



Australian Government
**Department of Climate Change
and Energy Efficiency**

thinkchange



Submission



Barriers to Effective Climate Change Adaptation

A Submission to the Productivity Commission

Department of Climate Change and Energy Efficiency

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Executive Summary

‘Climate adaptation’ refers to the decisions that people, communities, businesses and governments take to prepare for and respond to a changing climate. It also refers to the actions they take to manage climate impacts. It is similar in many respects to other actions or decisions that individuals or governments take every day to manage external shocks such as natural disasters or financial sector volatility.

‘Effective adaptation’ is the ability to make and implement the best possible decisions. In dealing with climate uncertainty, these decisions need to be timely, creative and flexible. Decision-making for adaptation is iterative. Under uncertainty, flexibility is important, so that decisions can be reviewed and adjusted easily over time as circumstances change.

Work carried out by the Department of Climate Change and Energy Efficiency (DCCEE) since 2007 demonstrates that while some progress has been made, there are systemic barriers to effective adaptation in Australia. Cascading market-related and regulatory barriers are associated with limitations in our understanding of the risks posed by climate change and our ability to act on this understanding.

Market barriers to adaptation include:

- *Information barriers:* Consistent and accessible information and the capacity to apply it is essential for effective adaptation. For example, inconsistent or poorly accessible information currently mean that insurance premiums and real estate values poorly reflect climate risks such as sea level rise.
- *Cognitive barriers:* Psychological factors influence our ability to act on information about climate change, including our perception of how urgent adaptation is. For example, the long timeframes and uncertainty about impacts make it difficult for decision-makers to understand the problem or scope a solution.

- *Disincentives for self-preparedness:* Even if the risks posed by climate change and options to adapt are understood, markets may not always generate the right signals for individuals and businesses to prepare for climate change. For example, governments often act as insurers of last resort for the adaptation choices made by others, creating moral hazard which reduces incentives for self-preparedness.
- *Investment barriers:* Limiting investment in adaptation for major assets such as roads, rail and ports, because the benefits of doing so are outside the scope and timeframe of private sector investment decisions.
- *Transaction costs and externalities:* Coordinating adaptation across regions can be costly and result in unintended consequences. For example, a challenge for local governments is that many adaptation decisions need to be made at a regional scale in order to be effective.

In addition, **regulatory barriers** occur where regulations such as the Building Code of Australia don’t take climate change into account, or where standards or codes reduce resilience to climate impacts.

Individual barriers to adaptation are unlikely to act independently, and so policy action should be holistic in its approach. When considering intervention, governments need to evaluate carefully whether there is evidence of a genuine need for Government intervention, and whether policy intervention is likely to lead to a better balance of adaptation than would otherwise be achieved. The type of intervention also needs significant consideration, including examination of risks and costs of action versus inaction. It is also worth considering other areas of policy that may serve as useful parallels to dealing with aspects of adaptation – notably health policy and a program of regulatory review such as in national competition policy.

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Introduction

The Department of Climate Change and Energy Efficiency (DCCEE) welcomes the Productivity Commission's inquiry as a timely contribution to the development of adaptation policy approaches in Australia¹. As the lead agency for climate change adaptation strategy and coordination in the Australian Government, DCCEE is responsible for developing and implementing climate change adaptation policy. This includes building adaptation capacity and information, as well as implementing adaptation program activities.^{2,3}

The Australian Government's climate change policy recognises that an effective climate policy must respond both to the *causes* of climate change (mitigation) and to its *consequences* (adaptation), and must place domestic action in an international context.

The Government's *Clean Energy Future* package will introduce a price on carbon from 1 July 2012, and create economic incentives to reduce carbon pollution in low cost ways. The Government is committed to reducing carbon pollution unconditionally by 5 per cent below 2000 levels by 2020, and by up to 15 or 25 per cent depending on the scale of global action. The government is also committed to reducing emissions by 80 per cent in 2050 compared with 2000 levels. These initiatives to reduce Australia's carbon pollution will contribute to global action to stabilise the concentration of greenhouse gases in the atmosphere as soon as possible to avert 'dangerous climate change'⁴ and will help support Australia's efforts to build global action to reduce emissions.

1. What is adaptation?

At its simplest level, 'climate adaptation' refers to the decisions that people, communities, businesses, institutions and governments take to prepare for, and respond to, a changing climate. Other perspectives of adaptation include 'building climate resilience' or 'managing climate risk'. In this sense, it is similar to other actions that individuals or governments take every day to manage risks and opportunities created by external shocks. Alternative definitions of adaptation include those in the Commission's terms of reference⁵ or the definition used by the Intergovernmental Panel on Climate Change (IPCC).⁶

Irrespective of the terminology or definition, adaptation involves two steps – first, making a decision to avoid or limit damage from climate change and take advantage of opportunities; and second, putting that decision into effect. Adaptation incurs costs, but results in benefits

that include reduced damage from climate change and realisation of opportunities that climate change may bring. Neither of these steps can take place, however, without a clear understanding in the first place of the ways in which climate is likely to change, and what this means for day-to-day activities.

Australia already is, and will increasingly be, exposed to the effects of climate change.

