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INSTITUTIONAL RESILIENCE AND CLIMATE CHANGE - A FOCUSED REVIEW

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The Australian Workplace Innovation and Social Research Centre (WISeR) *focuses on work and socio-economic change. WISeR is particularly interested in how organisational structure and practices, technology and economic systems, policy and institutions, environment and culture interact to influence the performance of workplaces and the wellbeing of individuals, households and communities.*

WISeR also specialises in socio-economic impact assessment including the distributional impacts and human dimensions of change on different population groups and localities. Our research plays a key role in informing policy and strategy development at a national, local and international level.

CONTENTS

1 INTRODUCTION

1.1 CONTEXT FOR THE LITERATURE REVIEW

This literature review is one component of a wider project being undertaken by the URPS led consortium to provide services associated with the implementation of South Australia's *Resilient South* initiative – an integrated climate change vulnerability assessment and adaptation action plan for the Southern Adelaide Region.

Resilient South is a collaborative project involving the Cities of Holdfast Bay, Marion, Mitcham and Onkaparinga. The project is designed to develop a greater understanding of strengths and vulnerabilities in the region and assist with the development of a climate change adaptation plan to guide future action.

In this focused review of the literature on resilience and climate change we seek to clarify what we mean by resilience, particularly institutional resilience, and identify how it has been operationalised in climate change policy, strategy and action. While there is much that we can learn from national and international experience it is important in the end, that resilience is examined in the context in which it exists. At the local level great variation and complexity can be found. Smart strategies seek to respond to this in an integrated way.

1.2 FOCUS OF THE LITERATURE REVIEW

Much has been written about resilience in the face of climate change, particularly in relation to the concept of resilience. This review summarises that information but its focus is essentially practical in that it explores how resilience can be fostered, supported and sustained. While some adaptation measures are undertaken by individuals, other types are institutional - planned and implemented by governments on behalf of societies (IPCC 2007). This review is focused on the latter. It examines the roles played by structural and process interventions and by key stakeholder institutions, reflecting the findings of the literature that resilient and effective response to climate change requires a coordinated and multi-faceted approach that integrates adaptation to climate change in planning and decision making processes across institutions. While individual and family resilience are of enormous significance in how we adapt to climate change, institutions play a pivotal role in mediating this experience through government and industry sponsored climate change mitigation and adaptation strategies.

The paper is structured in this way:

- Section 2 explores key concepts that together provide an understanding of resilience and its interaction with the concepts of adaptation, mitigation, risk management and vulnerability (in relation to climate change).
- Section 3 presents findings on adaptive responses by governments and businesses that support and promote resilience.

- Section 4 draws conclusions from all of the information reviewed and their implications for the *Resilient South* project.

- The Appendix section presents more detailed information and there are highlighted boxes presenting useful resources throughout the document.

2 Exploring Key Concepts

Much of the literature associated with Resilience explores key and related concepts involving **Adaptation and Adaptive Capacity, Mitigation, Risk, and Vulnerability.** At times these are used interchangeably and while their meanings are quite distinct, there are important relationships between them. This section clarifies and summarises their meanings.

2.1 Resilience

In simple terms, resilience involves the capacity to adapt to change (Folke *et al* 2002; UN Global Compact 2011) and to be flexible and prepared for change and the uncertainty associated with change (Marshall & Marshall 2007). Resilience is a capacity that is relevant for individuals, communities, organisations and systems. At a systems level, resilience represents the ability of a system to withstand negative impacts without losing its basic functions (SA Govt 2011: 64; UN Global Compact 2011: 68). Resilience can also be understood as an outcome – of the capacity to cope with change, to adapt to that change and in the process, to experience and be open to learning (SA Govt 2011: 62).

Resilience is...the ability to absorb disturbances, to be changed and then to re-organise and still have the same identity (retain the same basic structure and ways of functioning). It includes the ability to learn from the disturbance. A resilient system is forgiving of external shocks. As resilience declines the magnitude of a shock from which it cannot recover gets smaller and smaller. Resilience shifts attention from purely growth and efficiency to needed recovery and flexibility.... Learning, recovery and flexibility open eyes to novelty and new worlds of opportunity. (www.resalliance.org)

In the context of climate change, a more resilient system has the ability to withstand higher threshold limits for such events as droughts, heat waves and floods. Factors that can decrease the resilience of our natural, social and economic systems include:

- loss of biodiversity
- toxic pollution
- inflexible, closed institutions
- perverse subsidies that encourage the unsustainable use of resources
- a focus on production and increased efficiencies that lead to a loss of redundancy.

The resilience of human and natural systems can be strengthened by a range of interventions at systems level, including:

- ✓ stopping practices that put people at high risk
- ✓ improving understanding and awareness of climate change and the need to adapt

- ✓ integrating climate change information into planning, practice and decision-making
- ✓ implementing measures that proactively reduce climate impacts
- ✓ developing informed risk-spreading practices (Govt of SA 2011: 62-63).

2.2 ADAPTATION

Adaptation involves taking action to avoid, withstand or take advantage of current and projected climate changes and impacts, and can occur at an individual, community or systems level. Adaptation both decreases vulnerability and increases resilience to impacts (PMSEIC 2007: 23). It can involve reducing the harmful impacts of climate change as well as taking advantage of opportunities brought by climate change (Productivity Commission 2011: 5). Adaptation is the …

> **… ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences (IPCC: 2011)[1]**

Climate change adaptation involves structural adjustment which represents the combined efforts of adaptive responses and choices made by individuals, organisations, communities and governments.

> **Climate change adaptation is about the way people adjust to, and trade off, changes in costs and benefits brought about by climate change. These changes will affect where people live, how they do business, the occupations they choose, and the goods and services they buy. In this sense, adaptation is a form of structural adjustment – it is the aggregation of a countless number of decisions made … that, for the most part, can be expected to occur autonomously (Productivity Commission 2011: 5).**

Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation:

- ➢ *Anticipatory* (or proactive) adaptation takes place before the impacts of climate change are observed. It stands in contrast to *reactive* adaptation.
- ➢ *Autonomous* (or spontaneous) adaptation does not constitute a conscious response to the impacts of climate change but is triggered by ecological changes in natural systems and by market or welfare changes in human systems.
- ➢ *Planned* adaptation is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain or achieve a desired state (Govt of SA 2011: 64; IPCC 2001).

[1] Intergovernmental Panel on Climate Change

To be effective, adaptation to climate change often requires multi-sector involvement – government, business, non government organisations and community - and needs to be part of daily decision making, planning and risk management processes. This is because of the interconnected nature of human, economic and natural systems, with impacts in one area causing effects in others. The process of adaptation involves decision making in all areas of life, at the right time and maximising the benefits while minimising the costs. As such it is essentially a process of risk management (Stanley *et al* 2010: 8). Adaptation is also a learning process (Berkhout *et al* 2004). Adaptation needs to be local, regional and national because climate change differs in its impact on people and locations (Stanley *et al* 2010: 8). Different actors have differing capacities to adapt, shaped by the economic, social, cultural and political capital that is embedded or absent.

> **The development of social capital and the ability to draw on community strengths is important in the ability to adapt to climate change. Social capital brings with it a capability to gain access to resources and to enhance well being …[2]. Networks of reciprocity, for example, are important for coping with the impacts of extremes in weather and other catastrophic environmental events ….[3] It is important that the development of social capital and strong communities to respond to climate change is mainstreamed in approach ….[4] (Stanley et al 2010: 42).**

Principles underpinning adaptation strategies need to be:

- ✓ Inclusive
- ✓ Participatory
- ✓ Cost effective and efficient
- ✓ Consistent
- ✓ Complementary with other measures, such as, those addressing pollution
- ✓ Subject to ongoing review and modification (Stanley *et al* 2010: 8).

Responses to climate change require two closely aligned interventions - mitigation or reduction in greenhouse gas emissions into the atmosphere and adaptation or changing behaviour to respond and adjust to climate change. The more effective the mitigation, the less will be the adaptation needed (Stanley *et al* 2010: 8).

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[2] Bebbington A (1999) 'Capitals and capabilities: a framework for analysing peasant viability, rural livelihoods and poverty', *World Development*, 27, 2021-44

[3] Adger W (2003) 'Social capital, collective action, and adaptation to climate change', *Economic Geography*, 79 (4)

[4] Cemlyn S *et al* (2005) 'Poverty, neighbourhood renewal and the voluntary and community sector in West Cornwall', *Community Development Journal,* 40 (1), 76-85

2.2.1 ADAPTIVE CAPACITY

In relation to climate change impacts, adaptive capacity is the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. In other words, adaptive capacity is an expression of resilience in the face of the harm brought by climate change (Govt of SA 2011: 64; LGASA 2012: 11).

> **Adaptive capacity is the ability or potential of a system to respond successfully to climate variability and change, and includes adjustments in both behaviour and in resources and technologies. The presence of adaptive capacity has been shown to be a necessary condition for the design and implementation of effective adaptation strategies …. Adaptive capacity also enables sectors and institutions to take advantage of opportunities or benefits from climate change, such as a longer growing season or increased potential for tourism (IPCC 2007: Chapter 17.3.1).**

Adaptive capacity requires an understanding of the interrelationships between social, economic and ecological systems in order to prepare for the behaviour changes necessary in the face of significant changes to our climate (Govt of SA 2011: 63). Reduced adaptive capacity is associated with an increased vulnerability to climate change (LGASA 2012: 11).

