generation can take longer and decision implications may be more difficult to identify and justify.

Prioritising the number of key variables is important – particularly for the Tailored Exploration and Off-the-Shelf approaches. Too many critical variables will make subsequent steps long and difficult. Some well-known scenario planning methods distil just two variables. While this can help make the process simpler, it can also leave out critical issues. A suggested range is two to seven.

Another issue people may confront at this step for both the Off-the-Shelf and Tailored Exploration methods is how to compare and rank the various scientific estimations of future climate impacts. For example, whether to follow the CSIRO climate model outputs and/or what degree and rates of environmental change should be considered.

For the Tailored Visioning approach, this step involves prioritising the characteristics that will form a future vision. This is where broad participation is required to ensure buy-in. Participants may be asked to identify and prioritise the most important aspects of the desired future.

Box 7J: Three hypothetical case studies: Step 9 – Assessing and prioritising drivers

Longwater Bay Coastal Protection Strategy	City of Hollum Strategic Plan	Cocklebiddy Vision 2040
After an iterative process of discussion and further research, the scenario team filtered out those issues that they considered less influential for determining key risks on a graph of time versus impact. The main drivers that they felt would interact with the sea level rise scenarios and would be critical to determining the type of council actions that should be taken were grouped under two themes. One was population growth and urban density. The other was the question of council responsibility which they saw as incorporating factors including community expectations of the council and the appropriate role of local government in protecting residents and infrastructure near the coast. They saw this as tied up with the degree to which guidance, coordination and leadership would be forthcoming from higher levels of government. Other issues were	The main challenge at this step was reducing down the drivers to a reasonable number. Because the scenario planning process was designed to influence the council's strategic direction for many years, the scenario team felt it more important to focus on high impact issues that were uncertain rather than those that could be predicted with greater certainty. While it added to the time involved, the scenario team found great value in having the council CEO and a number of councillors involved at this step. At the end, participants felt confident that the short list of drivers was based on a strong consensus as well as solid analysis. The five final drivers were: the degree of climate change; the rate of population growth; the rate at which oil production declined; the level of community services demanded; and	Once a wide range of desirable characteristics were identified, these 'elements' were pinned up on a wall at the Cocklebiddy Mechanics Hall. Participants in the project encouraged other locals to have a look over a period of a few weeks and score the issues they saw as the most important. Those with the highest scores were sorted into themes. In total five were identified relating to community, economy,

considered either too uncertain or did not come under the responsibility of the council.	the state of economic conditions.	environment, identity and security.

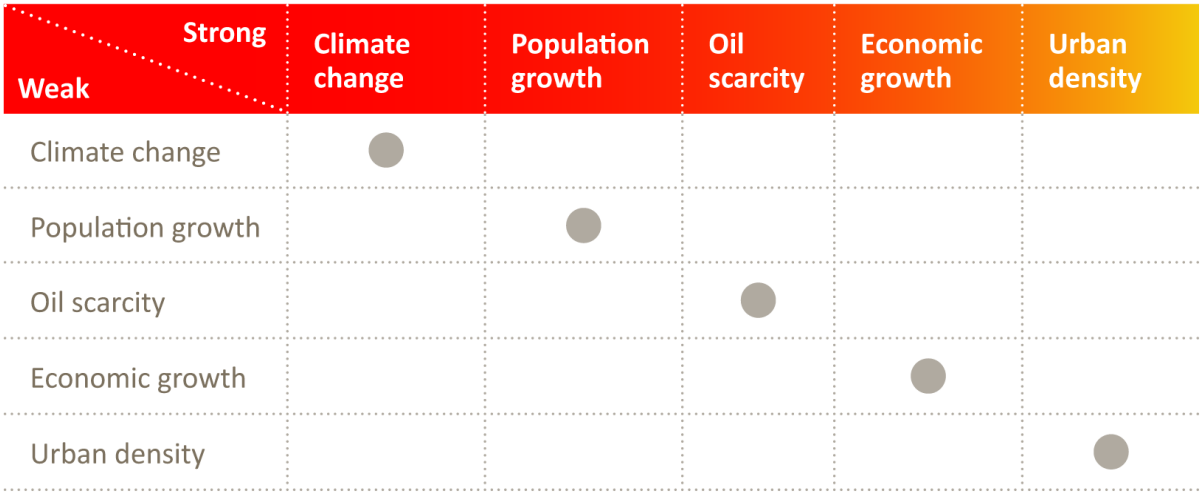
STEP 10 – Explore and select scenario trajectories

This step involves integrating the drivers and characteristics refined during Step 9 into scenario themes or trajectories, further prioritising those themes and identifying incompatibilities between drivers. The idea is to identify and test scenario 'trajectories' that may be developed further. At this point it will be clear that some drivers contradict each other within the same scenario trajectory. Scenarios that are not internally consistent or plausible will not make it past this stage. The number of trajectories will depend on the time available, the range and number of drivers and the scenario planning objectives. A Tailored Visioning approach will usually pursue only one scenario. Tailored Exploration and Off-the-Shelf approaches typically aim for three to five scenario trajectories.

At this stage, the process of creating and identifying trajectories for further exploration can be strongly influenced by participants' assumptions about the world. Letting these assumptions override or reshape uncomfortable insights can create scenario blind spots that may hide future risks. There are many ways people can let their assumptions re-shape scenarios. For example, many people are inclined to separate positive and negative drivers leading to single best and worst-case scenarios. People may also link drivers that they automatically assume go together without questioning these links (or their thinking). Others can take diverse variables and end up painting multiple scenarios that are all similar, or that diverge little from the status quo. This process needs to be carefully managed particularly within a Tailored Exploration or Off-the-Shelf approach. Within a Tailored Visioning approach, the objective is to create a scenario that is broadly inspiring so assumptions do not pose so much of a risk.

In the Tailored Exploration and Off-the-Shelf approaches, scenario ingredients should be integrated in a way that captures contrasting possibilities. This ensures that the development of adaptation strategies in Phase 3 confronts a range of plausible threats and events. Scenario planning will not be of much value if particularly unsavoury or difficult-to-imagine possibilities are ignored. One way to ensure all the basic scenario trajectories are identified is to develop a matrix with all variables plotted against each other. Variables may also be differentiated by degree or intensity as 'weak' or 'strong'. The objective of this process is to identify a limited scenario set that is highly contrasting and spans the widest range of possibilities.

Figure 7-G: A matrix of key drivers



Another method is to draw a diagram of two or more intersecting axes with each end of the axes representing a particular driver. Contrasting drivers or contrasting states of the same driver are placed at either end of the same axis. Examples could include an axis representing the continuum between a high versus low rate of temperature increase intersecting another representing the continuum between an unrestrained free-market versus a command-control economy. Any space within these axes then becomes the conceptual range in which multiple scenarios can be explored.

Alternatively, each driver may be set a 'zero' value – defined by present conditions. Values may then be explored around the zero point to define the positive or negative range by which this driver may depart from the status quo. Value ranges maybe defined arbitrarily or from quantitative projections such as IPCC models. The objective here is not to get caught making blind assumptions about the future. Test a higher number then try a much lower one. Quantifying drivers gives a tangible way of seeing whether and to what degree the selected scenarios vary from each other and from the status quo. This does not necessarily mean scenarios should combine all negative or all positive conditions – they should cover the extent of variability, not it's median.

From this point, scenario contexts can be created by beginning to describe what each of the main drivers would look within the time scale and context defined by the objective set in Step 6. Step 10 is also where interactions between the drivers can be explored – how do they affect each other? Techniques such as cross-impact analysis, which help explore how different events or conditions may interact, can be used to structure this process. Scenarios that lack an internal consistency can be ruled out. Trade-offs between positive variables may be required.

Box 7K: Three hypothetical case studies: Step 10 – Exploring and selecting scenario trajectories

Longwater Bay Coastal Protection Strategy	City of Hollum Strategic Plan	Cocklebiddy Vision 2040
The scenario team first plotted the three drivers – local population growth (high and low), council role	Because five drivers were chosen, the core scenario team spent considerable time on this step. They first used a matrix to plot the drivers against each other and systematically consider if any of the drivers could not feasibly work together.	Participants in the story-building process collected all the themes and began to

(high and low levels of responsibility) and climate change-induced sea level rise (high and low) – against each other in a three-way axis. As they discussed possible interactions between drivers it became clear that the team was very confident the population would grow no matter what. As a result, the team decided to build a matrix of four scenarios considering high and low sea level rise scenarios alongside high and low levels of council responsibility.	Doing so highlighted that for some combinations of drivers to be plausible, other conditions were also required. In other cases drivers were not compatible and these scenarios were not considered. For example, the participants agreed that a scenario combining a high rate of economic growth with a high degree of climate change could only work if India and China continued to demand high levels of Australian resources *and* be relatively unaffected by climate change, the plausibility of which was questioned by many. It was also agreed that a high rate of decline in oil production was not compatible with high economic growth. The team then plotted the drivers on three intersecting axes and chose five broad scenario trajectories that fell near the extreme margins defined by these drivers. A qualitative cross impact analysis was then conducted to consider if the five skeletons were compatible. This process considered how each driver would affect one another and if consistencies would hold over time.	play with ideas about how they could be brought together. At the end of a three - hour session, the group had identified two story possibilities. These differed mainly in the degree to which the community depended on agriculture in the future. Both of these futures were briefly defined in a series of short dot points that could communicate the key ingredients.

STEP 11 – Generate scenarios

Now that the skeletons for a number of scenarios have been created, Step 11 involves exploring these and filling in the gaps. The first task is to develop story lines. Here, the idea is to describe the meaning and reasoning behind the combination of drivers used in each scenario and their implications. It can help to think about who is affected, how they are affected and what this might trigger. This process can be done for key stakeholders or a range of hypothetical people who may be vulnerable in the community (the elderly, the young, a single parent, someone homeless). It can help to ground the make the story by covering all the who, where, what and how questions.

The second task is to build and test the internal logic within each scenario. How did they come about? Is the story feasible? For the scenarios to eventuate, what other external factors would need to have occurred. What effect would these have had on other parts of the scenario? This task also requires participants to assess the quality of the story. Does it hang together? Is it coherent and interesting enough that decision makers or members of the community can remember it (or even relate it to others)?

Box 7L: Defining a good scenario

What constitutes a good scenario depends on how it will be used. For Lindgren and Bandhold (2009), scenarios created to inform strategy must have seven key characteristics:

1. Decision making power – they must provide insights into the question or issue being considered.
2. Plausibility – all must be possible.
3. Alternatives – all scenarios must cover the widest range of possibilities while still being relatively equal in probability.
4. Consistency – the stories, processes and events must all fit an internal logic.

5. Differentiation – they must be structurally diverse, not deviations around a common base.
6. Memorability – scenarios must be easily represented, communicated and stick in people's minds after they have heard them.
7. Challenging – they must challenge people's perception of the future and how the world works.
8.

Clearly, the narrative style, detail and quality of the scenarios developed should be shaped by the objective set in Step 6. If the objective is to analyse climate change implications for a specific set of decisions (following an Off-the-Shelf approach), engaging language and creative input may not be necessary. For a Tailored Visioning approach, on the other hand, the scenario needs to be an engaging and inspiring change agent. Here, scenarios need a blend of plausibility and creativity. The quality of the narrative will affect how well it is received by stakeholders, who buys into the story and how much effort people put into making that scenario a reality. In this context it can help to get a professional creative writer to assist in the creation of the scenario and to test the story under development with the community it seeks to inspire.

Scenarios may need to serve multiple purposes under a Tailored Exploration approach. Clever narratives about climate change and its implications can be powerful engagement and communication tools, as well as decision aids. In this context, narratives will need to be highly plausible, but also conceptually challenging. Level of detail is also important and should match the objective set in Step 6. The level of detail conveyed in a scenario will need to reflect whether it will be used to educate, develop a new strategic direction or shape specific decisions.