Even if international action to reduce greenhouse gas emissions limits global warming to 2°C, the impacts of climate change could significantly disrupt Australia's economy and communities. In 2007, the IPCC found that Australia's coastal settlements, water resources, and biodiversity could struggle to cope with global warming of 2°C. If warming exceeds 2°C other sectors may also be at serious risk from climate change impacts.

The potential economic, social and environmental impacts are large. For example:

- Economic analysis undertaken for the 2008 Garnaut Review indicated that climate change could reduce Australia's GNP by 2 per cent by 2050, and 7 per cent by 2100, mostly due to the reduced performance or failure of infrastructure⁷
- The national coastal risk assessment found that more than \$226 billion in existing commercial, industrial, road, rail, and residential assets are potentially exposed to inundation and erosion hazards with sea level rise of 1.1 m⁸
- Drought could be 20 per cent more common by 2030 over much of Australia and up to 80 per

cent more common in south-western Australia by 2070. The economic impact would be significant - the 2002-2003 drought cost the Australian economy an estimated \$6.6 billion.⁹

Timely, appropriate action to manage climate change – adaptation – can reduce the potential costs and foregone opportunities significantly. For example, a recent study examined the adaptation options of three coastal settlements in south-east Queensland at risk from sea level rise. In each case the study found that there were strong economic benefits from acting now, with the benefit/cost ratios of adaptation options ranging from 1.4 to 45.¹⁰

2. Australian Government adaptation policy and action

There are strong economic reasons for the government to encourage effective adaptation in the community. Well-based decision-making can reduce risks and costs to individuals, communities, industry and to the economy more broadly. Well-coordinated adaptation action can also allow individuals and groups to capture any opportunities from climate change that may arise. It is also important to consider social equity – climate impacts and the ability to deal with them vary widely across society and the economy.

In this context, it is also worth noting that, as a Party to the United Nations Framework Convention on Climate Change, the Australian Government is bound by a legal commitment under Article 4.1(f) of that Convention to:

Take climate change considerations into account, to the extent feasible, in [its] relevant social, economic and environmental policies and actions, and employ appropriate methods, for example impact assessments,

formulated and determined nationally, with a view to minimizing adverse effects on the economy, on public health and on the quality of the environment, of projects or measures undertaken by [it] to mitigate or adapt to climate change.

The Australian Government's current adaptation activity is based on the National Adaptation Framework, (the 'Adaptation Framework') agreed by the Council of Australian Governments in April 2007. The Adaptation Framework outlined potential areas for action in 15 sectors such as agriculture, water, natural disasters, coasts and biodiversity. In the 2007-08 budget, the government announced the provision of \$126 million¹¹ over five years to fund an Australian Centre for Climate Change Adaptation ('the Adaptation Centre Program') to support implementation of the Framework. Activities under the Program, which concludes at the end of the 2011-12 financial year, are managed by DCCEE.

The projects funded by DCCEE under the Adaptation Centre Program have provided the community and the government with clearer information about climate risks in particular sectors or regions. They have also provided experience through pilot programs which has enabled the government to identify barriers to adaptation and draw lessons to support a policy approach. The Adaptation Centre Program has delivered, among other things:

- Provision of \$50 million to establish and fund a National Climate Change Adaptation Research Facility (NCCARF) to build capacity in the research community on adaptation and to generate the information decision-makers need to adapt to the impacts of climate change
- Advances in coastal adaptation through a first pass national assessment of climate change risks to Australia's coast and a range of other coastal adaptation activities that have analysed adaptation and policy options (\$25 million allocated in line with the Government's 2007 election commitment)
- Support for adaptation in the built environment, including grants to local governments to develop strategies for managing risks from climate change impacts, and identify priorities and barriers to adaptation in major infrastructure sectors
- Improved tools and information for decision-makers, including better projections of climate extremes, coastal inundation risk maps and training for professionals on how to manage climate change risks
- A better understanding of climate change risks in key regions, including the Murray-Darling Basin and south-east Queensland and risks to Indigenous communities across tropical northern Australia; and
- Improved information on the vulnerability of

natural ecosystems and protected areas to climate change and strategies for reducing this vulnerability (one component of this work was a world-class vulnerability assessment and action plan for the Great Barrier Reef, conducted by the Great Barrier Reef Marine Park Authority).

The Australian Government's 2010 position paper Adapting to Climate Change in Australia ('the Position Paper') recognised that adaptation is a shared responsibility. Individuals and business are often best placed to manage risks associated with their assets and realise the private benefits. As such, although the Government has an important role in effective adaptation, the costs and benefits of adaptation should largely accrue to those who bear those costs and benefits. In this context, the Position Paper set out the Australian Government's role in climate adaptation as:

- Maintaining a strong, flexible economy and a social safety net
- Leading national reform (in particular on managing climate risks and consistent national standards)
- Managing Commonwealth assets and programs; and
- Providing national science and information on climate impacts to support adaptation planning.

It also identified six areas as national priorities for adaptation action, namely:

- Coastal management
- Water
- Infrastructure
- Agriculture
- Natural systems of national significance; and
- The prevention, preparedness, response and recovery to natural disasters.