Technology can play an important role in adapting to climate change, for example, through efficient cooling systems, improved agriculture techniques, and other engineering solutions to reduce water availability. Innovation is an important aspect of adaptation, particularly under uncertain future climate conditions (IPCC 2007: Chapter 17.3.1).

Adaptive capacity is also mediated by human capital and community strength, which will vary widely. The IPCC identifies numerous examples where '… social capital, social networks, values, perceptions, customs, traditions and levels of cognition affect the capability of communities to adapt to risks related to climate change'. Community organisation has also emerged as an important factor in adaptive strategies to build resilience among communities (IPCC 2007: Chapter 17.3.1).

> **… there has been a convergence of findings in the literature showing that human and social capital are key determinants of adaptive capacity at all scales, and that they are as important as levels of income and technological capacity (IPCC 2007: Chapter 17.3.2).**

RESOURCES TO SUPPORT ADAPTIVE CAPACITY

A number of resources are available online to inform about climate change and adaptation to climate change. Some of these appear in the box below, all taken from the NCCARF website.

ONLINE CLIMATE CHANGE AND CLIMATE CHANGE ADAPTATION RESOURCES

CLIMATE CHANGE

- IPCC website: www.ipcc.ch
- UNFCCC website: unfccc.int
- Australian Government Department of Climate Change: www.climatechange.gov.au
- Tyndall Centre for Climate Change Research: www.tyndall.ac.uk
- UK Climate Impacts Programme: www.ukcip.org.uk
- Stockholm Environment Institute: www.sei.se

CLIMATE CHANGE ADAPTATION

- UNFCC on adaptation unfccc.int/adaptation/items/4159.php
- CSIRO Climate Adaptation Flagship: www.csiro.au/org/ClimateAdaptationFlagship.html
- Resilience Alliance: www.resalliance.org
- WikiADAPT: wikiadapt.org
- WeADAPT: www.weadapt.org
- Eldis page on adaptation: www.eldis.org/go/topics/dossiers/climate-change-adaptation
- Community based adaptation exchange – Eldis: community.eldis.org/.59b70e3d/
- AusAid webpage on adaptation: www.ausaid.gov.au/keyaid/adaptation.cfm
- World Bank webpage on adaptation: beta.worldbank.org/overview/climate-change-adaptation
- OECD work on adaptation: www.oecd.org/env/cc/adaptation
- Unofficial Adaptation Blog – http://acclimatize.wordpress.com

SOURCE: NCCARF WEBSITE - http://www.nccarf.edu.au/

2.3 MITIGATION

Responses to climate change require two closely aligned interventions - mitigation or direct reduction of emission of greenhouse gasses (GHG) into the atmosphere and adaptation or changing behaviour to respond to climate change (IPCC 2007: Chapter 18.1; PMSEIC 2007: 23). The more effective the mitigation, the less will be the adaptation needed (Stanley *et al* 2010: 8).

> **… climate change response includes not only adaptation to climate change impacts but also emissions mitigation measures. The nature and degree of mitigation measures is likely to influence the extent of adaptation measures in different sectors of the economy. Similarly, the effectiveness of adaptation measures … can help inform mitigation policy (PMSEIC 2007: 23).**

Mitigation reduces the impacts of climate change and thus reduces the adaptation challenge, whereas adaptation is selective; it can take advantage of positive impacts and reduce negative ones. Mitigation can enhance adaptive capacity by eliminating market failures and distortions, and by providing incentives that foster desired behaviours such as, adjustments in consumption and investment patterns (IPCC 2007: Chapter 18.1).

The key difference between mitigation and adaptation is that mitigation aims to slow the rate of climate change while adaptation is a response to existing or projected consequences of climate change. However, both are needed to achieve climate change resilience (UN Global Compact 2011: 68).

2.4 Risk and uncertainty

Adaptation to climate change involves working with considerable uncertainty and managing risks, and both can complicate adaptive responses. Although uncertainty is part of daily life and part of daily decision making in a range of sectors (for example, it is central to farming), the uncertainty associated with climate change is much greater, partly because of incomplete information (Productivity Commission 2011: 6).

Risk management is also an inherent part of adaptation (Stanley *et al* 2010: 8). An Independent Working Group of the Prime Minister's Science Engineering and Innovation Council (PMSEIC 2007: 23-25) identifies six sectors or systems at particular risk from climate change:

- Cities and coastal communities
- Water
- Health
- Agriculture fisheries and forestry
- Infrastructure
- Natural systems.

The PMSEIC report identifies the expected negative impacts for each, key locations around Australia affected, and a range of potential adaptive responses (2007, Table 5 pp 24-25). The PMSEIC Independent Working Group recommended that action be prioritised through the following four areas of focus:

- Australia's major cities and urban centres
- The Murray Darling basin
- Iconic biodiversity tourism centres
- Communities with lower capacity to adapt and most vulnerable to the negative impacts of climate change, specifically, Indigenous communities, remote communities, older people and economically disadvantaged communities.

RISK MANAGEMENT AS A FRAMEWORK FOR DECISION MAKING

The methodology associated with recognised and formalised approaches to risk management is considered to provide one framework for choosing adaptive responses to climate change. It has the advantage of providing formal methods to manage uncertainty, the capacity to involve different stakeholders, the ability to evaluate policy options without defining policy directions, the capacity to integrate different disciplines and of ensuring that climate change is addressed within broad decision making processes (PMSEIC 2007: 29).

The Local Government Association of SA notes the need to understand the limitations of standard risk assessment methodology in determining the likely impacts of climate change, and in determining resilience to climate change. Therefore, risk assessment needs to be accompanied by vulnerability assessment which is more tailored to assessing the likely impact of climate change and the capacity to adapt.

> **Most critically, the likelihood of an event occurring is difficult to quantify as an understanding of past climate events will not provide an accurate picture of the future. Instead of considering likelihood and consequence, a climate change vulnerability assessment determines the impact of climate change by considering … sensitivity … to the expected changes, and then how exposed the organism or system is to the expected changes. The assessment then builds upon a risk analysis by considering not only the impacts associated with climate change, but also the intrinsic capacity to overcome stress and adapt to changed conditions – adaptive capacity (LGASA 2012: 9).**

Risk management at local government level is discussed further in *Section 3.1.3.*

2.5 VULNERABILITY

> **[Vulnerability is] ... the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity (IPCC 2011: Chapter 19.1.2.1).**

Vulnerability involves higher than normal susceptibility to disadvantage combined with reduced capacity to manage change. People already experiencing some form of disadvantage and who are at risk of social exclusion are the most vulnerable and experience the greatest difficulty in adapting to climate change if not offered targeted support and resources (Stanley *et al* 2010: 11; OECD 2010: 17). Climate change becomes a compounding challenge to a range of other existing difficulties. Adaptive capacities are unevenly distributed, across and within societies (IPCC 2007).

While vulnerability reduces the likelihood of strategies that promote resilience being effective, it also represents an outcome of a lack of resilience and capacity to adapt. Vulnerability to climate change can occur at a range of levels and will vary between and within communities. From a systems level, climate change induced environmental vulnerability encompasses a wide range of harm and loss, including

reduced water quantity or quality, increased habitat fragmentation and damage to ecosystems. For social systems, climate change related vulnerability can involve disrupted social networks and community strength, reduced productivity, increased illness, and reduced income. For physical systems, vulnerability can involve damaged infrastructure assets, increased need for maintenance or relocation of those assets and reduced capital value of assets. In terms of individuals, climate change induced vulnerability can involve increased illness and mortality, and reduced access to care and support. (LGASA 2012: 10).

The term 'vulnerability' can therefore refer to the vulnerable **system itself** (e.g. coastal cities), the **impact to this system** (e.g. flooding of coastal cities) or the **mechanism causing these impacts** (e.g. disintegration of the West Antarctic ice sheet). Many impacts, vulnerabilities and risks merit particular attention by policy-makers due to characteristics that might make them 'key'. The IPCC identifies seven criteria from the literature that can be used to identify key vulnerabilities:

- The magnitude of impacts,
- The timing of impacts,
- The persistence and reversibility of impacts,
- The likelihood (estimates of uncertainty) of impacts and vulnerabilities, and confidence in those estimates,
- The potential for adaptation,
- The distributional aspects of impacts and vulnerabilities, and
- The importance of the system(s) at risk (IPCC 2007: Chapter 19.2).

However, further understanding of the 'key vulnerabilities' concept requires further interdisciplinary research and approaches that integrate bio-geophysical and socio-economic processes. In particular, there is a need to better understand the underlying dynamics of changing socio-economic conditions which determine vulnerability with the relevant research questions being less about how welfare is affected by changing socio-economic conditions, and more about *how much* change in socio-economic conditions affects vulnerability to climate change (IPCC 2007: Chapter 19.4.4).

Assessing degree of vulnerability to climate change is not a straightforward task and there is significant debate in the scientific community about how best to do this, and about which resources are most suitable (LGASA 2011: 8). Assessment of vulnerability has been defined as a 'measure of possible harm' to the environment, to the people living in that environment and to the social and physical systems in which they function (LGASA 2012: 10 citing Hinkel 2011).