Box 7M: Three hypothetical case studies: Step 11 – Generating scenarios

Longwater Bay Coastal Protection Strategy	**City of Hollum Strategic Plan**	**Cocklebiddy Vision 2040**
Fleshing out scenario descriptions was left to the asset management officer who engaged other members of his team and council strategic planners. The climate change consultant and other key decision makers identified at the start of the project including the Coast Care and regional development representatives were also consulted periodically. Each of the four scenarios came to include a short description of the future with a GIS-based projection of coastal flood risk that was mapped for the area with key council assets and potential decisions identified. Given that the scenarios were intended to help inform the development of strategic adaptation options, it was not seen as necessary to fully develop the storylines for each. Instead they were left in raw form with maps and graphs that could be understood by the council planning team and managers. They were given shorthand names:	The scenario team developed five narratives: • ***Big brother*** – where significant economic and climate disruption left the area isolated, crime-ridden and with high rates of depression. • ***Big family*** – where strong growth in bottom-up initiatives in response to climate change sees a reduced role for state government and rapid growth in the domestic informal economy. • ***Winner takes all*** – where a growing population outstrips faltering economic growth leaving a growing inequality gap and deficit in services delivered. • ***Swiss army LG*** – where communities increasingly demand specialist knowledge and capacity building from local government in response to growing crises. • ***Arakis Hollum*** – where the response to climate change and global	A single story line was prepared by a local journalist with support from the scenario team. This came to several pages. The story was widely circulated and a competition set up to encourage people in the community to prepare visual images representing what they liked in the story. Some of these ideas were taken and further developed by a local artist and graphic designer

• *Rough waters*: High sea level rise/High council responsibility; • *Sink or Swim:* High SLR/Low council responsibility; • *Control the flow:* Low SLR/High council responsibility; and • *Smoother Sailing* Low SLR/Low council responsibility – which were useful for the team to communicate with each other.	economic disruption is a highly sophisticated development of local hi-tech industrial 'enclaves' with economic deserts in between. After creating the scenarios, the council asked the CSIRO, a planning consultancy and the state planning authority to assist with a quantitative assessment of the scenarios.	to become a final suite of images that accompanied the story.

Key messages: Phase 2: Scenario Building and Refining

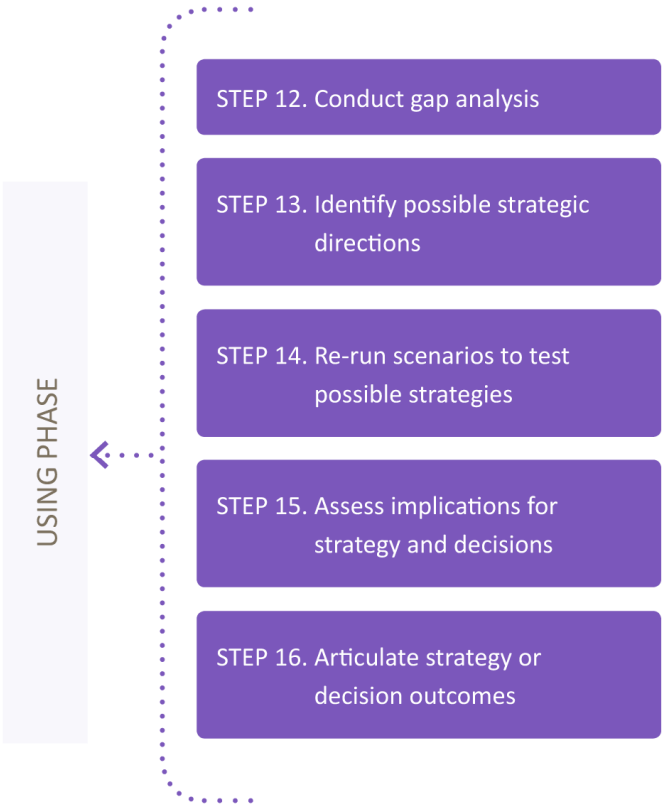
- The most widely recognised, practised and described stages of scenario planning take place in the building and refining stage.
- Participants in the scenario building process need to begin this stage with a clear, shared understanding of the scope and aims of the scenario planning process
- Scenario planning techniques are known to be particularly valuable for fostering new ideas and thinking about a range of future challenges. It is important that participants in scenario building are encouraged to 'think the unthinkable' and break away from ingrained modes of thought.
- Scenario building involves first identifying key drivers of change, then assessing and prioritising which drivers are most important and most uncertain. These steps are often part of an iterative process, drawing on diverse sources of information.
- Possible scenario trajectories can then be developed by considering different interactions between prioritised drivers of change and selecting a set of combinations each of which are internally consistent.
- Finally, scenarios are generated from the selected trajectories. The scenarios can take many forms from technical outputs such as graphs and maps with short descriptive storylines to creative narratives, images, films and designs.

7.4. Phase 3: Using Scenarios

Once a set of scenarios has been built and refined, they can then be used in a variety of ways. The third phase in this integrated methodology includes several steps for using scenarios in the context of informing strategic planning and decision making. It is important to highlight, however, that scenario planning processes in practice do not necessarily use the scenarios to inform decision making, at least not in a formalised way. Rather, it is quite common for a scenario planning process to end with the publication and communication of a set of scenarios that have been built, without a commitment or intention, to undertake a structured method of analysis and integration into organisational strategic planning.

Explaining and disseminating a tailor-made set of scenarios can be useful in and of itself. The communication of results from a scenario-building exercise can also be a primary aim in some situations. However, in many cases it is desirable that the set of scenarios created be used to influence strategic planning and decision making. Phase 3 of our methodology is concerned with translating insights gained from the Scenario Building and Refining phase into 'decision-ready' strategies and recommendations. Here, the scenarios created in Phase 2 are used to text existing strategies, define new ones and develop adaptation pathways, decision trigger-points and new areas for exploration.

Figure 7-H: Phase 3: Using Scenarios



STEP 12 – Conduct gap analysis

This step involves a comparison between current organisational conditions and the areas of adaptation required for each scenario. As a result of this step, the scenario team should have identified key issues, risks and success factors that stakeholders need to be aware of, plan for, and potentially address as a result of climate change. Participants should also have a clear understanding of the scale and nature of adaptation required for each scenario. Because this step is the first to directly interrogate scenario implications, it is likely to raise significant unknowns within those scenarios, some of which may pose important (and tricky) questions for the organisations involved. These questions may trigger further uncertainties. To minimise getting distracted by new concerns, this step must be kept within the remit of the objective identified in Step 6. However, all relevant unknowns should be recorded for further analysis and research. In a worst-case scenario, this may prompt the lead organisation to revisit its original objectives and review the process to this point.

For Off-the-Shelf and Tailored Exploration approaches, we suggest first interrogating the future state described in each scenario. Then identify what characteristics would enable successful adaptation to the conditions described – remembering that adaptation may involve capitalising on new opportunities. Depending on the objective, characteristics considered might include skills, infrastructure designs, assets, functions, relationships, mind-sets, values or the whole organisations' strategic orientation. If there are multiple stakeholders involved, consider what the scenarios would mean for each of them. Where possible, identify characteristics that are essential and those that are less important.

Next, participants analyse how existing characteristics compare with those required for successful adaptation and consider what is missing and what is different. Even where an organisation appears to have the characteristics needed in each future scenario, participants should consider how those characteristics might need to be adapted under different conditions. The desired characteristics may vary in their significance and be more or less easy to build or change. These questions will be explored further in Step 13; the purpose of Step 12 is to identify all scenario-specific gaps, needs and opportunities, not to describe a trajectory of change. There are specific techniques, such as SWOT or TOWS analysis, which can be used to structure this step in a formal way. The TOWS process is certainly more rigorous but also time consuming (see e.g. (Weihrich, 1982).

The main difference between an Off-the-Shelf and Tailored Exploration approach in Step 12 will be the scale and level of detail explored. In an Off-the-Shelf approach, this step may result in differentiating between existing capacities, assets and management processes and those required for each scenario. Under a Tailored Exploration approach, this step may result in the whole organisational direction coming under question and attention being given to a new one. As with preceding steps, the objective defined at Step 6 should frame this gap analysis.

In the Tailored Visioning approach, the objective of Step 12 is slightly different. Rather than focus on the deficiencies within existing conditions, the aim is to identify prerequisites and enablers for the ideal future. As above, the idea is not to identify a trajectory but the tangible functions and building blocks upon which the future vision is based. These need to be specific enough that they allow the creation of a transition pathway that leads from what exists to what is desired.

Box 7N: Three hypothetical case studies: Step 12 – Conducting gap analysis

Longwater Bay Coastal Protection Strategy	City of Hollum Strategic Plan	Cocklebiddy Vision 2040
In conducting the gap analysis, the core team found that across all four scenarios the main changes required in the council's operations related to the nature, cost and extent of coastal maintenance and the level of community understanding of climate change implications along the coast. Furthermore, some form of change to planning zones would be required within the two high sea level rise scenarios.	The council realised that it would face significant challenges no matter what scenario eventuated. In some scenarios, it became clear that the council would not have the resources to provide the current level and breadth of services. A triage system would need to be developed to identify and wind-down some existing services. Another key challenge was how the council would successfully educate the community about the challenges faced and manage people's expectations. This highlighted that a key task was to identify and monitor indicators that would show when scenarios were emerging. This would trigger a particular response. As a result, the council realised that more diverse skills were needed, particularly in community engagement.	The scenario team spent considerable time identifying a series of steps and enabling factors for the future vision to be reached. These were ranked in order of preference and impact and then colour-coded to indicate which of the factors were inside or outside the influence of the community. In some cases, multiple factors had the potential to bring about a desired outcome. The scenario team then went to a broader group of stakeholders to hear their perspectives on the factors identified and find out whether they agreed with the way these had been categorised. As a result of this process a number of factors that had been considered completely outside the community's influence were shown to lie within the sphere of influence of a number of people and businesses in Cocklebiddy. The discussion with the stakeholders also considered a number of barriers to progress that lay outside their sphere of influence to see if alternative enablers could be identified.

STEP 13 – Identify possible strategic directions

By now, participants will have identified some of the key demands that the organisation will need to cope with, capabilities it will need to develop, and risks and decision trade-offs it faces. Opportunities may have also been identified.

For the Off-the-Shelf and Tailored Exploration approaches, Step 13 requires participants to propose and develop suitable strategies in response to those risks, trade-offs and opportunities – rehearsing for future conditions. In particular, this involves systematically answering questions A, B and C below for each scenario. It is important to note that while this stage does require necessary adaptations to be identified, it does not require the creation of an adaptation blueprint. Before we get to this (Step 16), adaptation options will be more thoroughly tested. For the Tailored Exploration approach, Step 13 involves identifying key stages and decisions along a pathway that leads to the desired future. It is vital for key decision makers to be involved at this step. Ideally, the issues and questions considered here should be understood and carried out in the context of the organisations' normal strategic planning processes.

A. What does the organisation need to do to minimise the risks and take advantages of the opportunities it will face in each future scenario?
Strategic responses will depend on the range of climate change threats and opportunities in any context. While there are an infinite number of issues requiring adaptation, there are just a few main approaches for successfully dealing with strategic challenges. These approaches are neither specific

to climate change, nor mutually exclusive. Strategic options can overlap and change over time. The following five approaches are taken from work on strategic scenario planning (Marcus, 2009) .