3. *Effective adaptation*

'Effective adaptation' is the ability to make and implement the best possible decisions in the context of a changing climate. It involves timely, flexible and creative decision making.¹² Adapting effectively also means taking action appropriate to the nature of change being experienced. This action can be undertaken before or after change occurs. Effective adaptation has the following characteristics:

- **Proportionate** – actions should match the size and time horizon of the anticipated climate impact. For this to happen, individuals need to perceive the risk correctly. Otherwise, they risk taking either too little action too late which proves to be costly, or too much action too soon, which could divert resources better used elsewhere;
- **Robust** – this means managing predictable risks while also taking the best decisions when faced with uncertainty, including deferring action while actively seeking new information;
- **Iterative** – the ongoing nature of climate change means that the best approaches are likely to be flexible, and able to be reviewed and adjusted regularly at low cost as circumstances change; and
- **Cross-cutting** – the economy-wide impacts

of climate change mean that effective adaptation might lead to a reassessment of other policy goals, involve trade-offs in implementation, and require coordination across regions, sectors and tiers of government.

Decision making in a changing climate involves addressing three different types of change to the climate system:

1. The risk of more frequent or intense climate extremes, such as intense rainstorms, heatwaves and droughts;
2. Heightened variability, such as changes to the patterns of drought and wet years from the El Nino Southern Oscillation; and
3. Long-term change, such as sea level rise, ocean acidification and other changes in the average state of the climate system caused by the accumulation of greenhouse gases over extended periods of time.

Taking the above into account, the capacity for effective adaptation will also largely be dependent on the extent and timing of climate change. Rapid increases in climate change (especially through feedback effects) could potentially cause structural shocks sooner than expected and of greater impact – and this in turn may lead to calls for a greater role for Government.

4. *Barriers to adaptation in Australia*

To date, the experience of Australian Government activities has found that the process of building climate resilience in the economy and society means facing one or more of the following challenges:

- Government and business decisions (eg on infrastructure investment) are often taken without factoring in a changing climate, risking the effectiveness of those decisions over the life of the asset;
- A low awareness of likely climate change impacts and how to prepare for them throughout many sectors and regions in Australian society;
- Action is frequently taken reactively in response to extreme events such as fires and floods, rather than by anticipating future change;
- Limits to the availability of, or access to, information as well as the understanding, funds, expertise and other capacity necessary to

make appropriate decisions and implement the actions that flow from these decisions;

- A misunderstanding of the nature and timing of climate change, especially the perception that it will occur in a slow and linear manner; and
- Emerging awareness of a range of institutional, regulatory and other factors which act to constrain action to prepare for the impacts of climate change.

These conclusions are consistent with the global findings of the IPCC¹³ which recognise significant barriers to implementing adaptation, including capacity barriers such as funding, limits to the rate of change that can be absorbed by physical and ecological systems, and limits to technological developments in enabling new adaptation options. The IPCC also identifies a range of information, cognitive and socio-cultural factors which affect people's behaviours and which could constrain adaptation.

Barriers to adaptation are unlikely to occur independently of one another. Analysing barriers to adaptation one-by-one risks overlooking more holistic and potentially more efficient opportunities to address their combined effects. This is a factor which should be considered in developing policy options to deal with barriers to adaptation.

Australian Government activities to date have revealed a cascading set of market-related and regulatory barriers associated with limitations in our understanding of the risks posed by climate change, and our ability to act on this understanding.

Market barriers

The Australian Government recognises that market approaches can facilitate the efficient achievement of climate change policy objectives. Market approaches can also establish incentives across all sectors of the economy to change behaviour and support innovation and the uptake of new low-cost solutions.

However, DCCEE's work to date has found that even if the risks posed by climate change and options to adapt are at least partially understood, markets do not always generate the right signals for individuals and businesses to prepare for climate change. This is particularly the case where market mechanisms or institutions don't allow for a changing climate. Markets can also fail when they don't provide the necessary information about climate change impacts and adaptation options, the incentives for self-preparedness, or where the market is unable to facilitate the degree of cooperation required for effective adaptation.

Market barriers of particular relevance to adaptation include:

- *Limited availability and/or access to information* about climate change and adaptation options because the benefits of this information to the community are beyond the scope of private sector investments in research;
- *Cognitive barriers* reducing the ability of decision makers to translate awareness of climate change into action;
- *Disincentives* for self-preparedness such as *moral hazard* and a *free-rider* problem;
- *Adverse selection* limiting the private sector's ability to provide insurance markets;
- *Investment barriers* limiting investment in adaptation for major assets such as roads, rail and ports, because the benefits of doing so are outside the scope and timeframe of private sector investment decisions;
- *Transaction costs* working against economies of scale and the coordination of adaptation across scales and jurisdictions; and
- *Externalities* in which the adaptation actions of one decision maker have unintended and uncompensated consequences on the adaptation options of others.

Information barriers

Consistent and accessible information and the capacity to apply it is essential for effective adaptation. Information about climate change and options for adapting has public good characteristics. The science behind this information, and the tools and services necessary to support its use by decision makers, are expensive to produce. Successive Australian Governments have partly recognised this through funding for the Australian Climate Change Science Program (ACCSP), which has supported science into the processes and impacts of climate change since 1989.