It is important to recognise the role of values in assessing vulnerability. Individuals and communities can value the significance of climate change impacts on human and natural systems differently. This is most commonly seen in differences expressed between environmental groups and extractive industry groups.

THE RELATIONSHIP BETWEEN RISK, VULNERABILITY, ADAPTIVE CAPACITY AND RESILIENCE

The Vulnerability Framework depicted below is adapted from Preston & Stafford-Smith (2009) and demonstrates the relationship between the key concepts of vulnerability, risk, adaptation and resilience and how resilience can be the key outcome of adaptive interventions which are designed to manage risk and reduce vulnerability. If the critical element of adaptive capacity is removed then the outcome will not be resilience and is replaced by vulnerability and being at risk.

In other words, the less adaptive capacity that exists, the less resilience will prevail, and the greater will be the vulnerability to climate change.

FIGURE 1: THE ROLE OF ADAPTIVE CAPACITY IN PROMOTING RESILIENCE (PRESTON & STAFFORD-SMITH 2009)

INTEGRATED VULNERABILITY ASSESSMENTS

Acknowledging the interactive impact of different sources of climate stress, integrated vulnerability assessments (IVAs) take into account more than a single system. They may involve a triple bottom line approach that integrates environmental, social and economic factors or they may involve a 'five capitals' approach (human, social, financial, physical and environmental dimensions of capital) – which is the recommended approach of the Local Government Association of SA (2012). The key outputs of an IVA involve identifying:

- ⇨ Which industries, communities, businesses, ecosystems, and species are most vulnerable to climate change, and
- ⇨ Why they are vulnerable – for example, because they are more exposed, more sensitive or have low adaptive capacity (LGASA 2012: 12).

There are a number of benefits to the IVA approach, including:

- ✓ Coordination of action across different stakeholders and sectors
- ✓ Designing responses that have multiple positive impacts
- ✓ Enhancing efficient use of resources
- ✓ Building networks, raising awareness levels and engaging key partners through the collaborative process (LGASA 2012: 12).

CRITERIA FOR ASSESSING VULNERABILITY

The Intergovernmental Panel on Climate Change (IPCC) identified a number of criteria for assessing vulnerability including the following:

- ☑ Magnitude - impacts are of a large scale (e.g. high number of people or species affected) or a high intensity (e.g. catastrophic degree of damage such as loss of life or extinction)
- ☑ Timing - impacts are expected in the short term and/or are unavoidable in the long term if not addressed
- ☑ Persistence/reversibility - impacts result in persistent (e.g. water shortages) or irreversible (e.g. species extinction, melting of ice sheets) damage
- ☑ Likelihood/certainty - projected impacts or outcomes are highly likely
- ☑ Importance - sectors or systems at risk are of high value to society (Govt of SA 2011: 28).

3 STRUCTURED ADAPTIVE RESPONSE TO PROMOTE RESILIENCE

A significant amount of the literature on adapting to climate change is focused on institutional change, with behavioural and attitudinal change at individual level being an outcome of this type of strategy. Institutional change is collective and coordinated change across key stakeholder sectors of influence, namely, government, business and community organisations. It involves integrating climate change adaptive responses into mainstream planning and decision making and ensuring that its impact therefore occurs at all levels and across sectors. This strategy is evident in the international literature as well as in that pertaining to Australia. Leadership on climate change response needs to be institutional to be effective.

> **... leadership [on climate change] is not just an individual issue; it is also institutional and has to do with the way responsibility, coordination, and accountability for climate policy are organized .... (World Bank 2010: 332.**

Significant institutional leadership is provided by the International Panel on Climate Change (IPCC) which was established in 1988 by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation to assess scientific, technical and socio-economic information pertinent to climate change and provide a primary source of information for policy makers. IPCC information is presented in such a way as to enhance understanding of climate change and the ways in which it is likely to impact, and to highlight possible adaptive responses.[5] It does not undertake primary research but reviews the findings of thousands of scientists from around the

[5] See http://www.ipcc.ch/organization/organization.shtml#.UTKjjzckEmU

world, and in its synthesis of their research, it aims to reflect the range of differences involved.

As an intergovernmental body, the IPCC is open to all member countries of the United Nations (UN) and WMO and has 195 member countries. Governments participate in the review process and the plenary Sessions, where main decisions about the IPCC work programme are taken and reports are accepted, adopted and approved. The IPCC has presented a series of Assessment Reports, the fourth in 2007 (which concluded that global warming has accelerated in the past few decades and that stronger evidence exists to link increased greenhouse gas emissions with human behaviour) and the fifth due for release in 2014. *Findings from recent Assessment Reports are reflected throughout this review of the literature.*

3.1 The role of Government

In its analysis of available research findings, the IPCC concluded in its most recent assessment report that governments have a critical role to play in increasing resilience through promoting adaptive capacity at the institutional level. Governments can ensure that people and organisations are informed in the choices and decisions they make, and in providing protection from the impacts of climate change.

> **An emerging literature on the institutional requirements for adaptation suggests that there is an important role for public policy in facilitating adaptation to climate change. This includes reducing vulnerability of people and infrastructure, providing information on risks for private and public investments and decision-making, and protecting public goods such as habitats, species and culturally important resources (IPCC 2007 citing numerous researchers).**

Government intervention is important because of the need to address multiple market failures in pricing, research, technology development, changing attitudes, educating and informing the public, and coordinating action globally, nationally and locally. Government also has the *legitimacy* to intervene to address these issues (World Bank 2010: 330-331). This is not to discount the important role of business (discussed in *Section 3.2*) and non-government organisations.

An essential strategy for governments to promote is that of **integration** of adaptive and mitigation responses into mainstream decision making across its own agencies and outside of government, across sectors. Examples include the integration of climate information into environmental data sets, vulnerability or hazard assessments, broad development strategies, macro policies, sector policies, and institutional or organisational structures. The mainstreaming strategy ensures consistency in institutional-focused adaptation to climate change (IPCC 2007).

Finally, the role of government will differ across different levels of government depending on which activities are most appropriate for the sphere of influence exerted at each level.

3.1.1 Federal Government

No single government agency can manage all of the responsibilities, policy making and planning required to address the different aspects of climate change. As with other complex issues, cross-government intervention is essential. However, in most countries climate change is the responsibility of the agency specialising in environmental issues, which is usually less powerful than agencies with central influence, such as, Treasury (World Bank 2010: 332-333).

Structural strategies for overcoming this barrier to adaptation include establishing climate change policy units across government complemented by sectoral plans for mitigation and adaptation at national and local levels; establishment of a climate change lead agency with power to coordinate across agencies; establishing climate change coordination structures, such as Cabinet committees and coordinating climate change policy at federal level. Strategy documents support these structural interventions, by providing frameworks which consolidate activity and coordinate policy (World Bank 2010: 333-334). Government accountability for climate change response can also be enhanced by making line agencies more accountable to core government ministries, such as the Department of Prime Minister and Cabinet, or by making the entire government more accountable to Parliament (World Bank 2010: 334).

In 2002 the Australian government defined 'responding to climate change and variability' as a priority goal under the *National Research Priority for an Environmentally Sustainable Australia*[6] and since that time a number of national initiatives have been developed to support mitigation and adaptation to climate change.

In 2006 the Department of Climate Change and Energy Efficiency (previously the Australian Greenhouse Office) released the Climate Change Impacts and Risk Management Guide focusing on Business and Government (Australian Greenhouse Office 2006) which outlined how to undertake a climate change impact and risk assessment based on the widely used Australian and New Zealand Standard for Risk Management (AS/NZ 4360:2004). It identified five key steps which occur within a framework of communicating and consulting, and monitoring and reviewing:

- ✓ Establish the context
- ✓ Identify the risk
- ✓ Analyse the risk
- ✓ Evaluate the risk
- ✓ Treat the risk (Australian Greenhouse Office 2006, Figure 5 page 19).

This located climate change related risk analysis within mainstream processes for **risk assessment,** in line with good practice trends relating to integration of climate change management. The Department then produced a companion guide for Local Government (Dept for Climate Change & Energy Efficiency 2007) which also locates

[6] See http://www.arc.gov.au/pdf/nrps_and_goals.pdf

climate change adaptation within an overall risk management regime to ensure that adaptation actions form part of planning and day to day operations. The report provides a framework for local governments to identify appropriate adaptation responses for their potential level of risk, and identifies potential climate change adaptation options for each local government sector.

A range of resources developed by the Australian government appear in the box below.

There are a range of useful reports on the website of the Department of Climate Change and Energy Efficiency – www.climatechange.gov.au . In addition, the Department provides funding for a range of adaptive programs, including the *Local Adaptation Pathways Program* which funds climate change risk assessment projects. Other Australian government agencies providing funding and resources for mitigation or adaptation activities include:

- The Department of Environment Heritage Water and the Arts – this agency assumed responsibility for energy efficiency and renewable energy programs that were transferred from the Department of Climate Change & Energy Efficiency and manages rebates for households under the National Rainwater and Greywater Initiative and Education for Sustainability programs. (www.environment.gov.au)

- The Department of Regional Australia, Regional Development and Local Government provides the Local Government Reform Fund which is designed to build local government capacity and build resilience in critical areas like asset and financial management, workforce planning or demographic and climate change adaptation. (http://australia.gov.au/directories/australia/regional-dept)

- The Attorney-General's Department is responsible for the Natural Disaster Resilience Grants Scheme which provides grants to local government to undertake natural disaster risk assessment and risk reduction initiatives. (www.ag.gov.au)

The Council of Australian Governments released in 2007 the *National Climate Change Adaptation Framework* which set an agenda of collaboration between governments to fill knowledge gaps impeding effective adaptation to climate change.[7]

In the same year the Australian government established the **Climate Adaptation National Research Flagship** at the CSIRO[8] to support practical action across vulnerable sectors to manage the risks of climate change, and to support a partnership between government, scientists, industries and communities. The scientific work of the Flagship is intended to inform and underpin the *National Climate Change Adaptation Framework*.