- **Best bet options**: Here, decision makers take a punt on a particular set of future conditions occurring. This is a high-risk approach to be considered where confidence in future conditions is overwhelming (i.e. short-term, low complexity problems). It is the approach least likely to arise from an investigation of climate change implications and scenario planning in general, and most aligned with more conventional decision aids (such as cost-benefit and sensitivity analysis). This type of response can be legitimate, but if it arises it should raise questions about whether group-think has influenced the process or if scenario planning was the wrong tool for the job. However, in some cases, best bet options may simply relate to a minor decision positioned within a range of broader strategic decisions.

- **Robust strategies**: This is where an approach or decision is selected that provides the best outcome across all future contingencies. Such options are ideal, but can be difficult to identify. They are also often expensive, which can involve a high level of risk if something has been overlooked and all contingencies have not been analysed.

- **Delay and assess**: In situations where too much uncertainty exists, an organisation may seek to clarify unknowns or wait to see what occurs. In the context of climate change, this will always be tempting. If this path is taken, scenario planning participants will need to be honest about why. If reasons relate to a hesitancy to take an unpopular decision, or an unwillingness to face uncomfortable truths, this option is likely to exacerbate the risks an organisation already faces from climate change. However, in some situations, this option may be the best choice, provided it is coupled with steps to actively fill whatever knowledge gap inhibits commitment, and to monitor external conditions that would force a decision to be made.

- **Commit with fall-backs**: Organisations may commit to one path but have the ability to change tack if required. This is perhaps the best pathway in uncertain and changing conditions. The downside of this approach is that commitments often create path-dependencies that make subsequent changes difficult. This option may make the most sense if coupled with awareness about possible resistance to change at later stages and where decisions do not involve large financial investments.

- **Shape the future**: Some organisations may feel that the only secure way to meet climate change is to 'take the bull by the horns' and commit to a path of radical climate change adaptation. This approach may be taken when all alternatives seem equally uncertain and a decision needs to be made, or when the momentum of change is seen as an important ingredient in generating further adaptation. This approach is what the Tailored Visioning approach to scenario planning does from the beginning but it can also arise from an Off-the-Shelf or Tailored Exploration process.

B. What decisions would need to be taken and who would be responsible for those decisions?
This stage involves moving from broad strategy to specific decisions. These should not just plot out the steps that need to occur, but should identify the people who would be responsible and impacted on at different stages, the appropriate time-scale over which those decisions would occur and the resources required.

C. What conditions would trigger those decisions?

The final process in Step 13 is developing an understanding about when key decisions need to be made. Indicators from internal and external conditions should be identified, which (if they occurred) would enable decision makers to know:

1. If one of the scenarios (or key features of it) is becoming a reality.
2. What strategic orientation to pursue.
3. When to take key decisions within each strategy.

Under a Tailored Visioning approach, the objective at Step 13 is to clarify the decisions and conditions needed for the desired future scenario to occur. It is important to recognise that while the Off-the-Shelf and Tailored Exploration approaches involve repeated reality checks, Step 13 presents the first serious reality check within the Tailored Visioning approach. This step should not be rushed.

The first task here is to identify a transition process by casting forward from the present day or back-casting from the future. Sometimes, doing both can help. Where a highly ambitious climate change adaptation scenario has been created, back-casting has the advantage of avoiding any initial focus on barriers to change. These barriers can often be so ingrained in the way we think that it is difficult to start imagining a change process that overcomes them (at least in a feasible way). These barriers can be addressed once other aspects of a transition pathway have been identified.

In a back-casting process, participants begin by imagining a number of pathways that lead from the desired future to the present. The more pathways, the more options people have to achieve the scenario imagined, but the more time this stage will take. A key challenge is to develop pathways that are grounded in plausibility; they do not rely too heavily on external forces or assume unrealistically favourable conditions. Pathways tend to start fairly skeletal with prerequisites closest to the future state being identified first. Once these are identified, subsequent prerequisites can then be defined. These could take multiple forms – for example, key stakeholder decisions, regulatory changes, technical innovations, investment choices or even environmental disasters or events. While there is a tendency to define discrete alternative pathways between the future and the present, it is important to consider how transition pathways can depend on both common and separate requisite steps. This is particularly crucial when considering the type of changes in the external environment that could influence the best pathway to take. The more detail that can be gathered about major steps in the transition the better.

After a sequence of decision steps has been identified, the next stage is to identify the types of conditions and responsible agencies that would enable or prevent decisions and prerequisite stages within the transition pathways.

Box 7O: Three hypothetical case studies: Step 13 – Identifying possible strategic directions

Longwater Bay Coastal Protection Strategy	City of Hollum Strategic Plan	Cocklebiddy Vision 2040
At Longwater Bay, the team decided that the best option would be to recommend that council combine a 'commit and fallback' strategy with regard to securing the coastal cliffs, and a 'robust approach' when it	Due to the high level of uncertainty and complexity that the City of Hollum faces, the scenario planning participants identified that the council, related state government agencies and the Hollum community needed to develop a system (leading to a culture) of ongoing adaptation. Furthermore it was seen	The scenario team mapped out all the steps between the future state and the present on a long roll of paper. Key enabling factors were marked at each step. Where alternative steps existed, these were also noted. Links

comes to defining planning zones for new development. In the first case the council decided that using riprap (rubble) to shore up the coastal cliffs was a reasonably low cost option but one that may not be totally effective over time. In this case, the team thought that the next option would have to involve council assisting a gradual re-location inland. However, this next option would have serious feasibility problems that they would need to be prepared for. In order to reduce future costs of relocation, the council would also have to limit additional building and reduce its investment in high-cost infrastructure (mainly roads) within a 400m coastal zone.	that decision-paralysis in the face of complexity posed a big risk and that waiting to identify clear trends was probably the worst option the organisation and other stakeholders could take. Therefore, it was believed that the council needed to develop a highly pro-active 'shape the future' type strategy as an overall orientation. Reflecting this, the council saw a need to commit to the development of local energy, food and water production capabilities with active engagement in lobbying for state and federal policy changes. In practice, a combination of all five types of strategic options would be needed at different scales within the organisation and over time. The next steps would need to involve drilling down into tasks, identifying additional relevant stakeholders and beginning to map out specific points or conditions under which decisions would need to be made - or 'decision triggers'.	were then made between steps and important processes occurring between steps were identified and briefly described. Major decisions points were highlighted. The story was then again checked with key stakeholders in the wider community. More details were filled in, with special attention given to critical events and key people who held decision making power or might be able to capitalise on opportunities. This then enabled the stakeholder team to begin to see how their different local organisations and businesses might begin to work together (or work together differently) at different stages in the future.

STEP 14 – Re-run scenarios to test possible strategies

Step 14 involves an analysis of the scenarios and transition pathways (in the case of Tailored Visioning), now that strategies and decisions have been identified and developed. This is a critical iterative step that is often ignored within scenario planning exercises. It acts as a testing process to explore what effect the proposed adaptation strategies and decisions will have and how well they stack up against the conditions in each scenario. The key is to remember that the first time the scenarios were created, they did not factor in organisational adaptation. With the adaptations now defined, these should be considered as adding a new layer of uncertainty into the scenarios.

At this step, for Off-the-Shelf and Tailored Exploration approaches, the scenario team would re-incorporate the proposed decisions and strategies back into the original scenarios. By re-running the scenario process with adaptation decisions as new inputs, participants should be able to ask: Are the proposed adaptations feasible? Will they work in the way we expect? Could they have unintended consequences? Under a Tailored Visioning approach, this step may be considered valuable but optional. It can help to re-consider pathways to achieving the future vision in chronological order and may identify key gaps missed so far.

Box 7P: Three hypothetical case studies: Step 14 – Re-running scenarios to test possible strategies

Longwater Bay Coastal Protection Strategy	City of Hollum Strategic Plan	Cocklebiddy Vision 2040
The scenario team went back to their original scenarios and looked at the adaptation responses they had developed. They drew a short chronology for each scenario and against this plotted the adaptation options. This helped demonstrate how some of the decisions might impact on the evolution of the different scenarios. For example, the decision to use riprap as a sea wall seemed a 'no-brainer' as an interim step. But when included in the exploration of what could happen, some in the scenario team saw a possibility that this action early, could give residents the misleading impression that the council was largely responsible for preventing coastal cliff erosion – something they wanted to avoid unless guaranteed funding could be found. Potential also existed for residents to be divided on the issue, with those near the coast supportive and others more critical of the loss of beach amenity. Longer-term changes also threw up new issues. It was originally acknowledged that any decision to re-zone along the coastal strip was likely to annoy key stakeholders but on a second assessment, the team recognised this might have a noticeable impact on the council's projected population and income from rates. Some people in the team even suggested a strong regulatory hand might drive residents to move elsewhere. Actually thinking about what impact a re-zoning might have also raised questions about the response of other stakeholders. What was the role of state government? Would they challenge such a decision? Could the retirement home owners put up a legal challenge? With these new questions raised, the scenario team recognised they needed to review their original strategies and decisions.	When the core scenario team reviewed the scenarios in light of the strategies proposed by the larger scenario group it was clear that, in their enthusiasm, key assumptions had been glossed over. In one scenario, problems with food security were addressed through major projects to promote local food production. However, little thought had gone into how this might work when (in the same scenario) population growth was quite high meaning space would be at a premium. Furthermore, no one was clear on the amount of food that would need to be grown to address food shortages imagined. The scenario team felt that the proposed strategy had merit but needed careful consideration – particularly in how to balance competing demand for urban space. In another scenario, the council needed to play a larger role in service provision, auditing and policing. Initially, the scenario participants had assumed a large rate-paying population would compensate the additional funds needed, but this turned out to be highly questionable because the same scenario had predicted high unemployment. In yet another scenario, a significant restructure in a state government department was assumed necessary in order to work more closely with the local government in service provision. This was considered a challenging proposition but one that was justifiable given the scenario conditions. Incorporating this action back into the scenario made it clear big assumptions had been made about how quickly that re-structure could occur. In fact, to take that path, a decision on a re-structure was probably needed within five years. This finding made the scenario team realise how much relevant capacity was lacking and current resources needed to be dedicated to better monitor the possible development of this scenario.	When the scenario team went through the process of vision creation in chronological order they identified a number of assumptions and gaps in thinking that had not yet been considered. At this step, the team also asked a few external stakeholders to review the process. This helped identify two stages where significant and rapid change in the community had been brushed over and needed further thinking through and better articulation. This exercise was also valuable in identifying steps in the story that were less attractive and would need to be communicated carefully and with additional explanation.

STEP 15 – Assess implications for strategy and decisions

At this step, participants need to evaluate the findings from Step 14 and consider whether proposed adaptation strategies are as effective as they need to be, or if some need to be dropped, re-worked or prioritised. This can be done by systematically exploring:

- **the long-term consequences of each strategy:** How do the outcomes of the adaptation strategy developed stack up against the objectives defined in Step 6? If they don't, why is this? Perhaps the objectives were wrong or perhaps key stakeholders have made a political decision to ignore those objectives. What does this mean?
- **the strategies more likely to deliver the types of outcomes desired across a broad range of climate change scenarios:** Strategies that pose a win-win outcome are obviously more attractive than those containing inherent risks. Consider which strategies were more robust against multiple contingencies.
- **the strategies and decisions least likely to put the organisation and its stakeholders at risk:** Issues to consider here include negative impacts that may arise from an adaptation strategy. High political risks, large debts and path-dependencies may all pose a problem.
- **the strategies and decisions that best match the long-term goals and aspirations of the stakeholders:** Even where a strategy may meet the objectives of adapting to climate change, there may be unwanted consequences for the organisations or region involved. Are there on-going management challenges created by a strategy? Do people want the proposed future?