Even when information is available, the tools and capability to apply and translate it into decisions and action are sometimes lacking. This is particularly an issue for local governments.¹⁴

In most areas of Australia, information on climate related threats, such as the risk of inundation or coastal erosion due to sea level rise is not available for specific properties. This prevents individuals from making investment decisions that reflect future climate risk, makes it difficult for insurance companies to set premiums and reinforces the idea that climate risks are outside the responsibility of normal market processes.

DCCEE's feedback from stakeholders suggests that there is a strong demand for readily accessible information on the risks of climate change impacts. This demand extends to information on the range, cost-effectiveness and optimal timing of adaptation options that can be incorporated into business decisions. In a recent survey of members of the Australian Sustainable Built Environment Council, for example, the lack of information on climate change and the costs and benefits of adaptation options was identified as a reason why adaptation is not occurring.

DCCEE's investment in supporting risk assessment at local government scale by developing coastal inundation risk maps, and in current projects on *Coastal Adaptation Pathways* are illustrating effective approaches to coastal adaptation over time for local governments and

water utilities, and have been well-received by stakeholders.

The Government is aware that investment valuation approaches may not consider the long term future impacts of climate change, and therefore may not be able to appropriately value options for managing the uncertainty associated with climate change. For example, a recent report commissioned by DCCEE found that the approach to cost-benefit analysis used to evaluate potential changes to the building code does not appropriately value the whole of life utility of buildings.¹⁵

Cognitive barriers

Even if information on climate change and options for adapting is available, cognitive barriers can reduce our ability to act on this information. Cognitive barriers underpin all the other barriers. The long timeframes and uncertain impacts associated with climate change make adaptation decision-making challenging for many people. Cognitive barriers arise from psychological factors that influence how we understand and respond to climate change, including the perception of how urgent adaptation is, and the judgements necessary to select appropriate adaptation options.

Evidence from the United States suggests that despite general risk aversion individuals often fail to adopt even low cost climate change adaptation measures. A survey of participants in a program to protect homes in hurricane and earthquake prone areas in the United States found a strong inclination to disregard benefits of risk mitigation beyond about three to five years¹⁶. The IPCC has noted that individuals often fail to purchase insurance against low-probability, high-loss events even when it is offered at favourable premiums.¹⁷

The strong attachment that individuals can have to place and lifestyle, which we see through the sea-change and tree-change phenomena, influences their perception of climate change risk,

and judgement about appropriate responses. This can limit the uptake of effective adaptation. For example local government offers to reclaim Brisbane properties highly exposed to flood risk at current market prices have had a low uptake.^{18,19}

The agricultural sector has a long history of managing climate risk²⁰, largely because agriculture is highly flexible and adaptable. Decisions year to year on which crops to plant, or which irrigation or feed methods to use can be adjusted easily and at relatively low cost as the climate changes. A concern is that climate change will cross thresholds beyond the innate coping capacity of existing farming systems over the next 50 years.²¹ Sudden change could have significant adverse social consequences if current livelihoods strategies begin to fail and reduce the viability of rural communities.

Disincentives for self-preparedness

The Australian Government recognises that dealing effectively with the risks of climate change involves allocating responsibility for risks to those best able to manage them. Insurance markets can help communities recover from occasional but damaging disaster events through the spreading of losses across time and across society. With climate change likely to increase the frequency and/or severity of extreme weather events, a strong insurance market can contribute to Australia's capacity to understand and manage risk, and to rapidly recover economic activity following a damaging weather event.

However, disincentives for self-preparedness are reflected in the fact that many households are uninsured or underinsured against climate-related extreme events such as floods, bushfires and cyclones.²² The 2009 parliamentary committee report *Managing our coastal zone in a changing climate: the time to act is now* noted that around 1.8 million Australian households are without building or contents insurance. The report also notes that there are significant gaps in insurance cover in the coastal zone

such as for saltwater risks, coastal erosion and land values which form a significant part of a property's overall value.²³

Moral hazard is likely to occur where governments act as insurers of last resort for adaptation decisions made by others. Knowing government will be there to assist can inhibit efficient adaptation if those affected by climate change lack an incentive to take out adequate protective measures to reduce the damage caused by climate change.

The government response to the Queensland 2010-2011 floods is a relevant example. Australian Government funding of \$5.6 billion was provided for infrastructure reconstruction.²⁴ The Queensland Government allocated \$149.2 million in assistance to owners of damaged homes, and \$31.7 million to the owners of home that were destroyed.²⁵ This damage was the result of an interplay of many different barriers, including moral hazard but also planning decisions and a lack of risk disclosure limiting the availability of insurance.

With climate change, governments could face increasing costs as the capacity of individuals and communities to manage climate risks is likely to be exceeded more frequently. Up to 247 000 existing coastal residential properties are exposed to inundation from a 2100 sea-level rise scenario, and these properties are valued at up to \$63 billion.²⁶ This means that there is considerable potential for costs to government to grow, particularly if development intensifies in flood-prone areas.