[7] http://www.climatechange.gov.au/en/government/initiatives/~/media/government/initiatives/nccaf/national_climate_change_adaption_framework.pdf

[8] http://www.csiro.au/en/Organisation-Structure/Flagships/AboutNationalResearchFlagships/NewFlagshipClimateAdaptation.aspx

Also established in 2007 was the **Australian Centre for Climate Change Adaptation at** the CSIRO and this has a key role to play in promoting cross-disciplinary research, and in strategically focusing research to yield common benefits, linking research organisations, and coordinating multidisciplinary and cross sectoral research. It is seen as 'bringing coherence to Australian adaptation research', and providing a much needed interface between researchers and decision makers (PMSEIC 2007: 42).

Australian government funding also supported the **National Climate Change Adaptation Research Facility** (NCCARF)[9] an interdisciplinary research community whose work is also providing both information and leadership around adaptive response to climate change. NCCARF is responsible for the preparation of national Adaptation Research Plans which identify critical climate risk management information gaps for decision makers in government, in vulnerable sectors. A series of Adaptation Research Networks has been established to implement these Plans, bringing together a community of researchers and practitioners to progress climate change adaptation knowledge. Different universities host the networks which are focused on –

- Terrestrial Biodiversity
- Primary Industries
- Water Resources and Freshwater Biodiversity
- Marine Biodiversity and Resources
- Human Health
- Settlements and Infrastructure
- Emergency Management and
- Social Economic and Institutional Dimensions (www.nccarf.edu.au).

While the Australian Government recently announced that funding for NCCARF will not be extended to 2014 a range of outputs will be generated from existing commitments over the course of 2013.

3.1.2 State Government

All State and Territory governments have developed policy statements on adaptation to climate change and some have overarching legislative frameworks to support this adaptation (Productivity Commission 2011: 12). State government targets for climate action are set in *South Australia's Strategic Plan 2011* updated from 2007 (Government of SA 2011), and in its *Renewable Energy Plan for South Australia* (Government of SA 2011). Carbon reduction goals are also included in *The 30-year Plan for Greater Adelaide*, and in the *Adelaide Green City Sector Agreement* (Government of SA 2009, 2010).

The South Australian government is also providing leadership for institutional level adaptation to climate change through the work of several agencies and structures, such as, the Premier's Climate Change Council, and the Sustainability and Climate

[9] http://www.nccarf.edu.au/

Change Office, as well as through the overarching *Climate Change Adaptation Framework.* Refer to **Appendix A** for more details about the Framework's content.

The *Climate Change and Greenhouse Emissions Reduction Act 2007* made South Australia the first state in Australia to legislate targets to reduce greenhouse emissions. Apart from setting targets, the legislation also commits the State government to work with business and the community to develop strategies to reduce greenhouse emissions and adapt to climate change. Resulting initiatives include Climate Change Sector Agreements and the Climate Change Adaptation Framework for South Australia (discussed in more detail below).

Climate Change Sector Agreements are formal cooperative agreements between the State Government and business organisations, industry sectors, community groups and regions to help address climate change. The agreements typically encourage actions to reduce greenhouse emissions and adapt to climate change and partners may include:

- ✓ businesses and industry groupings
- ✓ non-government or not-for-profit organisations
- ✓ state and local government
- ✓ representatives of regional areas
- ✓ the environment and conservation sector
- ✓ the scientific and education community
- ✓ individuals and special interest groups of the general community.

The **Premier's Climate Change Council** is a high level, independent structure established to advise the Premier on reducing greenhouse gas emissions and adapting to climate change. Adaptation is seen as a high priority strategy by the Council, which worked with the Natural Resources Management Council to produce the Climate Change Adaptation Framework (Govt of SA 2010: 12).

The **Sustainability and Climate Change Office** was established in 2006 within the Department of the Premier and Cabinet. In January 2012 it moved into the Department of Environment, Water and Natural Resources.[10]

3.1.3 Local Government

> **...because [local governments] are at the intersection of government and the public, they become the space where government accountability for appropriate responses plays out (World Bank 2010: 334).**

Local government's response to climate change requires a dual approach involving these complementary and mutually reinforcing activities:

- ⇨ management and reduction of greenhouse gas emissions (mitigation)

[10] See http://www.sa.gov.au/subject/water,%20energy%20and%20environment/Climate%20change

- making adjustments to existing activities and practices so that vulnerability to potential impacts associated with climate change can be reduced or opportunities realised (adaptation) (Dept for Climate Change & Energy Efficiency 2007: 9).

The nature of the relationship between each local government and their community means that local government has the ability to play a role as educator and raise awareness within their communities, and to promote sustainable development (Dept for Climate Change & Energy Efficiency 2007: 12).

The Local Government Association of South Australia (LGASA) has provided leadership and a range of useful resources to guide local councils in mitigation and adaptation responses to climate change. These include the *LGASA Climate Change Strategy 2008-2012* and the *South Australian Local Government Sector Agreement – Climate Change* – both released in 2008, and reflecting the directions set in *South Australia's Greenhouse Strategy 2007-2020*. The LGASA has set a target since 2007 for SA local councils to purchase at least 20% Green Power.

Across Australia there have been numerous surveys of local government authorities to determine their responses to climate change. In South Australia, Zeppel (2012) surveyed 14 inner and outer metropolitan Adelaide councils. All reported damage from extreme weather events, mainly due to drought (71%); heat waves (64%); flash floods (57%); bushfires (43%); river floods and wind storms (36%), and coastal erosion or storm surges (63%). All agreed that climate change was an important issue and that it was important to reduce the carbon emissions of their local council. Survey results indicated that the main focus of councils was on reducing greenhouse gas emissions through a range of carbon mitigation and renewable energy measures.

However, the integration of adaptive strategies in mainstream decision making across Councils was less evident in Zeppel's findings. Council responsibility for climate change issues was found to be mainly delegated to environmental services, sustainability and planning areas, and staff from these areas indicated they sometimes lacked support from managers or other council departments. However, those councils with climate change strategies and policies were integrating carbon mitigation across council operations, communicating proactive climate actions both internally (i.e. council staff) and externally (i.e. ratepayers), and reflecting on local carbon options. The City of Onkaparinga was described by Zeppel as a 'leader'.

Nursey-Bray (2010, Table 3) has developed a *Climate Change Governance Framework for Local Councils*, involving three levels of focus – management, communication and reflexive practice. It is shown in the box below.

Climate Change Governance Framework for Local Councils (Nursey-Bray 2010)

1. Adaptive Management

• Continually improving managerial practices for climate change (e.g. energy efficiency)

• Build on environmental assessment techniques and environmental management systems (GHG audit)

• Institutionalise climate change framework to implement varied policies, learning over time (e.g. plans)

• Mainstream climate change into existing council strategies and day-to-day business (climate proofing)

• Build more strategic alliances with ratepayers/local groups to trial mitigation and adaptation options

2. Communication

• Communicate climate change/variability using science; need to take proactive action; discuss options

• Communicate feasible climate change options for different groups (ratepayers, staff, councillors) and link/align climate change issue with local interests and agendas (e.g. solar PV power)

• Market climate change mitigation projects and schemes implemented by council

• Involve all interest groups (from community/conservation groups to the Mayor) in low carbon actions

• Add climate change into existing council processes for emergency management, health and safety etc and incorporate climate change guidelines into council policies (e.g. renewable energy)

3. Reflexive Practice

• Reflecting on global, national and state programmes for climate change mitigation by councils (e.g. CCP)

• Review other low carbon initiatives and practices and adapt these to suit local needs and locations

• Develop a council data base, web links, seminars on carbon mitigation products and services

• Work with other local councils on climate mitigation projects and initiatives to save time and money

• Build regional alliances and networks and allocate council funding to carbon mitigation actions

STRUCTURED RISK ASSESSMENT AT LOCAL GOVERNMENT LEVEL

The Local Government Association Mutual Liability Scheme (LGAMLS) **Climate Adaptation Program** (2008) was the first coordinated assessment of climate change risks affecting a government sector in Australia.[11] It was designed to provide South Australian Councils with *'… a framework to translate climate impacts into identified*

[11] Details at http://www.lga.sa.gov.au/site/page.cfm?c=16030

risks to their business operations, whilst developing realistic adaptation measures over short and long term planning horizons.' The program also aims to build and maintain the resilience of local communities, and is based on local level assessment which is subsequently consolidated into an industry wide position. Using climate change variables developed by the Australian Government's *Climate Change in Australia Technical Report 2007* and endorsed by the Bureau of Meteorology and region specific CSIRO scientific data, a number of scenarios have been developed to inform decision making about future risks and potential adaptive responses. Furthermore, the Climate Adaptation Program is designed to integrate adaptation into strategic planning and management by using a risk management framework based on the *Australian Standard Risk Management* (AS/NZ ISO 31000).