Box 7Q: Three hypothetical case studies: Step 15 – Assessing implications for strategy and decisions

Longwater Bay Coastal Protection Strategy	City of Hollum Strategic Plan	Cocklebiddy Vision 2040
Upon review of their initial recommendations, the scenario team still decided that stone riprap was the best short-term option to protect the coast. However, they also agreed that it should be used sparingly and combined with a strong emphasis on community engagement. Some saw the riprap as an opportunity to raise awareness and educate the community about the risks posed by climate change and also highlight the fact the coast was constantly changing due to natural erosion. This message could be presented in a way that emphasised that the council would take necessary steps to slow this process but that it could not hold full responsibility for stopping coastal erosion.	The key lesson from the previous step was that adaptation options considered for each of the five scenarios were even more complex than initially conceived and involved very difficult (and potentially controversial) shifts in council operations. However, despite shifts in the timing of enacting decisions, and a greater emphasis on monitoring of contextual drivers and community engagement, few changes to the strategies were needed. If anything, the review of adaptation responses relative to the original scenarios at this point made the scenario team more committed to implementing change early rather than waiting for the future to dictate a response.	The process of going backward and forward to different community members to discuss the community vision and the sorts of steps it would require to achieve it had given the scenario team confidence that the vision could now be 'unleashed' on a wider audience. By that point, many community members were aware of the project and were keen to see what would come of it. The scenario team had to keep reminding themselves that the vision was necessarily incomplete and needed to be out there being discussed and seen as relevant in the broader community in order to be of any significance.

STEP 16 – Articulate strategy or decision outcomes

This final step involves adjusting the proposed strategy based on lessons from Step 15, and ensuring final outcomes from the whole scenario planning process become meaningful and active. Where considerable changes to decisions or strategies have been made in step 15, the organisation may wish to repeat Steps 14 and 15 before focusing on this step.

It is important that significant time gets dedicated to conduct step 16. The results may have been produced on paper but the critical test is how they get used. It is vital that all the important stakeholders that have come on-board during various stages of the process are involved in deciding how best to use the material produced and how to build on the momentum generated. Ensuring the scenario planning outcomes don't become a dust collector will depend heavily on context and ownership. At this step, the scenario team should be trying to ensure insights and recommendations developed in the process are acknowledged and acted on and any areas of continued uncertainty are given further attention. Organisations should seek to embed the scenario planning outcomes by developing a series of aims, objectives and action strategies that are integrated into day-to-day operations.

As emphasised in the preparation phase, integrating learning and outcomes into current decision making processes and getting senior position and decision makers on board is critical. The more preparation leading up to this step, the easier the scenario process and outcomes will build into existing organisational processes. Articulating the outcomes and implications from the process to people not involved can also be valuable. Communicating the vision, strategy or decisions defined in the scenario process can take different forms depending on the intended audience, process aims and level of detail achieved.

Box 7R: Three hypothetical case studies: Step 16 –Articulating strategy or decision outcomes

Longwater Bay Coastal Protection Strategy	**City of Hollum Strategic Plan**	**Cocklebiddy Vision 2040**
At this step, the scenario team presented the findings (along with the maps produced) at a series of internal meetings with council managers and councillors. Following this, the CEO and asset manager agreed to a list of steps that could be taken within the following financial year. Changes were made to the way coastal erosion was monitored and additional time was given to the planning team to identify areas where development should be encouraged and discouraged over the coming years. The scenario team made it clear that a lot of questions had been raised during the process that would be ongoing challenges for the council. These included the need to work out how to incorporate longer-term climate change projections – noting that the CSIRO had information out to 2100 – into decisions about bigger infrastructure projects with long time horizons and the need for council to be	At this step, the CEO of the City of Hollum and the heads of strategic planning, community services and innovation decided to instigate strategic planning exercises for departments identified as key players within the scenarios. This worked relatively smoothly because key department personnel had been involved throughout the scenario process. Due to a lack of funding, the main challenges lay in identifying where existing activities could be adjusted in ways that best aligned with the	For the Cocklebiddy community, this step involved a series of community presentations and discussions hosted by the local school, church, footy/netball club and other community groups. These were advertised by the local newspaper and partly funded through public fundraising, business and council donations. From these meetings, an enthusiastic group of committee members were identified to continue the work of promoting the vision and coordinating the

advocating for clearer guidance from other levels of government. They also suggested that other areas of council operations be engaged in similar adaptation planning to ensure that emerging risks from climate change (beyond sea level rise) were being explored.	scenario planning recommendations and identifying new sources of revenue that would support the greater monitoring and community engagement programs needed.	development of business, community and community linkages necessary for the vision to succeed.

Key messages: Phase 3: Using Scenarios

- Once scenarios have been created they can be used in many different ways. Scenario planning projects often end with a set of scenarios which constitute valuable communication tools, but may not be easily integrated into decision making processes.
- This methodology focuses on how scenarios can be used to inform organisational strategic planning and decision making.
- Once scenarios have been developed the current level of preparedness of an organisation to cope, adapt or respond under each scenario can be explored. This process can highlight the options for actions or changes that may be required today in order to avoid or improve preparedness to deal with future possibilities.
- The organisation needs to develop and choose between different strategic options, for example, 'best-bet options' or 'commit with fallback' strategies. At this step, a set of adaptation decisions can be mapped out and information collected about who is responsible for making the decision, the time-scale and resources required and the conditions under which different decisions might be triggered.
- The decisions identified can then be considered against, or 're-run' through, the original set of scenarios to assess the possible implications of each. This is likely to be an iterative process which can lead to different conclusions about the best recommended actions.
- Finally, the recommended actions or decision outcomes need to be articulated. Depending on the context this can be formalised as an adaptation strategy or action plan or it can take the form of presentations or discussions in which ideas and recommendations arising from the scenario analysis are shared with others.

7.5. Embedding scenario planning in organisational practice

The above integrated methodology outlines a generalised process for using scenario planning to assist with climate adaptation objectives. It is clear, and cannot be emphasised enough, that the organisational context in which the process takes place will determine whether many of the steps are able to be followed, and if so, how successfully. For example, depending on the level of support and resources available, the steps may take days, weeks or months and may be more or less aligned with other organisational strategic planning practices.

It is also clear that, depending on their particular context, there is a range of political and practical challenges facing climate change adaptation policy makers and planners in utilising scenario planning methods. There are, nevertheless, different options for realising benefits from scenario planning techniques or scenario 'thinking' that could be applied in different contexts and settings. Scenario-based exercises can be undertaken in a relatively informal way in situations with limited resources and with limited organisational support. For example, a person with limited resources may organise a discrete scenario visioning exercise to be run as part of a meeting or workshop with colleagues or stakeholders.

Where there is limited organisational understanding of the value of scenario planning and support for its use, there may be opportunities to 'make the case' for using scenarios to improve robustness of decision making, for example, by presenting examples of successful or innovative scenario planning approaches being adopted by others. Where there is much greater understanding and support for scenario planning, opportunities could arise to integrate or embed scenario planning techniques as part of whole-of-organisation strategic planning, including designating ongoing responsibilities to a 'scenario planning for climate adaptation' team. Such a team could ensure tailored exploratory or visionary planning processes could be followed through as intended – allowing for full benefits of the idealised scenario planning model presented above.

8. Summary of conclusions and future priorities

In this section

→ About this chapter

→ Key findings: How is scenario planning being used to support climate adaptation in Victoria?

→ Maximising the potential for scenario planning to inform and support climate adaptation decision making

→ Towards an integrated step-by-step methodology for using scenario planning to improve climate change adaptation.

→ Future policy and research priorities

8.1. About this chapter

The aim of this research project and report has been to strengthen knowledge about the use of scenarios and scenario planning as tools for climate change adaptation decision making, drawing on the recent experience of Victorian climate adaptation policy makers and practitioners. This chapter summarises the key findings of the research, leading to a suggested set of principles and steps for maximising the potential of scenario planning for climate adaptation. The chapter concludes with some suggestions about future policy and research priorities.

8.2. Key findings: How is scenario planning being used to support climate adaptation in Victoria?

Key findings from analysis of the recent experience of Victorian climate adaptation policy makers and practitioners using scenario planning to inform and improve climate adaptation outcomes include the following:

1. Scenario planning processes and outputs are frequently and effectively being used in Victorian – and in other Australian and international – jurisdictions as a tool for engaging stakeholders and for building shared understanding of climate change risks, challenges and priorities. There is also a range of positive examples of the use of scenario planning to strengthen the capability and resilience of organisations and communities.

2. The use of scenario planning as a tool for deciding on and implementing specific climate adaptation policy options and investment pathways remains more problematic. The 'holy grail' for many policy makers continues to be the ability to make firm, confident predictions about the likelihood of future climate trends and impacts. This commonly leads to a preference for scenario planning approaches at the more predictive end of the spectrum, often combined with other modelling, cost benefit and forecasting techniques. The risk, however, is that policy makers will place too much faith in the predictive capacity of such techniques, leading to erroneous or maladaptive policy and investment choices.

3. Key variables upon which scenario planning processes for climate change adaptation differ include:
   - broad purpose or adaptation goal, including, which adaptation challenges, at various stages of understanding, planning and implementing, are being addressed and the relative emphasis given to scenario planning process (learning, relationship building) as opposed to outputs (influencing a decision, making an argument);
   - sources of information – for example, whether qualitative, quantitative or both, whether expert knowledge is emphasised;
   - scale of focus and linkage between scales – for example, is the starting point global climate change model outputs which then need to be down-scaled or is it local community-based assessments of vulnerability and adaptive capacity which then need to be integrated with other information or scaled up?
   - scenario characteristics;
   - participation in scenario development;
   - intended scenario audience and communication.

4. The range of scenario planning approaches and methods currently in used in Victoria include:

- Off-the-Shelf climate change scenarios used as inputs into climate change adaptation planning;
- Off-the-Shelf climate change scenarios combined with other trend-based data (such as socio-economic projections, water, food, electricity demand/supply projections) to produce more context-specific scenarios, which are then being used as an input into climate change adaptation planning;
- Tailored exploratory scenarios being built through a process of understanding and prioritising a wide range of drivers of change;
- Tailored visions being built through an exploratory process, which leads to the identification of more desirable futures and points to drivers which are leading to unsustainable or untenable future conditions;
- Tailored visions being built through a process of setting a goal for the future (e.g. 'a sustainable, carbon neutral community by 2050').

5. Problems and limitations frequently encountered in using scenario planning for climate adaptation include:
   - lack of shared framing of the aims and scope of climate adaptation. This includes the challenge of ensuring shared understanding of aims and assumptions at all levels of the organisations involved;
   - lack of shared framing of the aims and scope of scenario planning, particularly the distinction between predictive forecasting and scenario planning;
   - lack of clarity about the aims and outcomes of the specific scenario planning project;
   - failure to gain initial buy-in and support from all relevant decision makers and stakeholders;
   - limited organisational preparedness to allow or encourage broad engagement with the full range of scenario drivers and pathways;
   - constraints on developing or incorporating out-of-the-box perspectives;
   - problems in designing and implementing scenario planning processes. This includes problems in effectively engaging all relevant stakeholders, decision makers and audiences;
   - problems in ensuring that the range of scenario drivers and outputs are sufficiently broad;
   - problems in accessing and analysing relevant data, including data and evidence needed to inform development and prioritisation of scenario drivers;
   - Difficulty in integrating knowledge from different fields or disciplines;
   - Problems in downscaling and applying pre-existing scenarios;
   - Problems in ensuring scenario planning processes and outputs are effectively integrated into decision making processes.

8.3. Key principles for maximising the potential for scenario planning to inform and support climate adaptation decision making

The following principles for developing and using scenario planning for climate adaptation are informed by the learning from recent Victorian policy and practice experience, as well as relevant research literature on the use of scenario planning in other Australian and international jurisdictions.