The Australian Government also has a long standing role as insurer of last resort through supporting farmers in times of exceptional drought under Australia's National Drought Policy (NDP). Over time, the provision of assistance has proved costly. Between 2001–02 and 2010–11 the Australian Government provided approximately \$4.85 billion in Exceptional Circumstances (EC) drought assistance.²⁷ EC expenditure peaked 2007-08 at \$1.1 billion, when 69.2 per cent of agricultural land was EC declared.²⁸

A 2009 Productivity Commission inquiry found that the existing NDP's EC declarations and related drought assistance programs do not help farmers to improve their self-reliance, preparedness or climate change management.²⁹ In response to the Australian Government's review of drought policy, a pilot of drought reform in Western Australia is testing measures to support farmers to prepare for future challenges, rather than waiting until they are in crisis to offer assistance.

The 2011 review of the pilot by independent experts recommended that future government farm business assistance activities need to improve resilience by helping farmers prepare for future climate-related challenges such as drought, climate variability and reduced water availability.³⁰ Activities to improve preparedness identified by the review included training in managing risks associated with climate variability, the trialling of new innovations, assisting landholders to access alternative income streams and natural resource management.

The Australian Government is currently reviewing the adequacy of flood insurance and exploring approaches to improve the availability and transparency of flood insurance for residential buildings and contents.³¹ An effective future approach to flood insurance will recognise that climate change will alter flooding risks, and also recognise that the area and number of existing properties highly exposed to flood risk will change with even mid-range climate projections.

A useful example of how the insurance industry can assist in building resilience to climate change is the partnership between the Government of the United Kingdom and the Association of British Insurers.³² In this partnership the insurance industry provides flood insurance cover as a standard feature of policies to an agreed probability of flood risk. In areas of high risk the industry will maintain insurance cover only if local governments undertake flood protection works to limit the risk of flooding. The agreement is based on ongoing government investments in

flood protection, reforms to land-use planning, improved integration of urban drainage systems, and improved communication of risk.

Investment barriers

Investments in major infrastructure assets, such as roads and airports, produce benefits to the community which are outside the scope and timeframe of private sector investment decisions. An emerging issue is whether, and to what extent climate change is allowed for in the design and valuation of infrastructure investments. Failing to consider the future impacts of climate change can distort current investment decisions and risks creating open-ended liabilities for future generations.

Sydney airport is the busiest airport in Australia, handling 31.9 million passengers and nearly 300 000 aircraft movements in 2007. The airport is almost entirely surrounded by waterways, with Botany Bay to the south, Botany wetlands in the east, Alexandra Canal to the north, and the Cooks River to the west. A sea level rise of 1.1 metres combined with a storm surge would inundate parts of the airport, interrupting operations and causing damage to infrastructure.

More broadly, the National Public Private Partnership Guidelines that apply to the procurement of most major public infrastructure projects in Australia do not include consideration of climate change. Valuation standards within the guidelines require costs and revenues to be forecast over the life of the project, which can be much shorter than the life of the asset. Assets such as roads and bridges will be in operation as long as 90 years after they are built – that is, within the timescale of greater climate change impacts from increased heat, sea level rise or extreme weather events. Current valuation methods mean that any features in the project aimed at reducing climate change risks that could arise after the completion of the project but during the life of the asset cannot be accounted for in determining the overall value of a project.³³

A useful approach to facilitate consideration of climate change impacts and adaptation in the planning for long life assets has been proposed by Dr Ron Ben-David, Chairperson of the Victorian Essential Services Commission.³⁴ This involves long-term risk-based analyses of the impacts of climate change on service delivery, looking 30 to 50 years into the future. Long-term investment plans that incorporate adaptation and which can be revisited as new information emerges could be informed by this analysis. Existing five-year investment plans can be stress-tested against the long term plans to ensure that current action does not lock out or unnecessarily raise the costs of future options.

Transaction costs and externalities

Responsibility for on-ground adaptation action is often devolved to local governments as they make many of the day-to-day decisions about land use, development assessments and protective works such as seawalls.³⁵ However, local governments and other actors – small communities or individuals – face a range of capacity challenges in incorporating climate change into such decisions.³⁶

A challenge for local governments is that many adaptation decisions need to be made at a regional scale to be effective.³⁷ For example, a local government can make a decision to upgrade pipe infrastructure to provide better drainage but may not have the ability to ensure that neighbouring local governments also upgrade linked infrastructure. In many cases the coordination mechanisms to support larger scale responses are not in place.³⁸

A lack of coordinated adaptation action at the right scale can result in externalities. In a number of areas around coastal Australia, for example, developers or private coastal property owners have undertaken work to protect their properties, with a significant loss of public beach amenity or impacts to adjacent properties (for example, the Port Geographe canal estate in Western Australia³⁹). The costs of maintaining

public beaches through sand replenishment, where this is feasible, will generally exceed the local rate base and require diverting funds which could be spent on other community services. The result has been legal actions over coastal planning decisions. There are examples of private landowners initiating proceedings to compel Councils to construct coastal protection works, as well as examples of Councils taking legal action to prevent private landowners constructing coastal protection works.⁴⁰

Well-coordinated action across tiers of government can help overcome many capacity barriers. National and State inquiries into coastal zone management have recognised inconsistent and uncoordinated approaches among state and local governments as a barrier to the integrated decision making that is required.⁴¹

National coordination on benchmarks, methodologies and common approaches can help decision makers plan and build efficiencies into information gathering and analysis. For example, there is not yet a common national methodology for monitoring coastal sea level rise, leading States and Territories each using different methodologies with the result that they may be over or under estimating their risks. Similarly, there is no national approach to defining, declaring or managing heatwaves. A one-size-fits-all definition of sea level rise or heatwave conditions will not work for Australia, given the climatic differences across the country. But agreed national methodologies would allow the development and delivery of information to support effective adaptation.