The Interim Report found that this common risk assessment framework could be applied across 29 councils with diverse locations, and that this framework supports the identification of key risks on individual council as well as a sector wide basis.

Risks were assessed using a four step method involving –

1) Rating the level of impact of a risk event on a community, in a range from Insignificant ⇨Minor ⇨Moderate⇨Major⇨Catastrophic.
2) Exploring the consequences of those impacts on a community's resilience
3) Rating the likelihood of a risk event occurring (in a range from Rare to Almost Certain)
4) Assigning risk management priorities.

The following five steps were found to be critical to Councils implementing a '*comprehensive climate-resilient strategy'* at local or state wide level -

- Create an inclusive local community effort.
- Recognise the different roles for each stakeholder, including all tiers of government, community, business and individuals.
- Define current and target priorities for adaptation measures.
- Address existing obstacles to implementing adaptation measures, such as, policy, organisational capabilities and legislative barriers.
- Encourage sufficient funding from State and/or Federal governments.

A number of resources have been developed to guide local governments in their climate change adaptation efforts. Some of these appear in the box below.

RESOURCES TO GUIDE LOCAL GOVERNMENT ADAPTATION ACTIVITIES

The leading international agency, ICLEI (Local Governments for Sustainability) is an association of local governments supporting over 1100 cities around the world. ICLEI provides access to international expertise and information on sustainable development for council authorities, and programs that support local government agencies in climate change mitigation and adaptation. This includes the Adaptive and Resilient Communities program and the Cities for Climate Protection program – see www.iclei.org . ICLEI's **Resilient Cities 2013** initiative provides a range of resources, including *'Toward Resilience: A Guide to Disaster Risk Reduction and Climate Change Adaptation'* which provides essential information, guidelines for action, case studies and links to useful tools and resources, for the application of an integrated, rights-based approach to disaster reduction and climate change adaptation – see http://resilient-cities.iclei.org/ . This is one of many resources held in the ICLEI Library which can be accessed at http://resilient-cities.iclei.org/resilient-cities-hub-site/resilience-resource-point/resilience-library/ .

Nationally, the Australian Local Government Association (ALGA) provides information, resources and policy advice relating to adapting to climate change, and participates in COAG and other relevant Ministerial structures (see http://alga.asn.au/?ID=210&Menu=44,419).

The Local Government Association of South Australia (LGASA) has produced guidelines for local government authorities that support government-driven management of climate change adaptation at the local level. Following the release of the SA Government's Climate Change Adaptation Framework, the LGASA released a set of guidelines to assist councils undertaking a Climate Change Action Plan and in 2012 released a follow up guide which provided an expanded methodology for preparing such Plans, including the process for undertaking an integrated climate change vulnerability assessment (IVA) (LGASA 2011). The methodology in the second guide builds on climate change risk analysis method by addressing climate change impacts on council business together with the sensitivity and adaptive capacity within the regional context in which the council operates. The guide is designed to promote consistency in the actions of stakeholders within the region when undertaking an integrated climate change vulnerability assessment, which in turn, supports consistency in the application of the State level adaptation framework (LGASA 2012) http://www.lga.sa.gov.au/site/page.cfm?u=1544

There are numerous local government authority climate change adaptation resources, including risk and vulnerability assessments and adaptation strategies. Examples include:

Kinrade P, Justus M *et al* (2008) *Impacts of climate change on settlements in the Western Port Region: climate change risks and adaptation,* Victorian Government - http://www.climatechange.vic.gov.au/__data/assets/pdf_file/0015/73230/ImapactsofClimateChangeonSettlementsinWesternport2008.pdf

Gosford City Council (2010) *Gosford City Council Business Case for managing climate change adaptation* - http://www.gosford.nsw.gov.au

NSW Mayors' Agreement on Climate Change - http://www.kempsey.nsw.gov.au/pdfs/documents/docs/climate%20change%20agreement.pdf

Preston B *et al* (2008) *Mapping climate change vulnerability in the Sydney Coastal Councils Group*, CSIRO and the Sydney Coastal Councils Group - http://www.sydneycoastalcouncils.com.au/

Cooma Monaro Shire Council (2009) Climate change risk assessment: Adaptation Report - http://www.cooma.nsw.gov.au/files/docs/environmental_management/0382_br_echelon_climate_change_risk_assessment_cooma.pdf

Swan River Trust (2010) *Climate change risk assessment project: a methodology enabling local government to assess the vulnerability of foreshore areas to sea level rise,* East Perth - http://www.swanrivertrust.wa.gov.au/docs/technical-reports/climate-change-risk-assessment-project-introduction-and-executive-summary.pdf

3.2 The role of Business

The role of business in tackling climate change has largely been focused on mitigation (reducing green house gas emissions) than on structured adaptation to climate change, although much is also happening in relation to the latter. The literature identifies a growing awareness of the need to locate climate change related risk and opportunity analysis in mainstream business planning and decision making. Some writers also identify direct links between resilient communities and vibrant businesses (UN Global Compact 2011: 17).

> **The private sector is a relative newcomer to climate change adaptation …. To date, most businesses concerned about climate change have been more focused on reducing their GHG emissions to mitigate climate change than on responding to … climate change risks and impacts (UN Global Compact 2011: 17).**

The United Nations Global Compact outlines a business case for adaptation to climate change using strategies that build the resilience of vulnerable communities in developing countries (UN Global Compact 2011). This is based on the 2010 *Caring for Climate* survey of corporate signatories to the Compact and on a review of literature. It offers a resource for companies with global, national or regional reach and makes the point that both public and private sector involvement are required for effective institutional approaches to climate change adaptation.

> **It is ultimately the responsibility of the public sector to meet the critical climate change adaptation needs of the poor and vulnerable; thus private sector engagement cannot substitute for critically needed public investment and policies. However, private sector investment can serve as a pivotal part of a comprehensive government-led approach to addressing climate impacts (UN Global Compact 2011: 5).**

The report crystallises the mutually dependent relationship existing between public and private sectors, and between businesses and communities in developing resilience in the face of climate change, highlighting that all these stakeholders can be vulnerable if mitigation and adaptation strategies are not pursued. For businesses, however, the report identifies the potential to gain competitive edge through responses that simultaneously meet community needs. Competitive edge can be obtained through, for example, developing new products and services which assist communities and individuals to adapt effectively, and building positive reputations as corporate citizens. Significant opportunities are identified in supporting a transition to a green economy, which has strong synergies with climate change adaptation. *(See Section 3.3 for further information.)*

The survey of companies which informed the report found that despite 83 per cent of companies perceiving risk to their business by climate change, few had adopted strategies which comprehensively managed that risk. Twenty percent or more of companies identified eleven high to very high impact risks associated with climate change, including (and in order of significance):

- Increasing costs for natural resources and raw materials
- Water scarcity
- Energy security
- Threats to human health
- Greater exposure to natural disasters and changing weather patterns
- Transportation risks (UN Global Compact 2011: 19).

The survey found limited understanding about climate adaptation and what it involves for businesses and the markets they serve, and found few resources or tools that targeted business to support their adaptive capacity. Companies also perceived few incentives in making upfront investments to support climate resilience, making it unlikely that adaptation was seen as a strategic priority. The following six strategies were identified as necessary for businesses:

- ✓ Connect climate adaptation and resilience to the company and corporate culture, building on existing mitigation initiatives.
- ✓ Integrate climate adaptation into core strategic business planning processes.
- ✓ Align business objectives with adaptation priorities.
- ✓ Build a portfolio of climate resilient goods and services.
- ✓ Build mutually beneficial strategies with stakeholders and build communication channels with them.
- ✓ Partner with internal and external decision makers (UN Global Compact 2011: 7).

> **Adaptation champions within the company will want to focus their colleagues' attention on three key questions: 1) What does climate resilience mean for the company? 2) What will position the company to navigate risks and lead markets in a warming world? and 3) How will the company engage partners to minimize risks and seize opportunities?(UN Global Compact 2011: 7).**

The ADAPT project in the United Kingdom was designed to identify how businesses can adapt their policies, practices and technologies to protect themselves from climate change associated risks while grasping opportunities associated with climate change. The project developed an organisational model of adaptation which defines adaptation as a learning process. The project worked intensively with nine businesses from the construction and water services sectors over a two year period. Research associated with the project developed a profile of the businesses' vulnerability, their knowledge of climate change related risks and their attitudes to those risks, the adaptation strategies that were available to the nine companies and their capacity to implement adaptive strategies. Among the project's findings were the following:

- Awareness of climate change and its impact varied markedly across the two sectors.
- Indirect impacts, such as increasing insurance premiums, proved to provide more significant incentives to adapt than did direct climate change impacts.

- While a potentially wide set of adaptive opportunities were available to the nine organisations, their capacity to implement these was impeded by a number of factors including the ambiguity of the link between business opportunity and adaptation, limited information about the benefits of adaptation, and the weakness of signals of climate change in terms of their tangible presence.
- Adaptive response was often complex and involved multiple adjustments.
- Effective adaptation relied not only on internal organisational capacity but on external relationships, including with regulators, suppliers, competitors and customers (Berkhout *et al* 2004).