1. Maximise clear, shared framing of climate change adaptation challenges and aims.
2. Maximise clear, shared understanding of the strengths – and limitations – of scenario planning.
3. Maximise clear, shared understanding of the primary goals of the specific scenario planning process.
4. Maximise high-level support for the scenario planning process from key internal and external stakeholders and champions.
5. Invest time and resources in planning, preparing and ensuring the right mix of skills and knowledge.
6. Draw on a broad range of relevant experience, expertise and evidence.
7. Deliberately encourage the identification and consideration of the full range of plausible drivers and pathways.
8. Create scenarios that are sharply defined and capable of effective communication to key audiences.
9. Give careful consideration to ways in which outcomes of scenario planning processes are to be integrated with strategic planning and decision making.
10. Embed scenario planning as an ongoing driver of organisational culture and decision making processes.

8.4. Towards an integrated step by step methodology for using scenario planning to improve climate change adaptation

The following steps are suggested as a framework for designing and implementing climate adaptation scenario planning initiatives and projects

Phase 1: Preparation

1. Clarify adaptation goals and issues relevant to your organisational context
2. Decide whether scenario planning is the right tool
3. Define aims and expected outcomes of the scenario planning process
4. Select a suitable approach: Off-the-Shelf, Tailored Exploration or Tailored Visioning
5. Identify stakeholders and design the process.

Phase 2: Scenario Building and Refining

6. Refine scope and objective
7. Create space for 'out-of-the-box' thinking
8. Identify and gather key drivers
9. Assess and prioritise drivers
10. Explore and select scenario trajectories
11. Generate scenarios.

Phase 3: Using Scenarios

12. Conduct gap analysis
13. Identify possible strategic directions
14. Re-run scenarios to test possible strategies
15. Assess implications for strategy and decisions
16. Articulate strategy or decision outcomes.

Beyond these phases, it is also suggested that steps be taken to promote the embedding of scenario planning methodologies and approaches into the ongoing practices of organisations and networks grappling with climate change adaptation. There is significant potential benefit to be realised from building a culture and community of practice around reflexive scenario planning among those seeking to improve organisational capacity to respond to rapidly changing and complex contingencies, risks and challenges.

8.5. Future policy and research priorities

Feedback from the wide range of stakeholders involved in the development of this report leads to the following suggestions for future policy and research initiatives.

- Designing and conducting applied, longitudinal research on the extent to which use of scenario planning is contributing to improved climate adaptation decisions and outcomes. This could usefully be aligned with research on the use of scenario planning to improve climate change mitigation decisions and outcomes.
- Identifying and overcoming barriers to effective use of scenario planning for climate adaptation.
- Improving the capacity to frame and communicate climate adaptation in ways that resonate with a diverse range of policy makers and stakeholders.
- Improving conceptual understanding of the similarities and differences between boundaries between predictive forecasting and scenario planning.
- Development of local and regional data sets that enable rapid analysis of local and regional level social, economic and environmental drivers.
- Strengthening understanding of the implications of increasing complexity and uncertainty for climate adaptation policy analysis, development and implementation.
- Research on the ways in which particular organisational and institutional arrangements and cultures assist or inhibit flexible and resilient policy making under conditions of complexity and rapid change.
- Understanding ways in which scenario planning methodologies can be tailored to be of most value to diverse public, private and non government organisations.

Appendix A: Case Studies

Victorian case study inventory: Collected examples of scenario-based projects for climate adaptation undertaken in Victoria, Australia

Title *Lead Organisation (Geographic Location)*	Short description	Reference	No.
State Government departments and agencies			
Future Coasts ***Department of Sustainability and Environment (Victorian coastal regions)***	DSE's Future Coasts Program is undertaking a state-wide assessment of physical impacts of sea level rise and storms on Victoria's coastline as basis for development of guidelines, tools and recommendations for coastal planning and policy in Victoria. The state-wide coastal climate change assessment has involved the use of sea level rise scenarios implicit in the IPCC's A1F1 emissions scenario as a basis for CSIRO modelling of projected sea levels and associated flood risk for Victoria's coast. Once finalised it will be accessible online.	www.climatechange.vic.gov.au/futurecoasts "Coastal Climate Change Assessments" August 2010: http://www.climatechange.vic.gov.au/__data/assets/pdf_file/0011/77924/Coastal-Climate-Change-Assessments_3-Pass-Approach-Overview-2010-10.pdf	**VIC1.**
EPA internal climate change risk assessment ***Victorian Environment Protection Authority (Victoria)***	Climate change scenarios used as part of an internal risk assessment process involving staff across all operations to better understand the implications of climate change for the core activities of the EPA.	n/a	**VIC2.**
Coastal Climate Change Advisory Committee ***Planning Panels Victoria (Victorian coastal regions)***	IPCC scenarios and CSIRO OzClim tool used as basis for modelling of sea level rise implications as part of project to examine the capacity of the Victorian land use planning system (particularly planning schemes prepared under the Victoria Planning Provisions) to respond to the impacts of coastal climate change. The objective was to test planning tools (either new or adapted) to see if they would provide a realistic regime for continuing use and/or adaptation of land use and development in coastal areas.	Coastal Climate Change Advisory Committee Issues and Options Paper, February 2010: http://www.dpcd.vic.gov.au/__data/assets/pdf_file/0003/34374/CCCAC_Issues_Paper__Main_Report.pdf	**VIC3.**
Development of water supply-demand strategies ***Department of Sustainability and Environment (Victoria)***	Scenario selection and analysis undertaken to inform the development of long-term strategies to ensure secure water supplies in Victoria to 2055. Scenarios included low, medium and high climate change scenarios as well as a 'what if the last 10-13 years continue' scenario. Scenarios were used to inform development of strategies by water	"Sustainable Water Strategies", *Our Water, Our Future,* Victorian Government: http://www.ourwater.vic.gov.au/pro	**VIC4.**

	corporations aimed at balancing supply and demand to 2055, subject to 5-yearly review. Planning process was then integrated at regional level through development of Regional Sustainable Water Supply strategies across Victoria based on similar scenarios.	grams/sws	
Resilient Agribusiness for the future of Sunraysia *Department of Primary Industries (Sunraysia region, Victoria and NSW)*	Scenario building process led by DPI Victoria involving representatives from horticultural industries and agri-business in the Sunraysia region of Victoria and NSW. The aim of the project was to assist community members and businesses to make better decisions in relation to future challenges such as drought and climate change by developing scenario based risk management strategies. Through the process industry participants were required to think outside their own industry and comfort zone. Four scenarios were created for integration into the strategic planning processes of participating stakeholder organisations and networks. The project also helped DPI develop stronger connections with the organisations involved.	http://www.resilientagribusiness.com.au/	**VIC5.**
Melbourne Water Sewerage Strategy *Melbourne Water (Greater Melbourne)*	Scenarios developed to explore strategic development of the Melbourne Water Sewerage Strategy. Exploratory process to assess future risks that needed to be managed.	Presentation: "The 2009 Metropolitan Sewerage Strategy", VicWater, 2009: http://www.vicwater.org.au/uploads/Downloads/Conference/2009/Owen%20Phillis.pdf	**VIC6.**
Melbourne Water Climate Change Study *Melbourne Water (Greater Melbourne)*	Melbourne Water commissioned CSIRO to undertake a study on the implications of climate change for Melbourne's water resources. Climate change scenarios for Melbourne area for 2020 and 2050 developed based on IPCC scenarios. Potential climate change implications coupled with potential water demand scenarios for Melbourne's water sewerage and drainage systems in order to identify major risks.	CSIRO: Melbourne Water Climate Change Study http://www.csiro.au/resources/ps16p.html Full Report: http://www.melbournewater.com.au/content/library/news/whats_new/climate_change_study.pdf	**VIC7.**
Future Directions for Public Land *Department of Sustainability and Environment (Victoria)*	Scenario building process undertaken with DSE staff and land managers to develop new ideas to improve business processes, prepare for change and build capacity for strategic thinking. Emphasis on new ideas with the scenario exercise intended to promote creativity and innovation as well as help set priorities for further investigation.	n/a	**VIC8.**
DSE Climate Change Forum	Scenario planning workshop held with DSE Gippsland staff to stimulate thinking about the	n/a	**VIC9.**

Gippsland *Department of Sustainability and Environment (Gippsland)*	importance and relevance of climate change to DSE's business. A Q&A session with a panel of climate change experts was followed by a scenario planning session focussing on two towns, enabling focussed conversations about climate change amongst participants. The project improved understanding of the challenges faced by local communities and the sorts of decisions that will need to be made to adapt to climate changes.		
Irrigation Futures *Department of Primary Industries (Goulburn Broken Catchment, Northern Victoria)*	Long term, comprehensive scenario planning project with aim of preparing for changing water availability and exploring irrigation issues and opportunities in the Goulburn Broken Catchment until 2035. A wide range of people affected by and involved in bulk water use in the region took part. Four scenario stories were developed and have been used as inputs into planning by state government (e.g. for the Food Bowl Modernisation Project) and local authorities (CMA, local governments), and into curriculum by education providers. The project had a strong emphasis on development of methodological tools and resources so that the project could be understood and replicated.	Wide range of reports covering process and outcomes available at: http://www.land.vic.gov.au/DPI/Vro/gbbregn.nsf/pages/gb_lwm_fwm_irrig_futures	**VIC10.**
Victorian Climate Change Adaptation Program (VCCAP) South West Region scenario project *Department of Primary Industries (South-West region, Victoria)*	Development of three scenarios exploring responses to climate change in the South West region of Victoria. The scenarios were intended for use by policymakers to influence future State Government action and investment in the region. Primary producers and associated industries, local, regional and state government authorities and community groups were all involved. An independent evaluation of the project showed that project goals had been achieved. These goals included to influence policy and to develop the capacity for dialogue amongst diverse groups around difficult and potentially life changing issues. *"The underlying component was new knowledge and skills which influence an attitude of inclusiveness and interdependence and developing community aspirations based on the highest common denominator through consensus. This [is] leading to a regional community that has the capacity and capability to take charge of their future by right not by might."* - Survey respondent	A range of resources are available at: http://www.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/climate_vccap	**VIC11.**
Boom or Bust: Possible Futures for Victorian Brown Coal in a Carbon Constrained World *Earth Resources Development Council, Victorian Government (Victoria)*	Scenario development process bringing together over eighty people including representatives from Victoria's energy sector, industry peak bodies, environment groups, unions, technology developers, financiers and government, to stimulate thinking around possible futures for Victoria's brown coal industry given climate change and other energy market issues. Four scenarios were developed through a three-phase process over seven months including 'framing', 'scenario building' and 'confirmation' workshops. The	http://new.dpi.vic.gov.au/earth-resources/industries/coal/futures-for-victorian-brown-coal "Boom or Bust? Possible Futures for Victorian brown coal in a carbon constrained world" Earth Resources	**VIC12.**