Coordination and shared information tools have gone some way to managing these risks with respect to Australian water policy, for example. The Murray-Darling Basin Authority was established in 2008, providing a single agency responsible for planning integrated management of the Basin's water resources. The Authority will prepare and oversee a Basin Plan that coordinates water allocation across 13 surface, 17 groundwater and 6 combined water resource plan areas.

Effective adaptation investment pathways for long-life assets

The development of large scale projects in Australia can be informed by the experience of adapting to climate change in major projects overseas such as the UK's Thames Estuary 2100 (TE2100) project. This project is a good example of adaptation decision-making under uncertainty applied to long-lived infrastructure decisions with high-sunk costs. London and the Thames are highly sensitive to climate change. The objective of the TE2100 was to provide a plan to manage flood risk in that area over the next 100 years. The project has identified packages of adaptation measures that can be implemented over time, to meet various scenarios of extreme water levels. Thresholds for decisions have been identified that are flexible, effectively manage risk, and avoid "stranded" investments.⁴²

Regulatory barriers

Regulation designed to work with an unchanging climate reduce the flexibility needed to respond to a changing climate.

Regulation underpins decision-making in many sectors, particularly infrastructure, utilities and land-use planning. A recent survey of over 600 members of the Australian Sustainable Built Environment Council found that the leading reason why member organisations do not consider climate change or take action to reduce its impact is that there is no regulatory requirement to do so (62.1%).⁴³

The Australian Government commissioned Maddocks Solicitors to review the role of regulation in facilitating or constraining adaptation, focusing on infrastructure.⁴⁴ The report identified a significant number of regulatory impediments to effective adaptation.

For example, the Building Code of Australia (BCA) determines whether or not houses being built now are adapted to the future impacts of climate change. The Maddocks review found that the BCA is generally applied through prescriptive

technical standards that assume an unchanging climate, because these provide certainty on building outcomes and costs. The risk is that, without regular review, technical standards for a particular region could become obsolete over time as the climate changes.

More generally, industry codes and standards influence the economy-wide perception of climate risk, and judgements about appropriate adaptation options. In addition to the *Building Code of Australia*,⁴⁵ other important standards include the *Australian Rainfall and Runoff Standard*⁴⁶ and the *Australian Risk Management Standard*.⁴⁷ An important barrier is that these codes and standards currently focus on predictable forms of risk, and do not yet incorporate guidance on how to manage the less predictable risks associated with climate change.

The Maddocks review also found that a significant barrier to adaptation is that industry codes and standards are reviewed infrequently and the process for updating them can be protracted. In addition, most standards do not take specific account of climate change projections.

The performance of most types of infrastructure is determined by regulatory standards. The future capacity of infrastructure to adapt depends on climate change being recognised in current standards. Climate change means that the design standards of infrastructure are likely to be exceeded more often. For example, during a record heatwave in Melbourne in January 2009, the cable under Bass Strait linking the electricity grids of Tasmania and Victoria went down when the temperature in northern Tasmania exceeded the design threshold of 35°C.^{48,49} Such events can be expected to occur more frequently with climate change.

The cost of not adapting electricity infrastructure to climate change is less reliable supply, with potentially serious consequences for economic productivity and quality of life. For example, 500 000 homes and businesses experienced rolling blackouts during the Melbourne heatwave in January 2009.⁵⁰ This event had flow-on costs to regions through lost productivity, additional maintenance and replacement.⁵¹

There is growing evidence that the regulation underpinning land-use planning poses a barrier to the adaptation of urban development, particularly in coastal or flood-prone regions. A contributing factor is a lack of clarity in the responsibilities and co-ordination between state and local governments affecting land-use planning in high risk areas. New urban development continues to take place in areas that will be adversely affected by climate change. Sea level rise and more frequent and severe extreme weather events will contribute to coastal erosion, inundation, and storm damage to properties.

Barriers limiting adaptation in land-use planning

include an absence of risk disclosure systems, the institutional capacity to apply these and legal uncertainty surrounding the consequences of doing so. Information on climate risk is essential for real estate and insurance markets to accurately value climate-related risks. Risk disclosure systems are important components of other policies relating to risk and safety, such as medical practice and air safety, and regulation of financial markets following the global financial crisis.

A long-embedded view of coastlines and coastal property rights has given rise to the legal principles of *existing use rights* and *injurious affection*. These principles may be limiting the ability of local councils to constrain development in high risk areas.⁵² Sea level rise is likely to mean that Australian coastlines begin to shift as coastal erosion and inundation progress, requiring a more flexible approach, similar for example, to that developed in other parts of the world with a longer history of coastal recession.