As the UN Global Compact observed, the key strategy to engaging the private sector in the collaboration required with governments and communities, and to engaging business expertise in contributing to climate change adaptation solutions, lies in finding the *'nexus of shared interest'* where business incentives align with the adaptation-related needs of communities (2011: 7).

Government and Business Collaboration

The UN Global Compact (2011: 41) delineates a range of policy measures which governments can initiate in order to build private sector capacity for adaptation. These are summarised in the table below.

Policy Goal	Associated Intervention
Build a foundation for private sector investments and action	✓ **Demonstrate policy and finance commitment to adaptation** ✓ **Engage businesses as stakeholders in planning and implementation**
Align public and private adaptation interests	✓ **Stimulate the market for adaptation through financial and risk reduction incentives** ✓ **Develop policy and regulatory frameworks to guide corporate practices**
Promote best practice and collaboration	✓ **Provide businesses with information and tools they need to make investments that support climate resilience in vulnerable communities** ✓ **Consider new forms of public-private partnerships to tackle the most complex challenges to sustainable development and climate resilience**

Resources to guide business Adaptation

There are a number of resources that have been developed to guide corporate climate change adaptation. The UN Global Compact report (2011 op cit) sets out clear guidelines for businesses to pursue in mainstreaming climate change adaptive strategies and can be accessed at - http://www.unglobalcompact.org/docs/issues_doc/Environment/climate/C4C_Report_Adapting_for_Green_Economy.pdf

Other resources are exemplified in the box below.

RESOURCES TO ASSIST BUSINESS IN ADAPTING TO CLIMATE CHANGE

- Business for Social Responsibility (2011) *Adapting to climate change: a guide for food, beverage and agriculture companies* – www.bsr.org
- Oxfam America (2010) *A fresh look at the green economy* – www.oxfamamerica.org
- Oxfam America (2009) *The new adaptation marketplace* – www.oxfamamerica.org
- Price Waterhouse Coopers (2010) Business leadership in climate change adaptation – www.pwc.co.uk
- World Resources Institute (2009) Making climate change your business: private sector adaptation in Southeast Asia – www.wri.org
- Economics of Climate Change Working Group (2009) Shaping climate resilience development: a framework for decision making – www.mckinsey.com
- World Business Council for Sustainable Development (2008) Adaptation: an issue brief for business – www.wbcsd.org

3.3 Climate Change Adaptation: Green manufacturing and employment

A growing number of reports highlight the opportunity presented by 'green' manufacturing and employment as an adaptive response to climate change. These encompass work associated with mitigation (eg reducing GHG emissions as occurs in the clean energy and building industries) as well as with adaptation. The development of new products and services that address adaptation needs benefits business while building industry and community resilience to climate change (UN Global Compact 2011: 28).

A green economy can emerge from increased use of renewable energy sources, through technologies associated with this (eg photovoltaic cells), through the creation of green industry start up businesses and the development of green products. 'Green' or 'Green Collar' jobs become the employment mechanism to realise these and other adaptive initiatives which present opportunities in the face of climate change risks. Government can play a critical role in facilitating a green economy through incentives and funding and information dissemination, it can support networks that enhance knowledge sharing relating to climate change mitigation and adaptation, and through funding industrial and public research collaboration in 'eco-innovation clusters' (OECD 2010: 21).

Green jobs can be a major source of employment, particularly in the public sector, and actively linked to supporting traditionally disadvantaged populations to adapt to climate change (Lee & Card 2012: 7).

> **The importance of putting forward a coherent jobs agenda as part of a green industrial revolution cannot be understated. Few workers will go along with a radical transformation to de-carbonize the economy and achieve sustainable production systems if they fear they will lose their livelihood in the process. A green jobs framework that aggressively ensures new employment in 'sunrise' sectors, a program of advanced skills upgrading and training, and a guarantee that no one will be left behind inform a 'green social contract' that is a prerequisite for change ….(Lee & Card 2012: 19).**

Transportation policy is another component of a green jobs plan, both in construction of public transport options to reduce reliance on private vehicles and to develop green vehicles and other green manufacturing (Lee & Card 2012: 44-45).

'Green manufacturing' provides further opportunities for employment while adapting to climate change. There is a need to make existing manufacturing operations more environmentally friendly while developing new green manufacturing opportunities in response to changing demands arising from climate change (Lee & Card 2012: 9). For example, in the automotive industry, government support can be directed to support green innovation while maintaining employment in this sector by supporting the transition from 'brown' to 'green' car manufacturing. There are also opportunities to 'green' existing manufacturing operations (Lee & Card 2012: 47).

A 'Green Social Contract', written or assumed, would involve government and its citizens and would guide governments to prioritise the environment as well as the well being of citizens in any decision making process. It would include strategies for helping workers transition to green jobs, for example, by assisting them to develop skills that can be transitioned through targeted training, income support and mobility allowances that support career changes (Lee & Card 2012: 10, 51).

3.4 Understanding the barriers to Adaptation

The IPCC's analysis of adaptive responses globally identifies that climate change adaptation faces a number of barriers, and that high adaptive capacity does not necessarily translate into successful adaptations to climate change. For example, research on adaptation to changing flood risk has found that high adaptive capacity is countered by weak incentives for proactive flood management, and has not prevented continuing high mortality levels and disruption to infrastructure from extreme heatwave events (IPCC 2007: Chapter 17.4.2).

Barriers to adaptation are closely linked to the rate and magnitude of climate change, as well as associated key vulnerabilities. The other set of limits are financial, institutional, technological, cultural and cognitive in nature (IPCC 2007: Chapter 17.5).

> **Adaptation presents new challenges for business and policy decision-makers: it will take time to build the skills and knowledge on how best to adapt and for implementation of decisions to make a difference.**
>
> **Those decisions made today lacking suitable climate foresight, for example in areas like major infrastructure investment, land use planning and building**

design, may create greater costs and risks in future (NCCARF – http://www.nccarf.edu.au/content/adaptation)

A number of studies have focused on the impediments to adapting to climate change (eg World Bank 2010; Berkhout *et al* 2004). In reviewing global climate change adaptation, the World Bank notes the trend to fragmentation, with most activities centred on stand-alone and disconnected initiatives, exacerbated by fragmented resourcing of those initiatives, which in turn hampers the integrated response so necessary to adaptive capacity (2010: 332).

The World Bank has focused on the barrier of 'behavioural and institutional inertia', in other words, a lack of responsiveness and capacity to act flexibly. The report finds that despite growth in the awareness of climate change and its impacts, there has been a 'disconnect between perception and action' as exemplified in the focus of most international energy policy on ensuring supply rather than managing demand (2010: 321-322).

The report argues that in order to effect climate change adaptation, it is necessary to follow up awareness-raising with understanding, and that research consistently finds that most people remain confused about the facts of climate change and its underlying science. This is addressed by multiple strategies, rather than a single approach, across these three points of intervention:

A. Communication

- ✓ Provision of clear information from trusted and credible sources, including information both about the risks involved as well as about the effectiveness of proven interventions. This increases public trust about adaptive interventions and at the same time, increases understanding about the need for resource allocation to support adaptation. Opposition to environmental taxes has been found to reduce when public understanding of their ultimate impact exists[12] (2010: 323-328).
- ✓ Well designed communication campaigns which acknowledge that the slow pace of climate change encourages complacency, peoples' preference for incremental rather than large scale change, and their difficulty in understanding the risks associated with less tangible threats like climate change (2010: 323-326).
- ✓ As with communication about AIDS prevention, scientists and the media need to cooperate to enhance the impact of their messages and use a marketing approach that involves individuals in *both* the causes and the solutions to a significant problem.

[12] Citing research by Kallbekken S, Kroll S and Cherry T (2008) 'Do you not like Pigou, or do you not understand him? Tax aversion and earmarking in the Lab', paper presented at the Oslo Seminars in Behavioural and Experimental Economics, University of Oslo

> **Well-designed communication campaigns that address individuals as members of a local community – and not as powerless members of an unmanageably large group – can empower them to act. This ... can help make a global phenomenon personally relevant and immediate, and accentuate the local and individual ownership of the solutions (World Bank 2010: 327).**

B. Institutional measures

✓ Because the general public may not understand the relevance of climate change related risks, or deny their impact, or have the information necessary for this understanding, institutions have a critical role to play in communicating clearly the direct and indirect benefits of adaptation and mitigation.

✓ Improved cost-benefit measurement tools can support decision makers to make appropriate choices in resource allocation and policy setting. For example, shifting to a 'green economy' and associated 'green jobs' and moving away from more traditional manufacturing requires informed cost-benefit analysis combined with accurate information about climate change on specific sectors.

> **Case studies in manufacturing conclude that these benefits can be considerable, sometimes equivalent to the value of the energy savings alone. So the timeframe for investment paybacks can be substantially shortened ... (World Bank 2010: 329).**

C. Social norms

Strategies that recognise the significance of social norms understand the impact of these norms under conditions of uncertainty. People will rely on others to determine their own behaviour, for example, in reducing energy consumption.