	scenarios are presented in a report with the intention that they form a starting point for further debate and consideration.	Development Council, 2010: http://new.dpi.vic.gov.au/__data/assets/pdf_file/0005/49982/2680-KES-DPI-ERDC-Brown-Coal-Future_Print-Ready-FINALv2.pdf	
Scoping climate change impacts on population health and vulnerabilities *Department of Health (Bendigo and Mildura)*	A small component of a broader project involving state-wide development and testing of a methodology for organisations or regions to conduct focussed assessments of the impacts of climate change on health and vulnerable populations in their area. In the trial phase of the project the beginnings of a scenario building exercise was run with stakeholders in regions of Bendigo and Mildura to stimulate discussion of impacts and possible adaptation actions, particularly focussed in heatwaves. Stakeholder input was critical as local expertise and knowledge was needed in order to project an image of the community in the future that could be used to think through impacts and adaptation. *"...it was actually through the process of stakeholders thinking about the future community and its variances to build a scenario that they thought through impacts and adaptive requirements".* - Survey respondent	"Scoping climate change impacts on population health and vulnerabilities" Project update, April 2009: http://www.health.vic.gov.au/environment/downloads/scoping_cc_impacts.pdf	**VIC13.**
Options for Adapting to Climate Change on the Gippsland Coast – Future Scenario Exercise for 2032 and Beyond *Gippsland Coastal Board*	Future scenario building exercise undertaken as one component of a two day forum on 'Options for Adapting to Climate Change on the Gippsland Coast' in September 2008, involving approximately 90 stakeholders. Session involved introduction of a hypothetical scenario for 2032 providing a 'worst case' assessment for low-lying Gippsland coastal towns and group exploration of likely impacts as well as implications for general policy direction in regard to settlement. Groups reached similar conclusions and presented ideas that reflected creativity and capacity to envision adaptation actions with positive impacts for the region.	n/a	**VIC14.**
Scenario Planning in the Grampians region *Department of Sustainability and Environment (Grampians)*	Scenario planning exercise involving local councils and state government agencies in the Grampians region. The project aimed to raise awareness of climate change impacts, to link regional projects and develop ongoing networks for continued consideration of climate change adaptation responses.	n/a	**VIC15.**
Scenario planning in the Loddon Mallee region *Department of Sustainability*	Scenario building exercise conducted with a range of stakeholders including community, government, CFA, learning and financial institutions in the Loddon Mallee region. Participants chose critical factors and developed a set of potential scenarios. The process	n/a	**VIC16.**

and Environment (Bendigo)	improved understanding and the ability to strategically review and analyse possible scenarios, then develop signposts and strategic responses. *"[The] best outcome [was] agreement to work more collaboratively across organisations to develop strategic climate change responses!"* - Survey respondent		
Energy Futures ***Department of Sustainability and Environment (Mildura)***	Development of scenarios designed to help build shared and improved understanding of energy futures and signposts among range of government, business and community stakeholders and develop strategic responses.	*n/a*	**VIC17.**
Lower Murray Landscape Futures ***Land Technologies Alliance (Lower Murray region, Victoria and South Australia)***	Project examining future scenarios of climate change, commodity prices and water availability in the Lower Murray region (Victoria and SA) and exploring different policy options under different future scenarios. Different outcomes under various scenarios presented through visualisation and mapping tools including Google Earth's digital globe interface, providing a simple way for natural resource management stakeholders, planners and policy makers to view and explore alternative landscape futures.	Lower Murray Landscape Futures http://www.landscapefutures.com.au/ Series of publications about the project: http://www.landscapefutures.com.au/publications.html	**VIC18.**
Future Air Scenarios ***EPA Victoria***	Development of scenarios to determine future air quality under climate change to inform strategic planning and decision making at the Victorian EPA. In collaboration with the CSIRO and with input from a range of State Government departments, the EPA is using a scenario-based methodology to explore possible future scenarios for air quality. A Most Likely Future Scenario has been developed incorporating growth scenarios. Two Alternative Future Scenarios will also be developed. The results will assist EPA in setting priorities and will also be used to inform state and national programs and policies.	*n/a*	**VIC19.**
NGOs, alliances or community sector			
Adapting to a low water future ***North Eastern Greenhouse Alliance (North East catchment, Victoria)***	Project to develop scenarios involving local governments, Catchment Management Authority and water authorities in the North East Catchment region of Victoria in order to identify climate change risks, specifically related to water.	n/a	**VIC20.**
Adaptation for community	A workshop for representatives of community service organisations to trial a scenario	n/a	**VIC21.**

service organisations *Australian Council of Social Service (Victoria)*	approach. Participants learnt about and experienced a method for scenario based risk assessment to assist with climate change adaptation in their organisation.		
Towards a Post-Carbon Gippsland *Gippsland Climate Change Network (Gippsland)*	Scenario planning process to inform the visioning and strategic planning of the Gippsland Climate Change Network. Two facilitated workshops were held involving government, business and community-based members of GCCN. Based on the outcomes of the workshops, a report was published that identified three potential scenarios, identified the desired scenario, and began to identify required steps to achieve that vision. Scenarios created also intended to be utilised as a community engagement tool.	n/a	**VIC22.**
Future Wimmera Mallee: Wimmera Mallee Sustainability Alliance Strategic Foresight Program *Wimmera Mallee Sustainability Alliance (Wimmera and Southern Mallee region)*	Scenario development process undertaken by members of the Wimmera Mallee Sustainability Alliance, local, state and regional authorities to consider the future of the Wimmera Mallee region in 20 to 50 years time based on different levels of resource utilisation. The three scenarios, one of which presents a vision for a 'post-carbon' society, were intended to inform regional strategic planning, stimulate discussion and help lead thinking in the region about sustainability issues and potential actions. The scenarios form part of WMSA's Sustainability strategy as narrative illustrations of the future to help inform options and future decisions.	"Wimmera Mallee Sustainability Green Paper" October 2010: http://www.wmsa.org.au/downloads/Wimmera_Mallee_Sustainability_Green_Paper_Oct2010.pdf	**VIC23.**
Ballarat Regional Sustainability Alliance Strategic Foresight Program *Ballarat Regional Sustainability Alliance (Ballarat, Grampians and Central Highlands regions)*	'Strategic foresight' planning session held in early 2010 involving a wide range of community, industry and government groups to create future scenarios for Ballarat and help participating groups understand potential future impacts of climate change and response strategies. Three different scenarios were created and a preferred future, described as 'post carbon' was chosen. The project helped to begin conversations, a shared vision and momentum among participants around a desired future scenario for the region.	Regional Sustainability Alliance Ballarat Direction Statement 2010 – 2012: http://rsaballarat.net.au/index.php/component/docman/doc_download/1-rsa-direction-statement	**VIC24.**
Research sector			
Visualisation tools for Lakes Entrance, Loch Sport and Anderson Inlet	Scenarios of sea level rise used to inform a project undertaken by researchers at Monash University and the Gippsland Coastal Board to produce tools that enable the user to visualise the impact of different amounts of sea level rise on three coastal communities in	Loch Sport Flood Visualisation tool: http://gracegis.com.au/lochsport/	**VIC25.**

Monash University and Gippsland Coastal Board (Gippsland)	Gippsland.	Lakes Entrance Flood Visualisation tool: http://sahultime.monash.edu.au/LakesEntrance/	
Scenarios for climate change adaptation in the Hamilton region of Victoria *RMIT Global Cities Research Institute and Hamilton critical reference group (Hamilton region)*	Two scenario planning workshops were held in 2008 with a diverse range of representatives from the community and local authorities in the Hamilton region. The intention was to tease out possibilities for what the future of the region might look like under climate change and to consider ways to better engage the regional community in planning for the future. After the workshops a report was sent to all participants and local writers worked with workshop participants to create four plausible yet challenging 'future stories' that were later published and distributed in the community.	Monograph: Nadarajah et al, "Unexpected sources of hope: Climate change, community and the future" June 2009: http://prodmams.rmit.edu.au/cyb31c4gyjn2.pdf "Community, Scenarios and Narratives of Action: Reflections on a case study in the Hamilton region of Victoria" http://www.emergingself.com.au/Download%20docs/Mulligan%20et%20al%20final%20chapter%20June%2008.doc_PI.pdf Gidley et al. (2009)	**VIC26.**
Port of Hastings expansion and climate change impacts *RMIT Global Cities Research Institute and Western Port Greenhouse Alliance (Port of Hastings, Melbourne)*	Scenario building workshop to explore a broad range of perceptions of how the future of the Western Port region might unfold over the next decade and beyond, with particular regard to the impacts and implications of climate change events and the proposed expansion of the Port of Hastings as Melbourne's second port. The workshop involved policy makers and government officials, community members, NGOs and people working at the Port.	n/a	**VIC27.**
VEIL/VicHealth Food Supply Scenarios project *Victorian Eco-Innovation Lab*	Research project investigating the impact of challenges to food production and distribution, under climate change and resource constraints, on access to healthy diets in Victoria. A set of exploratory or 'what if' scenarios developed by the research team, informed by a workshop of key stakeholders. Scenarios were designed to illuminate different relationships and system interactions, as well as potential shocks, affecting secure and sustainable food availability in Victoria.	Resources from the project: http://www.ecoinnovationlab.com/research/food-supply-scenarios	**VIC28.**

EcoCity (EBD) Visions *Victorian Eco-Innovation Lab*	Series of visions for a sustainable precinct in the centre of Melbourne in 2032 developed as part of a VEIL project involving staff and students designers from RMIT, Swinburne, Monash and Melbourne universities. Steps in the project included a series of workshops in 2008 with designers to develop revolutionary, zero-carbon visions for the development of the E-Gate site in Melbourne. Approximately 200 students used the visions to develop design ideas some of which were presented at a public exhibition in February 2009.	EcoCity (EBD): http://www.ecoinnovationlab.com/ebd EcoCity (EBD) Design Hub: http://www.ecoinnovationlab.com/design-workshops/186-ebd-design-hub	**VIC29.**
Broadmeadows 2032 *Victorian Eco-Innovation Lab*	Project to explore visions of transformation to a sustainable future in 2032 in the rapidly developing suburb of Broadmeadows, located in the City of Hume, north of Melbourne. A visioning workshop involving Hume City Council staff, VEIL Hub designers and Italian designer, Ezio Manzini, explored opportunities, helping to identify key potential 'eco-acupuncture' points – places at which visionary interventions could help trigger positive change – in the Broadmeadows community. Designs presenting a wide range of sustainable opportunities for the local area were showcased at an exhibition in Broadmeadows in July 2010, visited by hundreds of community members.	Broadmeadows 2032: http://www.ecoinnovationlab.com/revisioning-broadmeadows	**VIC30.**
Local government sector			
Rural local government in a climate of change *North Eastern Greenhouse Alliance, Alpine and Towong shire councils (Alpine and Towong shires)*	Climate change scenarios used as inputs into strategic adaptation planning process undertaken by Alpine and Towong shire councils through funding from the Australian Government's Local Adaptation Pathways Program (LAPP).	n/a	**VIC31.**
Integrated planning for a sustainable Shepparton community *RM Consulting Group (City of Greater Shepparton)*	Scenarios used as one input to the development of an integrated plan for the Shepparton region to manage climate change and reduced water availability. Scenarios were used to give participants, including representatives from state and local government, water authorities, VicRoads and Regional Development Australia, broad views about the future and a sense of what might happen. Scenarios were chosen to be consistent with those used by state agencies.	Integrated Planning for a Sustainable Shepparton Community – Draft Strategy, November 2010: http://www.google.com.au/url?sa=t&source=web&cd=4&ved=0CCwQFjAD&url=http%3A%2F%2Fwww.greatershepparton.com.au%2Fdownload.asp%3FRelatedLinkID%3D5824&ei=VptHTZm2I4HOvQPFpvzdBQ&usg=AFQjC	**VIC32.**

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Climate change adaptation strategy and action plan *City of Melbourne (Melbourne)*	Scenarios used as input to internal development of City of Melbourne's climate change adaptation strategy and action plan. Four potential extreme event scenarios were identified, which together embody the range of climate change risks for Melbourne, and were used as a basis for considering adaptation options and responses in the plan.	City of Melbourne Climate Change Adaptation Strategy, June 2009: http://www.melbourne.vic.gov.au/AboutCouncil/PlansandPublications/strategies/Documents/climate_change_adaptation_strategy.PDF	**VIC33.**