^{53,54}

Uncertainty in the requirement for adaptation has led to a number of coastal planning decisions being tested in the courts.⁵⁵ A contributing factor to this uncertainty is the absence in most legislative frameworks of guidance on the relative weighting that should be given to climate change considerations in decision making.

These regulatory barriers are likely to interact. For example, decisions about the location of urban development affect the location and design standards of related infrastructure. All of these regulations need to work cohesively to support effective adaptation. The depth and interaction of regulatory barriers suggests a comprehensive review process may be required.

Coastal adaptation: a case study of interacting barriers

The coast is an area where multiple barriers to adaptation play out. Many communities around Australia are already impacted by king tides and coastal erosion. A number of Torres Strait Island towns are repeatedly flooded during summer king tides. The 2009 King Tides project in NSW highlighted current risk for many settlements including Tweed Heads, Ballina, Coffs Harbour, the Central Coast, Sydney Harbour, Wollongong and Batemans Bay.

Climate change will exacerbate risks to coastal regions. A sea level rise of 1.1 metres (high end scenario for 2100), poses significant risks to major cities and infrastructure in areas such as Moreton Bay, Rockdale, City of Kingston in Port Phillip Bay, Port Adelaide and Mandurah. DCCEE's report *Climate change risks to coastal buildings and infrastructure* (2011) indicates that greater than \$226 billion in existing commercial, light industrial, road and rail, and residential assets may be exposed to inundation and erosion hazards around the end of this century. The productivity implications of the inundation and temporary lack of operation of a component of critical infrastructure, such as Sydney Airport, can be far-reaching.

Continuation of current development patterns will further increase our exposure to coastal hazards with a growing population; for example, Queensland is expected to double its population over the next two decades with the majority of housing demand expected in coastal areas.

An intersection of barriers is already evident in coastal zone decision-making processes. The experience at Collaroy on Sydney's northern beaches shows the increasing adaptation challenge brought about by the interplay of regulatory, institutional and capacity barriers. Multiple property boundaries extend across the dunes and onto the beach. A succession of coastal storms between the 1920s and the 1970s undermined and in some cases destroyed the original shacks. Despite this, property development has intensified with property now valued at over \$3 billion. The Council has attempted to purchase 'at-risk' properties, but the high land and property values and a low Council funding base has meant this has had limited success. That the planning system continues to allow for an increase in asset value in high-risk areas demonstrates both regulatory and market barriers.

At Kingscliff on the NSW coast, approximately \$700,000 has been spent over the past two years on the construction of a temporary seawall to protect a caravan park that was originally identified as being a 'relocatable asset'. The caravan park now plays a significant role in the local tourism economy. The immediate nature of the erosion hazard, which will make amenity blocks and other small infrastructure unstable and unusable unless addressed, is forcing short term decisions to be made about protecting 'at-risk' assets. This temporary sea wall has not been constructed to an engineering standard so will need to be removed if there is a decision to build a more permanent structure. Pressure to make short-term reactive decisions in 'knowledge poor' environments is a significant cognitive and behavioural barrier to adaptation.

Sea level rise impacts are also likely to require regional or strategic scale planning to guide local action. Altered water regimes as a result of climate change will have significant implications for sewerage and stormwater infrastructure which is owned by a mix of local governments, state agencies and water bodies. Regulatory, institutional and capacity barriers however limit the delivery of efficient integrated approaches to the upgrade of such assets.

5. *Directions for adaptation policy*

The barriers working against adaptation outlined in the previous section provide a case for investigating whether government intervention can improve adaptation beyond what would occur anyway. Given the potential aggregate cost to the national economy of adaptation falling short of that required, the Australian Government has a responsibility to lead national reform to ensure Australia is well placed to deal with the risks of climate change.

Policy options for overcoming these barriers can be drawn from theory, as well as experience in existing adaptation policy, international adaptation policy and other policy problems with similar characteristics.

The emerging evidence suggests that individual barriers to adaptation are unlikely to act independently. In many cases the interaction between barriers is likely to require holistic and coordinated policy responses.

Identifying barriers is not sufficient to justify policy intervention. Governments need to carefully evaluate whether policy intervention is likely to lead to a better balance of adaptation than would otherwise be achieved, what type of intervention may be required, and who would bear the cost of that intervention. This is particularly true of market related barriers. Markets are rarely complete or function perfectly, but in general provide a more efficient outcome than many policy alternatives.

Risk, decision-making and insurance

The lack of targeted information and the capacity to use it effectively in decision-making is a cross-cutting barrier to climate change adaptation. Many households, businesses and governments are uninsured or underinsured against climate-related extreme events such as floods, bushfires and cyclones.⁵⁶

An integrated policy response would seek to

share the risks of climate change efficiently and equitably between governments and households. It could be underpinned by reforms to planning regulations to prevent new houses and infrastructure being built in high risk areas, and codes governing modification to existing structures. Incentives to modify existing houses or relocate to low risk areas could be evaluated against their potential to reduce future government liabilities for reconstruction. The potential for insurance premiums to provide incentives to drive behaviour change to adapt to climate change could also be relevant.

The health sector provides examples of policy that seeks to overcome adverse selection and moral hazard issues similar to those that may affect adaptation. Proactive health policy involves overcoming disincentives for individuals to make long term investments that promote their future health, reducing future health expenditure by governments.