✓ Including climate education in school curricula has been found to assist in changing behaviours and to increasing public understanding about the need for adaptation to climate change (World Bank 2010: 329).

✓ Harnessing the power of social norms involves ensuring that adaptive decision making is made more visible publicly. This information has been found to increase people's willingness to cooperate in changing their behaviours (World Bank 2010: 330).

Public policy can build on the interventions associated with addressing social norms. For example, providing incentives in the form of tax rebates can change behaviours or by creating disincentives to resistance to adaptation.

> **Rather than simply treat ... social and psychological drivers of behaviour a barriers to adaptation and mitigation, policy makers can use them to build more effective and sustainable policy (World Bank 2010: 330).**

Governments play a critical role in addressing barriers to adaptation to climate change, in order to promote climate resilience. Australia's Productivity Commission has identified four categories of barriers to climate change adaptation. These involve:

- Market failures – these include incomplete or inaccurate information that leads to poor decision making, undersupply of goods and services required for adaptation or reduced competition in markets that inhibits innovation and responsiveness.
- Regulatory barriers – resulting from government policies or regulations that increase costs, create delays or impair activity. These could involve inappropriate planning rules, unnecessary administrative burdens or inconsistent regulations across jurisdictions that inhibit coordinated and cohesive adaptation.
- Behavioural and cultural barriers – involving constraints on individual decision making capacity or ability to process information that assists in decision making. Personal or cultural beliefs and traditions may also inhibit individual willingness to change behaviours. Because these are not the result of market failure, however, they may not be amenable to government intervention.
- Organisational barriers – involving constraints on organisational decision making capacity (2011: 7-11).

4 Imagining a Climate Resilient South

In imagining what a climate change resilient South might look like we are confronted by great complexity and uncertainty. We must ask ourselves what risks to life, health and wellbeing do people living and working in the South face as a consequence of climate change - over the short, medium and long term. In addressing these risks we also face difficult choices about how we build greater resilience into our institutions, infrastructure and communities. To balance all of these considerations, projects like Resilient South are needed to inform decision making and strategy development. A spatially sensitive risk profile of the region that seeks to overlay climate change risk and resilience in order to inform strategy and action is well supported by the literature. So too is the development of population sensitive climate change strategy and actions that can be reviewed and sustained over time in the face of uncertainty and new knowledge about the likely impacts of climate change.

It is also evident that integrated approaches to tackling climate change are essential. This necessitates considerable institutional resilience that manifests in a commitment to time-sensitive, cross-agency, multi-disciplinary problem solving. Governance arrangements require the participation of those with authority to make timely decisions once strategies and initiatives are agreed upon.

The literature also tells us that climate change imperatives can have transformative impacts on regional economies, creating demand for new goods and services that underpin the growth of innovative enterprises and rewarding jobs. A Resilient South

strategy in this context might aspire to the region becoming a national leader in clean technology development and application, linking our Universities with businesses and the wider community to solve challenges created by climate change. A successful Resilient South collaboration might be sustained by a catalytic enabling institution that supports the development, implementation and evaluation of climate change strategies and initiatives. Imagine a Centre for Resilient Cities that builds on the work currently being undertaken, creating a focal point for cross sectoral collaboration and evidence based strategy and action. Whatever the institutional form adopted, a well resourced driver or drivers of change can help to build additional institutional resilience as part of a Resilient South strategy.

5 APPENDIX A: THE SA CLIMATE CHANGE ADAPTATION FRAMEWORK

The Government of South Australia (2011) developed the **Climate Change Adaptation Framework**[13] in partnership with the Premier's Climate Change Council and the Natural Resources Management Council. The Framework is designed to guide State and local government agencies, non government organisations, research organisations, business and the community to develop informed adaptation responses to climate change. It supports a coordinated approach that will be integrated into planning, decision making and risk management strategies, and is designed to build recognition of the interconnections between social, environmental and economic systems (Govt of SA 2011: 6).

> **Adaptation is not an isolated stand-alone agenda. It will need to be incorporated into all our policy and planning processes and embedded into public and private risk management frameworks. Adaptation will play a complementary and equally important role to mitigation in our efforts to respond effectively to climate change.**
>
> **The majority of effort will need to occur at an individual, regional and local level. Those affected by climate change are likely to be in the best position to decide how to deal with its impacts (Govt of SA 2011: 6).**

The Framework also identifies the opportunities accompanying the challenges of effective response to climate change (Govt of SA 2011: 16) and this focus carries through the document. For example, in relation to employment generation, there is an opportunity to develop 'green' manufacturing (such as, producing electric cars) and a range of 'green' jobs (for example, solar panel installers).

> **Adaptation will also create many opportunities for innovation across all sectors. We have an unprecedented opportunity to incorporate sustainable development principles into everything we do (Govt of SA 2011: 1).**

The Framework is also intended to prioritise adaptation actions through assessment of risks, costs and equity using the best available evidence. Progress on its implementation is to be reported every two years as part of ongoing reporting on climate change activities in the State (Govt of SA 2011: 1).

The Framework uses a three-tiered, integrated approach – statewide level, regional level and industry level. It has four overarching, statewide objectives to guide adaptation responses at the State level. It also identifies the strategies to achieve them and the lead agencies with primary responsibility for their carriage, noting that adaptation is a shared responsibility across government, business, researchers, the community and individuals and specifying key roles for each (Govt of SA 2011: 6). The four objectives are:

1. **Leadership and strategic direction for building a more resilient state: lead SA's adaptation efforts by building partnerships, incorporating adaptation in all decision-making and actively participating in national and international activities.**

[13] *Prospering in a changing climate: Climate Change Adaptation Framework for South Australia*

2. **Policy responses that are founded on the best scientific knowledge: establish processes that deliver science of high quality and relevance to inform an adaptive management approach to building resilience and adaptive capacity.**

3. **Resilient, well functioning natural systems and sustainable productive landscapes: increase the resilience of terrestrial, aquatic, marine ecosystems and primary production systems and link adaptation, biodiversity conservation and sustainable landscape use.**

4. **Resilient, healthy and prosperous communities: build resilience and adaptive capacity by empowering communities and businesses with relevant information and decision-making tools and by helping the most vulnerable (Govt of SA 2011: 6).**

In relation to Objective 4, the Framework states:

> **The impacts of climate change affect the economy and the way people lead their everyday lives. Resilient, healthy and prosperous communities are built by allocating risk appropriately, and maintaining economic and social diversity; by seizing opportunities, and promoting and recognising successes; by factoring climate change considerations into planning and policy …, creating flexible decision-making frameworks, assessing the vulnerability of sectors and communities, and empowering people to take action with accessible information and decision-making tools; and by paying attention to the needs of the most vulnerable members of society, including the elderly, young children, and those who live in remote or highly vulnerable coastal communities.**
>
> **Businesses and sectors that have the potential to prosper through effective adaptation also need attention. Planning for training and workforce development will equip communities with the skills needed to take advantage of climate change opportunities, allowing them to make use of innovative solutions and technologies.**
>
> **Creating resilient and adaptive human systems will also mean paying attention to increasing the resilience of natural systems, because healthy, diverse ecosystems underpin successful and prosperous communities …. (Govt of SA 2011: 22).**

Objective 4 has five associated Strategies, and these involve:

> **Strategy 4.1**
>
> **Build the resilience and adaptive capacity of businesses and communities at the regional and local levels**
>
> ***Actions focus on supporting the regional approach in developing and delivering adaptation plans and actions***
>
> **Strategy 4.2**
>
> **Create climate resilient urban areas and address the needs of the most vulnerable members of the community**
>
> ***Actions focus on engaging with industry, government and non-government organisations***
>
> **Strategy 4.3**

Empower people to take action by making relevant information and decision-making tools easily accessible

Actions focus on providing climate information in a relevant and useable format

Strategy 4.4

Increase community awareness and understanding of the opportunities for adaptation

Actions focus on community engagement and on promoting the opportunities that adaptation action will bring

Strategy 4.5

Increase community resilience during times of crisis

Actions focus on improving resilience to weather related emergencies **(Govt of SA 2011: 23).**

The Framework also delineates a set of Principles to underpin adaptation action and ensure consistency in its application (Govt of SA 2011: 17).