Australian case study examples

Title	Short description	Reference	No.
Energy Futures Forum *CSIRO (Australia)*	CSIRO convened the Energy Futures Forum from 2004 to 2006 bringing together a wide range of industry and community groups to explore future possibilities for stationary energy and transport in Australia. Nine plausible qualitative scenarios were developed using a scenario planning process designed to explore the shape and nature of energy in 2050. The scenarios drew on both factual information and Forum participants' judgements about how the future may unfold. During discussion of key drivers of change, climate change emerged as the uppermost driving force. The scenarios describing different energy futures were presented to participants in Citizen Panels who were asked to provide feedback on their plausibility and comprehensiveness. Economic modelling was also undertaken for each scenario to assist the EFF understand the implications of the different scenarios.	http://www.csiro.au/science/Energy-Futures-Forum.html *The Heat is On: The Future of Energy in Australia (2006):* *http://earthhour.ice4.interactiveinvestor.com.au/CSIRO0702/The%20Heat%20Is%20On%20Report/EN/body.aspx?z=4&p=65&v=1&uid*	**AUS1.**
Envisioning possible futures for the Great Barrier Reef *CSIRO (Great Barrier Reef*	CSIRO scenario planning project to develop plausible alternative futures for the Great Barrier Reef Catchment for 2050. The project aimed to better understand major drivers of change, uncertainties and consequences for ecosystems and	*Envisioning possible futures for the Great Barrier Reef Catchment* http://www.csiro.au/science/GBRFutures--	**AUS2.**

region, Queensland)	societies as well as help enable stakeholders to make decisions in this context. The research involved building partnerships with many GBR stakeholder groups. Climate change was one of three key uncertainties identified through a literature review and more than 40 interviews with project collaborators, which led to the development of four scenarios. Other key project phases included refining scenarios, communicating them to a range of different audiences and applying them to specific policy planning questions.	ci_pageNo-1.html	
Future makers or future takers? ***CSIRO and Great Barrier Reef Marine Park Authority (Great Barrier Reef region, Queensland)***	Using existing data, models and scientific knowledge of the region, CSIRO researchers undertook a scenario analysis to understand the impacts of 2 key uncertainties on climate change impacts on the Great Barrier Reef region. The uncertainties related to global and national development pathways, specifically whether there was a focus on economic growth or broader concepts of human wellbeing and sustainability at each level. The analysis highlights the importance of cross-scale processes for management of the GBR region and points out that the future of the region depends largely on choices (by individuals as well as national or regional decision makers) to be active future 'makers' or passive future 'takers' in responding to global drivers of change.	*Future Makers or Future Takers? A scenario analysis of climate change and the Great Barrier Reef*: http://www.nccarf.edu.au/conference2010/wp-content/uploads/Butler-GBR-Scenarios-Session-131-Scenarios-for-the-future.pdf	**AUS3.**
Climate Futures Tourism Industry Tool ***CSIRO (Queensland)***	A project to help make climate change information accessible and simplify the adaptation planning process for tourism businesses in Queensland. CSIRO national climate projections (derived from IPCC global emissions scenario A1F1) translated into three storylines: '2030 warmer and drier'; '2030 warmer and wetter'; and '2050 hotter and much wetter'.	Climate Futures storylines tool for tourism operators in Queensland: http://www.tq.com.au/tqcorp_06/fms/tq_corporate/industrydevelopment/Climate%20Futures%20Industry%20Tool.PDF	**AUS4.**

International case study examples

Title	Short description	Reference	No.
Local Climate Change Visioning for Delta, British Columbia ***Collaborative for Advanced Landscape Planning, University of British Columbia (Canada)***	A local climate change visioning process undertaken for the Corporation of Delta, a municipality in Canada facing sea level rise impacts. The two main components of the project were: 1. The construction of frameworks and methods for downscaling climate change impact information and visualising alternative climate futures at the local scale and 2. Testing the influence of these visualisations on the awareness, emotional responses and motivation for behaviour change of the participants.	Tatebe, K., Shaw, A. and Sheppard, S. (2010) *Technical Report on Local Climate Change Visioning for Delta*: *Findings and Recommendations* http://www.calp.forestry.ubc.ca/wp-content/uploads/2010/02/Delta-Technical-Report_V1-0.pdf	**INT1.**
Kimberley Climate Adaptation Project ***Collaborative for Advanced Landscape Planning, University of British Columbia (Canada)***	Climate change visioning process for the City of Kimberley in British Columbia, Canada, using GIS mapping and 3D visualisation. Collaborative process to engage community and communicate complex information. Two scenarios developed: 'Kimberley Adapts' and :'Low Carbon Kimberley' providing a framework for exploration of current land use plans, local vulnerabilities, projected climate change impacts and response options.	http://cfubc.ehosting.ca/wp-content/uploads/2010/02/REF-CALP-Kimberley-Report2.pdf	**INT2.**
CLIMAR ***Management Unit of the North Sea Mathematical Models (MUMM) (Belgian coastal zone)***	Evaluation of climate change impacts and adaptation responses for marine activities (CLIMAR) is a research project which aims to identify adaptation scenarios and measures for several case studies in the North Sea region. The project also aims to produce an evaluation framework to help assess the effectiveness of different adaptation measures and consider their practical implementation and integration into current policy structures.	http://services.arcadisbelgium.be/climar/ http://www.ilvo.vlaanderen.be/EN/Research/Fisheries/Technisch/CLIMAR/tabid/5007/language/en-US/Default.aspx	**INT3.**
Envisioning 2050: Climate change, aquaculture and fisheries in West Africa ***World Fish Centre and the Leibniz Centre for Marine Tropical Ecology***	Series of scenario building workshops using participatory methods to discuss critical issues and uncertainties faced by fisheries and aquaculture sectors in Senegal, Ghana and Mauritania. Sectoral scenarios for 2050 were built and the implications of climate change were discussed. The project also included the development and exhibition of arts projects by young people under the theme of "Visions of the Future: What is African Youth telling us about our Ocean?"	Workshop report: http://aquaticcommons.org/5004/1/WF_2783.pdf	**INT4.**

Climate Change Adaptation in New Zealand: Future scenarios and some sectoral perspectives *New Zealand Climate Change Centre*	Set of papers providing sectoral perspectives on climate change adaptation in New Zealand under two different scenarios: a "high-carbon world", where global average temperatures reach almost 4 degrees C above pre-industrial by 2100 and a "rapidly decarbonising world" with global average temperatures limited to 2 degrees C above pre-industrial by 2100.	http://www.nzclimatechangecentre.org/sites/nzclimatechangecentre.org/files/images/research/Climate%20change%20adaptation%20in%20New%20Zealand%20%28NZCCC%29%20%28A4%20low%29.pdf	**INT5.**
Developing local and regional scenarios for climate change mitigation and adaptation. Part 1: A framing of the East of England Part 2: Scenario creation *Tyndall Centre for Climate Change Research, United Kingdom*	Three scenarios developed to examine how the East of England region might look in 2050 having achieved 60% emission reductions. Each scenario description indicates a different pathway for reaching the 2050 emissions reduction target. Researchers worked with Norfolk County Council, and the East of England Sustainable Development Round Table through joint workshops which contributed particular knowledge of the Eastern Region and helped enhance the scenarios' legitimacy with the users. The scenarios are intended for a wide range of audiences, but primarily regional and local government officers. The storylines represent sectors important to regional policymakers, addressing economy, societal values, the role of energy efficiency, the scale and strength of regional governance, the type and scale of the energy supply system and the balance and location of economic activity.	Part 1: A framing of the East of England http://www.tyndall.ac.uk/sites/default/files/wp54.pdf Part 2: Scenario Creation http://www.tyndall.ac.uk/sites/default/files/wp67.pdf	**INT6.**
Thames Estuary 2100 *UK Environment Agency*	A project established to manage tidal risk through London and the Thames estuary. The process is designed in recognition of the need for ongoing, adaptable and long-term flood risk management planning.	http://www.environment-agency.gov.uk/homeandleisure/floods/104695.aspx "How do you adapt in an uncertain world? Lessons from the Thames Estuary 2100 project" http://www.worldresourcesreport.org/files/wrr/papers/wrr_reeder_and_ranger_uncertainty.pdf	**INT7.**
Netherlands 'extreme' climate scenarios *Knowledge for Climate programme (KNMI), The Netherlands*	In 2007 the Netherlands' KNMI developed several 'extreme' scenarios for their Climate Changes Spatial Planning project 'Attention for safety (AVV)'. These scenarios are plausible but have low probability and are intended to assess safety issues related to flooding in the Netherlands. The scenarios include extreme sea level rise, shutdown of the warm Gulf Stream, 'super' storms, extreme summer rainfall, and extreme discharge of the rivers Rhine and Muese.	http://www.knmi.nl/climatescenarios/ http://www.knmi.nl/climatescenarios/knmi06/index.php http://www.knmi.nl/climatescenarios/additional/index.php http://www.knmi.nl/climatescenarios/d	**INT8.**

		ocuments/KNMI_2009_EN.pdf	
The future climate for development *UK Department of International Development / Forum for the Future*	UK Department of International Development / Forum for the Future created scenarios about trends in development and climate change to build capacity for strategic planning (factoring in climate change) for development agencies and NGOs: How the world will look in 203	http://www.dfid.gov.uk/Media-Room/News-Stories/2010/How-will-the-world-look-in-2030/ http://www.forumforthefuture.org/projects/the-future-climate-for-development	**INT9.**
Shell Energy Scenarios to 2050 *Shell*	*Shell Energy Scenarios to 2050* depicts two alternative futures termed 'Scramble' and 'Blueprints'.	http://www.shell.com/home/content/aboutshell/our_strategy/shell_global_scenarios/shell_energy_scenarios_2050/	**INT10.**
Mont Fleur scenario project *South Africa*	Scenario planning process undertaken in South Africa in 1991-92 widely renowned for its contribution to informing public dialogue and promoting shared understanding of possible future directions at a time of great national turmoil associated with the transition out of apartheid. The 'Mont Fleur' project brought together twenty-two prominent South Africans, including politicians, activists, academics and politicians, reflecting a diverse spectrum of ideological perspectives.	http://www.generonconsulting.com/publications/papers/pdfs/Mont%20Fleur.pdf	**INT11.**
Millennium Ecosystem Assessment *United Nations*	Work undertaken between 2001 and 2005 involving more than 1,360 experts worldwide to assess the consequences of ecosystem change for human well-being.	http://www.maweb.org/en/index.aspx http://www.maweb.org/documents/document.330.aspx.pdf	**INT12.**
Future Scenarios *Holmgren Design Services*	Development of scenarios mapping the cultural implications of climate change and peak oil by futurist and co-originator of permaculture, David Holmgren	http://www.futurescenarios.org/	**INT13.**
The Great Transition Initiative *Tellus Institute and the Stockholm Environment Institute*	Involving a network of scholars and activists internationally, the initiative builds on analysis of alternative scenarios to examine the requirements for a sustainable and desirable future.	http://www.gtinitiative.org/ http://www.gsg.org/index.html http://www.gtinitiative.org/resources/paperseries.html	**INT14.**