In addition, adapting to the risks posed by climate change has a number of characteristics similar to the risks created by the rapid globalisation of financial markets. The key lesson from prudential regulation is that governments are likely to be drawn into providing financial assistance in the event of financial market failures. This means that governments have an incentive to regulate risk-taking to the level that would be the case if all the consequences of an adverse outcome were borne by the risk-taker.

Regulatory reform

Regulation designed to work with an unchanging climate can reduce the flexibility needed to respond to a changing climate.

An integrated policy response would review regulation to assess whether and to what extent adaptation is supported or constrained. Priorities for review would be set by a systematic evaluation of the benefits of regulatory reform

against the costs, beginning with regulation underpinning the productivity of the economy. Mechanisms for coordination and consolidation of regulatory review provide options for achieving economies of scale.

National Competition Policy (NCP) provides an example of reform that flowed from a growing consensus that Australia's regulatory environment had evolved in ways that constrained competition and economic productivity. National competition policy involved a significant shift in thinking and practice affecting most sectors of the economy and government activity. NCP involved the systematic analysis of regulatory barriers to competition at a detailed level (legislation by legislation). The reforms counteracted falling productivity across the economy.

Infrastructure, development and productivity

New urban and infrastructure development continues to take place in areas that will be adversely affected by climate change. In coastal areas, sea level rise and increases in the frequency and severity of extreme weather will contribute to coastal erosion, inundation, and storm damage to properties. In many areas of Australia, climate change will increase the frequency and severity of bushfires.

Australian, state and territory governments recognise the need to significantly improve the integration of infrastructure and urban development, and to remove the barriers that limit this, in order to realise further productivity gains from our cities and workforce. The Australian Government's national urban policy reinforces the Council of Australian Governments' national objective to ensure our cities are globally competitive, productive, sustainable, liveable, socially inclusive and well placed to meet future challenges and growth. This includes a focus on climate change adaptation such as in the assessment of proposals for infrastructure

investment by Infrastructure Australia.

The Green Book guidance prepared by the UK Treasury and the UK Department of Environment, Food and Rural Affairs on accounting for the effects of climate change is useful as a model for guidance on how to incorporate adaptation in investment decisions across the economy.

The Australian Government currently provides significant funding to reconstruct residential housing, transport, electricity and other infrastructure after extreme weather events, whereas the location, design and management of this infrastructure is largely the responsibility of state and local governments. An essential policy goal is to meet equity objectives while focusing investment to reduce future budget liabilities.

Distribution issues and equity

While Australia has a good capacity to adapt to climate change impacts due for example to well developed health and social systems, the requirement for adaptation will fall unevenly across society. Climate change is likely to place a disproportionate burden on the disadvantaged in Australia. It is likely to impact most on those in rural regional areas with lower incomes and poorer health – in particular, Indigenous communities. Flow on effects from adaptation (such as price increases, shifts in industry composition) will also likely affect these groups disproportionately. To this end, there is a case for Government to ensure that adaptation policy recognises distribution and equity issues.

Markets can also fail to identify and address equity issues. In 2009 a heatwave across southern Australia resulted in over 400 excess deaths and \$800 million in costs. The elderly and the socially disadvantaged were particularly vulnerable.⁵⁷ Similarly, climate change may disadvantage lower income groups through the working of rental property markets.⁵⁸ Neither the landlord nor the tenant gains sufficient benefit from capital expenditure on retrofits for adaptation. This has equity considerations as

a disproportionate number of poorer people live in rental properties. Governments may need to consider a mix of policy responses including reviewing standards for rental properties where health and safety are at stake, and incentives for capital investment in adaptation.

Assessing and tracking performance

Monitoring and reporting on adaptation outcomes is essential for setting priorities, guiding implementation and assessing progress towards adaptation. Monitoring and reporting will need to consider the diverse nature of adaptation, including the range of barriers and the social, economic and environmental goals of adaptation.

To track our progress in positioning Australia to adapt to climate change the Government has decided to commission a regular Climate Futures Report. The Report will be produced every five years and will provide a mechanism to evaluate how effective our collective adaptation efforts are. It will tell us how well Australia is placed to deal with climate change risks and evaluate the effectiveness of policy measures taken by governments to improve resilience to climate change impacts.

This type of reporting could potentially draw on regular reports of adaptation progress by key agencies delivering elements of adaptation. Reporting by all public agencies is one of the foundations of adaptation policy development in the UK.^{59,60}

Footnotes

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- ² See *Administrative Arrangements Orders*, 14 September 2010, Commonwealth of Australia.
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- ⁴ United Nations Framework Convention on Climate Change, Article 2.
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- ⁶ The IPCC defines adaptation as 'the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities' (see AR4, WGII p. 7).
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- ²² Munich Re, 2010. *Topics geo natural catastrophes: analyses, assessments, positions*. Munich Re Insurance Company Report, p. 40.
- ²³ See Munich Re, 2010. pp. 115 – 120.
- ²⁴ Gillard, J. 2011. *Rebuilding after the floods*. Media Release 27 January 2011, Office of The Prime Minister of Australia, Canberra.
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