- **recognise uncertainty and deliver adaptation actions where there is a plausible risk of harm**
- **prioritise actions based on careful assessment of risks, costs, efficacy and equity using the best available science to inform adaptation responses**
- **give priority to sectors likely to provide the greatest social, economic and environmental benefit for the state**
- **develop responses at the most appropriate scale to effectively address risks and maximise opportunities**
- **involve individuals, industry, business, academia and all tiers of government in developing responses using a coordinated approach**
- **build on, enhance and learn from the experience of communities, sectors and regions in developing adaptation responses**
- **plan for uncertainty and take action using an adaptive management approach to allow for readjustments as new information arises**
- **use the best available, most appropriate and locally relevant science based on good data and robust processes, to inform those best placed to deliver adaptation responses and manage risks**
- **take into account the need for flexibility to respond to emerging trends, including population projections and socioeconomic trends**
- **consider how best to optimise and recognise the interconnections between social, environmental and economic systems, and linkages between sectors in planning to adapt to climate change in a sustainable manner**

- **ensure responses avoid unintended consequences and do not undermine our ability to adapt over the long term**
- **take early action where there are demonstrated cost–benefits**
- **ensure that adaptation responses are appropriately integrated and mainstreamed into ongoing business (Govt of SA 2011: 17).**

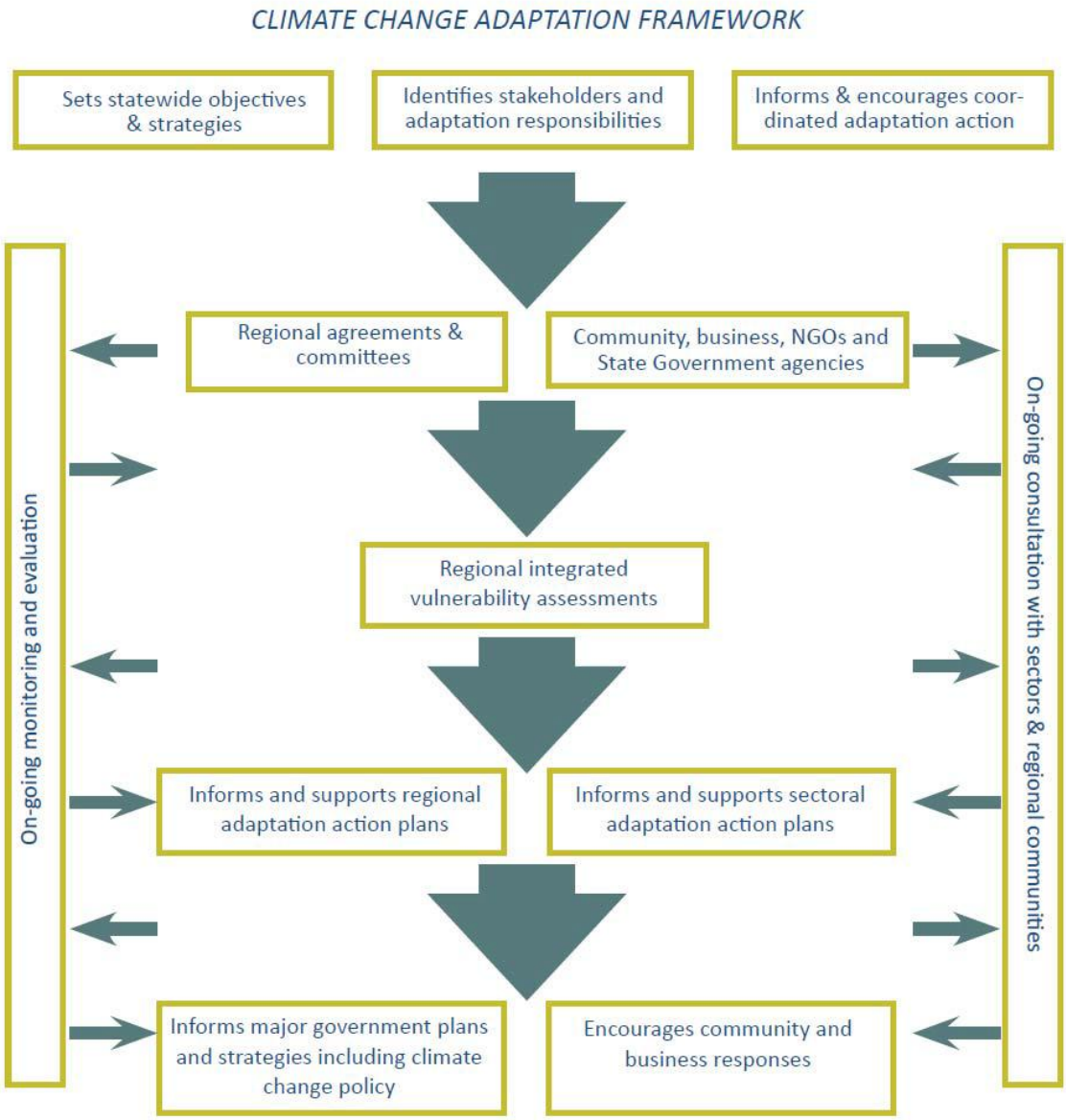
Critical to effective adaptation is identifying and understanding sectors and systems most at risk and how they are related. In part, this is seen to occur through regional vulnerability assessments (IVAs) which form the first part of adaptive response by informing planning and strategy development – including regional natural resource management plans, State strategies and plans, development planning and planning application regulations, industry plans and relevant local level regulations (Govt of SA 2011: 27-28). The Framework explores adaptation across different sectors, including community health and well being. Direct and indirect impacts are identified as including:

- **disruption of social networks, and forced migration**
- **lack of information, knowledge and skills**
- **heat stress, especially during heat waves**
- **increased risks to life and property as a consequence of greater and more frequent extreme events such as bushfires and flood**
- **an increase in the frequency of vector-borne infectious diseases such as Ross River Virus**
- **an increase in air pollution (e.g. from dust and bushfire smoke) that may increase respiratory diseases and allergies**
- **an increase in the frequency of water and food-borne infectious diseases**
- **a reduction in food production and nutritional quality**
- **the physical and mental health consequences that occur as a result of some direct or indirect impacts, such as drought.**

The Framework also identifies a number of possible opportunities arising from adaptation to climate change.

- ✓ **Using the cross-sector focus on climate change adaptation to deliver community health and individual wellbeing through proactive measures (e.g. by delivering healthier lifestyles such as walker-friendly urban design)**
- ✓ **Fostering greater community cohesion, social inclusion and social justice**
- ✓ **Gaining more effective emergency responses from better decision making based on improved information**
- ✓ **Reducing exposure to poor air quality, especially of the more vulnerable members of the population (Govt of SA 2011: 31).**

The Chart below summarises the key elements of the Framework and its implementation.



Source: Govt of SA (2010: 55)

6 Appendix B: The OECD Strategy for Cities' Adaptation to Climate Change

The OECD report *Cities and Climate Change* (2010: 21-28) outlines a multi-faceted strategy for cities to adopt in structuring adaptation to climate change, arguing that cities can be 'laboratories' for innovation. The strategy is designed around five Guiding Principles which are relevant at the national, regional and local levels, but require collaboration across sectors and stakeholder groups.

> **Very few OECD countries are applying a 'climate change lens' to the implementation of regional spatial or economic development policy framework[s]. Instead, regional development policies are typically applied independently of national sectoral strategies to address climate change. Similarly, national climate change policies are being applied in many countries without regard to regional strengths and opportunities. Greater horizontal coordination between national regional development and national sectoral climate change policies is lacking in most countries. Japan, Korea and Sweden provide the best examples of cross-sectoral, holistic regional approaches to address climate change by national governments. Alignment of incentives across sectoral and cross-sectoral policy areas is required to deliver policy coherence (OECD 2010: 25).**

Guiding Principle 1: Systematic, multi-sectoral strategic planning is required to exploit synergies between climate and other urban policy goals

- ✓ Ensuring policy complementarity and cohesion, for example, applying land use zoning policies that support higher densities and reduce trip distances to enhance public transport usage. In turn, strategic mass transit linkages can attract development and promote compact growth. While urban density can increase direct GHG emissions, reduced private vehicle use can reduce emissions associated with them.

- ✓ Strategic urban planning provides a mechanism to act on adaptation. For example, vulnerability to storm and extreme weather can be reduced through spatial planning and land management but need to have a long term focus to be effective.

Guiding Principle 2: Integrating climate priorities into the urban policy-making process and improving inter-municipal and regional coordination can overcome barriers to effective local action

- ✓ Climate change priorities need to be integrated in each stage of the urban policy development process – from agenda setting, to policy design, to implementation and evaluation.

- ✓ Regional level policy has a level of scale that enables a larger impact than can occur locally, and can have a greater impact on adaptation and mitigation. Regions can increase their critical mass by collaborating with other regions to support research and development designed to support adaptation.

Guiding Principle 3: Robust frameworks for multi-level governance and enabling national policies can advance climate action

- ✓ National governments can empower local governments and regions by providing funding and technical assistance, by leveraging from other policy and maximising resource usage, while improving alignment between climate change policy and other policy areas.

- ✓ Horizontal coordination between regional development and climate change policies supports a holistic response to adaptation, and ensures that a climate change lens is applied regional level policy on economic development

Guiding Principle 4: Finance is an issue – greening local revenues and financing local green activities

- ✓ Climate change puts additional pressure on city budgets and calls for changes in urban infrastructure investments that in turn creates challenges for urban finance. Local level tax can be structured to create incentives for mitigation activities and development charges can be linked to required infrastructure design.

- ✓ There is a need to explore complementary financial instruments eg increased access to carbon finance mechanisms.

- ✓ National governments can play a key role in greening urban finance, for example, by re-designing taxes and grants to state and local governments in such areas as property taxes.

Guiding Principle 5: National governments will need to create a sound financial institutional foundation and knowledge base to help local decision makers engage stakeholders and identify and carry out cost-effective actions

- ✓ National governments can assist state and local governments by supporting the development of a range of tools that assist cities to be more effective in responding to climate change. These include harmonised GHG emission inventory and reporting protocols to allow monitoring and comparison of progress in mitigation emissions;

- ✓ They can also assist by creating an interface between expert scientific information and local knowledge and promote local understanding of climate change risk and adaptive responses.

- ✓ Ensuring that a robust evidence bases exists to inform policy.

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