Global-Change Scenarios – Their Development and Use *US Climate Change Science Program*	Report which includes case study information about several major applications of climate change scenarios in the US including: - New York Metropolitan Region – Scenarios for Climate Change Adaptation - Scenarios of sea-level rise along the Gulf Coast (USA) - Scenarios in the California Water Plan - Climate change scenarios for the insurance industry - Scenarios of Climate Impacts in the Columbia River Basin - The Global Business Network Abrupt Climate Change Exercise	http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1010&context=usdoepub&sei-redir=1#search=%22parson+2007+climate+change+scenarios+US+climate+science%22	**INT15.**
National Climate Research, The Netherlands *Climate changes spatial planning and Knowledge for Climate programmes, The Netherlands*	Series of projects using climate change scenarios in the Netherlands.	http://www.climateresearchnetherlands.nl/research-themes/climate-projections-and-scenarios http://promise.klimaatvoorruimte.nl/pro1/projects/projecten.aspx?superproject_id=0&personid=0&relatieid=0&supercompanyid=0&cost_centreid=0&clusterid=0&subclusterid=0&groupid=29&status_project=4&sorting=1	**INT16.**
From the academic literature			
Citizen perceptions – UK and Italy	Study into perceptions of the future among citizens in Norwich (UK) and Rome (Italy) – specifically testing the impact of climate and socio-economic scenarios	(Lorenzoni and Hulme, 2009)	**INT17.**
Scenarios for Knowledge Integration: Exploring Eco-tourism Futures in Milne Bay, Papua New Guinea	An example of how scientific and stakeholder knowledge at different scales can be brought together through scenarios. Considered changes in perceptions before and after the scenario development process e.g. increased awareness of processes occurring at broad spatial and temporal scales and the need for longer-term planning.	(Bohensky et al., 2011) http://csiro.academia.edu/ErinBohensky/Papers/402150/Scenarios_for_knowledge_integration_exploring_ecotourism_futures_in_Milne_Bay_Papua_New_Guinea	**INT18.**
Learning with local help: Expanding the dialogue on climate change and water	Example of a process combining development of scenarios relating to water management with multi-stakeholder dialogue on implications and adaptation options in the Okanagan Region, Canada.	(Cohen et al., 2006)	**INT19.**

management in the Okanagan region, British Columbia, Canada			
MedAction, Europe	Information and decision support systems for land degradation in Europe involving multi-scale stakeholder participation.	See (Kok et al., 2007)	**INT20.**
Makanya Catchment, Tanzania	Participatory scenario planning process to consider strategies most appropriate under different alternative futures.	See (Enfors et al., 2008)	**INT21.**
Water management Essex, United Kingdom	Example of 'robust adaptation decision making' in water management.	See (Wilby and Dessai, 2010)	**INT22.**
Various	ALARM scenarios Global Scenario Group Global Environmental Outlook World Business Council on Sustainable Development World Water Vision Millennium Ecosystem Assessment Africa Environmental Outlook Latin America and the Caribbean Environmental Outlook Southern Africa MASRES-based scenarios for Europe: ATEAM, EURalis, ACCELERATES, PRELUDE, ALARM, FARO-EU, ESPON	See (Rounsevell and Metzger, 2010)	**INT23.**
Various	PRELUDE socioeconomic scenarios: Explores what European landscapes will look like 30 years from now and beyond: www.eea.europa.eu/multimedia/interactive/prelude-scenarios/prelude GEO 4 Global Environment Outlook: Four scenarios to 2050 exploring different policy approaches and societal choices at both global and regional levels: www.unep.org/geo/geo4/media/ GECAFS Global Environmental Change and Food Systems: www.gecafs.org/ SCAR Foresight process identifying scenarios for European agriculture in a 20-year perspective: http://ec.europa.eu/research/agriculture/scar/index_en.cfm?p=3_foresight	See (Bryson et al., 2010)	**INT24.**

	SCENAR 2020 Scenario study on agriculture and the rural world: http://ec.europa.eu/agriculture/publi/reports/scenar2020/index_en.htm AG 2020 Foresight analysis for world agricultural markets (2020): www.risoe.dk/Research/sustainable_energy/energy_systems/projects/AG2020.aspx?sc_lang=en FARO Foresight Analysis of Rural Areas of Europe: www.faro-eu.org/home/tabid/195/Default.aspx Foresight Future Flooding Scenario analysis to inform strategic choices to address future flood risk in the UK: www.foresight.gov.uk/OurWork/CompletedProjects/Flood/index.asp REAP Resources and Energy Analysis Programme (REAP) – tool to access data for a whole Local Authority or Region, to develop policy scenarios and model changes in the footprint of residents: www.resource-accounting.org.uk/ GRIP Greenhouse Gas Regional Inventory Protocol: www.grip.org.uk/htmlversion.htm		

Appendix B: Links and resources

Tools – scenario generation, decision support, visualisation

Tool name	Short description	Reference
OzClim *CSIRO*	Scenario generation tool produced by the CSIRO which provides step-by-step options to create and explore different rainfall and temperature scenarios for Australia over different time periods. There is also an advanced section designed for the scientific research community and policy makers.	http://www.csiro.au/ozclim See (Page and Jones, 2001) http://www.mssanz.org.au/MODSIM01/Vol%202/Page.pdf. (Ricketts and M., 2007) http://www.mssanz.org.au/MODSIM07/papers/10_s61/AWebBasedVersion_s61_Ricketts_.pdf
Climate Futures Industry Tool *CSIRO and Tourism Queensland*	Tool designed to help make climate change information accessible and simplify the adaptation planning process for tourism businesses in Queensland.	http://www.tq.com.au/tqcorp_06/fms/tq_corporate/industrydevelopment/Climate%20Futures%20Industry%20Tool.PDF
Climate change and scenario planning tool for Alice Springs *Charles Darwin University and Natural Resource Management Board, NT*	Online scenario modelling tool which shows different possible futures for Alice Springs and explores how climate change may affect these futures.	http://www.users.on.net/~treehugger/ser/stella.html
Climate Kelpie *Managing Climate Variability, Grains Research and Development Corporation*	Collection of information, decision support tools and farmers' experiences.	http://www.climatekelpie.com.au/
Irrigation Futures Scenario Planning resources *Department of Primary Industries, Victorian Government*	Range of in-depth reports covering all aspects of the scenario planning work undertaken in the Goulburn-Murray catchment area.	http://www.dpi.vic.gov.au/dpi/vro/gbbregn.nsf/pages/gb_lwm_fwm_irrig_futures
Innovative Management for Europe's Changing Coastal Resource (IMCORE) *University of Cork, North-West Europe*	Online database of Northern European initiatives to manage coastal risks linked to climate change including links to decision support tools and case studies, many of which have utilised a form of scenario planning.	http://www.imcore.eu/tagazan/index.php http://imcore.eu/

UK Climate Impacts Programme (UKCIP) *UK Department for Environment, Food and Rural Affairs (Defra) and Environmental Change Institute, Oxford University*	Range of tools and resources to support adaptation planning and policy in the UK, including information on socio-economic scenarios and the use of the most recent UK climate projections (UKCP09).	http://www.ukcip.org.uk/ http://www.ukcip.org.uk/ses/ http://www.ukcip.org.uk/ukcp09/
Pastoral properties future simulator, Northern Territory *Charles Darwin University*	Project to explore possible futures for the cattle industry in the Northern Territory using scenario planning and modelling.	http://forio.com/service/netsims/ser_cdu/pastoral_properties_futures_simulator/index.html
IMCORE *University of Cork (North-West Europe)*	Database of initiatives to manage coastal risks linked to climate change: http://www.imcore.eu/tagazan/index.php	http://www.arcadisbelgium.be/climar/ Decision support tools: http://www.imcore.eu/tagazan/index.php?mode=visuTags&num_tag=9
Advanced Spatial Science Uncertainty Reduction Engine (ASSURE) - Westernport Spatial Decision Support System *Department of Primary Industries, Victorian Government*	Project to develop decision support systems to assist with sustainable management of terrestrial-marine systems.	http://www.land.vic.gov.au/dpi/nrensr.nsf/LinkView/876B96E3D5B2BA43CA25740A0010228D26200B8A5DC746B0CA2573A3000E1592/$file/Westernport%20Fact%20sheet.pdf
'Decision making in a changing climate' World Resources Report website	Various examples and resources.	http://www.worldresourcesreport.org/

'How to' scenario planning resources

Scenario planning resources *Futureamb*	Webpage with articles and links to related pages, suggested books for working with scenario planning.	http://www.well.com/~mb/scenario_planning/
'Scenario references' page *Nautilus Institute for Security and Sustainability*	List of links and references includes scenario 'how-to' guides, theory, national and regional development projects, climate change projects and other complex global problem solving projects.	http://www.globalcollab.org/partners/gci/scenarios/scenario-references
Scenario Planning Toolkit *Waverley Management Consultants for UK Department for Transport*	Useful online reference on scenario planning processes and activities to run.	http://www.dft.gov.uk/pgr/scienceresearch/futures/secsceniss/wrdsenariotoolv2.doc
Scenarios: An Explorer's Guide *Shell International*	Downloadable scenario guidebook produced by Shell International Limited. It gives a useful overview of the rationale and approach used by Shell. May be a useful reference when having to justify the value of a scenario-based approach.	http://www-static.shell.com/static/public/downloads/brochures/corporate_pkg/scenarios/explorers_guide.pdf
Scenarios: The art of strategic conversation *(van der Heijden, 2005)*	Book written by a respected practitioner in the field. Includes useful guides on process and activities that organisations can use to improve strategy through scenario planning	See (van der Heijden, 2005)
Scenario planning: Managing for the future *(Ringland, 1998)*	Another classic text on scenario planning for strategy. Recommended by scenario practitioners.	See (Ringland, 1998)
Framework for developing climate change adaptation strategies and action plans for agriculture in Western Australia *(Hills and Bennett, 2010)*	Provides useful advice on how to run scoping, risk assessment and scenario-type exercises for developing climate change adaptation strategies.	See (Hills and Bennett, 2010) http://www.agric.wa.gov.au/objtwr/imported_assets/content/lwe/cli/climatechangeframework_no%20cover_web.pdf
Local climate change visioning and landscape visualizations: Guidance	Great resource for people considering the use of visual material as a way of understanding and conveying climate change impacts and	http://www.calp.forestry.ubc.ca/wp-content/uploads/2010/02/CALP-Visioning-

Manual *Collaborative for Advanced Landscape Planning, University of British Columbia*	adaptation.	Guidance-Manual-Version-1.1.pdf See also: Working Papers – visualisation, visioning http://www.calp.forestry.ubc.ca/publications/
"Planning with Uncertainty: Using Scenarios with African Pastoralists" *International Institute for Environment and Development, (Cavanna and Abkula, 2009)*	Two resources from scenario planning work with African pastoralists including a report and "how to" guide.	See (Cavanna and Abkula, 2009) Report : http://pubs.iied.org/pdfs/12562IIED.pdf "How to" Guide http://pubs.iied.org/pdfs/10023IIED.pdf
"Scenarios for Sustainability – Recipes and guidelines"	Webpage providing links and resources for carrying out different scenario analysis tasks.	http://scenariosforsustainability.org/howto_recipes.php
"How to build and use scenarios" *Presentation, Adam Gordon, The Future Studio*	Online slideshow presentation describing a method for building and using scenarios.	http://www.slideshare.net/adgo/scenario-building-workshop-how-to-build-and-use-scenarios
"Futures Methodologies" *RAND Corporation*	Links and resources to different futures methodologies.	http://www.rand.org/international_programs/pardee/pubs/futures_method/scenarios.html
"Scenario Development – Connecting Goals and Audiences", *Brown University Seminar, Dr. Angela Wilkinson, University of Oxford*	Online slideshow presentation explaining background to scenario planning.	http://www.watsoninstitute.org/ge/scenarios/presentations/Wilkinson.pdf
Effective Engagement toolkit *Department of Sustainability and Environment, Victorian Government*	Downloadable toolkit to assist practitioners plan engagement activities, including references to scenario planning and backcasting activities.	http://www.land.vic.gov.au/dse/wcmn203.nsf/Home+Page/8A461F99E54B17EBCA2570340016F3A9

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The Victorian Centre for Climate Change Adaptation Research (VCCCAR) is a consortium of Victorian universities supported by the Victorian Government to undertake multi-disciplinary research about state-specific climate change impacts and adaptation options. Its brief is to:

1. *Increase Government decision-making capacity about state-specific climate change impacts;*
2. *Encourage the inclusion of adaptation needs in Government strategic planning; and*
3. *Bring together expertise to work on the provision of multi-disciplinary advice to government, industry and the community.*

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