Investor Group on Climate Change

FROM RISK TO RETURN:
INVESTING IN CLIMATE CHANGE ADAPTATION

NCCARF
National Climate Change Adaptation Research Facility

JAMES COOK UNIVERSITY AUSTRALIA

Eureka REAL ASSETS

The Investor Group on Climate Change (IGCC) is a collaboration of Australian and New Zealand institutional investors and advisors, managing over $1 trillion in assets under management and focusing on the impact that climate change has on the financial value of investments. IGCC aims to encourage government policies and investment practices that address the risks and opportunities of climate change. www.igcc.org.au

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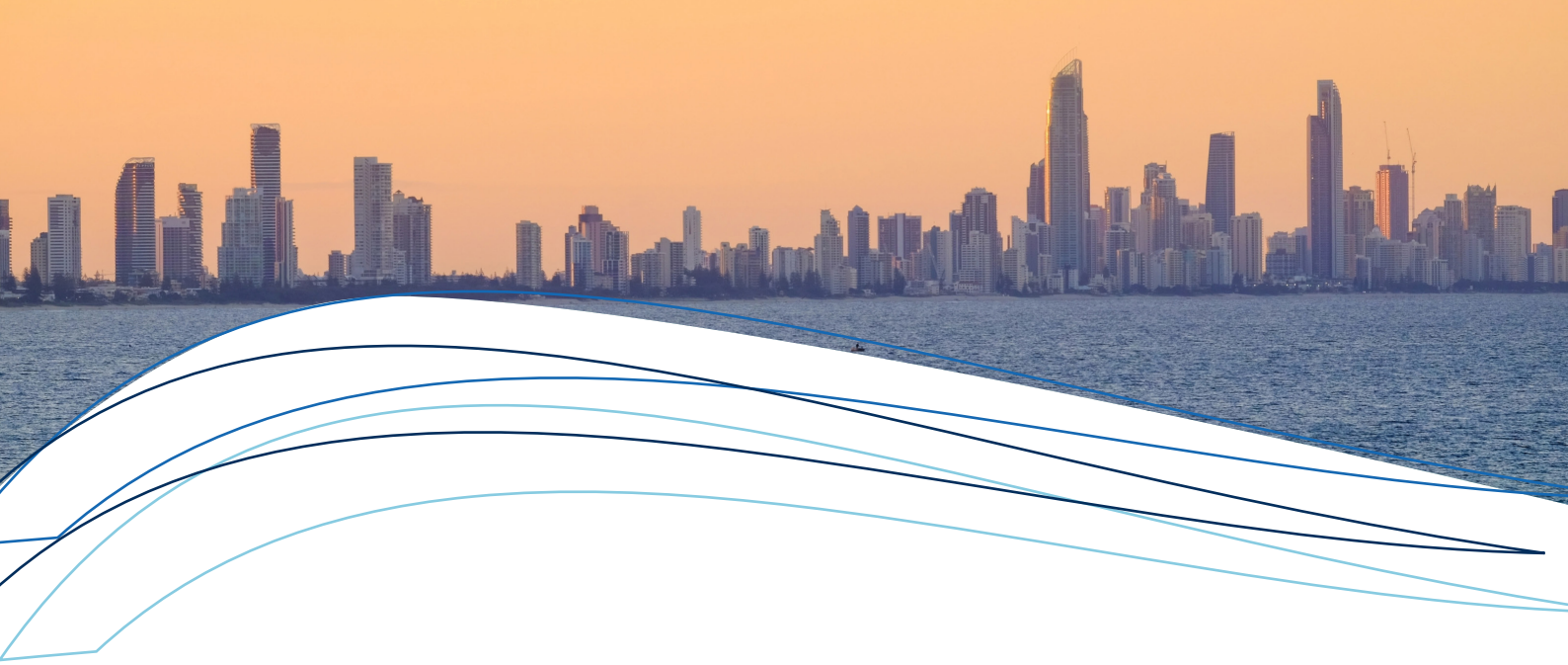


FOREWORD

Eureka-Real Assets

Eureka-Real Assets is pleased to sponsor this report *From Risk to Return: Investing in climate change adaptation*.

At Eureka, we seek investment opportunities and funding solutions for environmental upgrades, resilience projects and climate change adaptation in real assets. Eureka currently manages the only investment Environmental Upgrade Fund in Australia, which has funded over $40m in energy efficiency projects to date.

We consider adaptation as critical to building resilience in our cities and infrastructure. Adaptation is still relatively unchartered in Australia with markets seeking a greater understanding of what it means and how to create investment opportunities for investors around adaptation projects.

This report is an opportunity to bring together research on funding adaptation and provide key stakeholders with framing around adaptation as a viable investment opportunity.

We hope this paper will be useful in defining adaptation risks and opportunities and promotes further engagement by investors and other stakeholders around adaptation finance gaps.

We thank IGCC for running the Adaptation Working Group and for furthering the discussion around climate change adaptation.

Niall McCarthy,
Director, Head of Business Development

IGCC

The Paris Agreement sets out an ambitious goal of limiting global warming to less than two degrees by the second half of the century to avoid the worst impacts of climate change.

Although there are now significant steps being taken across the economy to reduce emissions, we also know that a certain amount of global warming is inevitably locked into the system.

For investors, this means that physical risk must become BAU for investment decision making, and new investment must begin to flow into adaptation solutions to future proof our infrastructure and our cities.

Climate change is here and the impacts are being felt. They will increase and we must start adapting.

In undertaking this work, IGCC began with the questions: how do we increase the amount of investment going into adaptation solutions? What works? What lessons can we learn from other areas of investment activity and what steps can be taken to increase capital flows into resilience measures?

We hope that this report acts as a practical guide for investors and decision makers across the economy and we look forward to contributing further to this important area of work.

Emma Herd,
Chief Executive Officer

Eureka
REAL ASSETS

Investor Group on Climate Change

EXECUTIVE SUMMARY

Too often, climate change is thought about as a challenge for future generations. But as records continue to be broken, it is increasingly clear that the effects of climate change are being felt today.

There is no doubt that the Paris Agreement was a major milestone in establishing the framework for tackling climate change, by setting the global goal of limiting global warming to less than 2°C and moving to a net zero emissions economy by the second half of the century. But we should not lose sight of the fact that 2°C warming still involves substantial change for our infrastructure, our economy and our communities.

For investors, this means that the physical risk dimensions of climate change must be part of the risk assessment process, and that increasing investment into adaptation to ameliorate the effects of climate must accelerate.

Given that climate change has been such a dominant topic in public debate for a number of years now, it is perhaps surprising that relatively little work has focused on the practical aspects of adaptation, particularly on how to finance it. Where this work has taken place, it is predominantly focused on public finance, while the hard yards of increasing private sector investment into adaptation is only now beginning.

This report looks explicitly at how to increase investment into adaptation. Developed through a multi-stakeholder climate adaptation finance consultation process, it aims to identify real world investment barriers and recommend potential solutions, with the goal of enabling the finance sector to access adaptation investment opportunities. It also sets out a pathway ahead with specific recommendations that IGCC will be taking forward.

Comments of participants in this process are included throughout the report.

Throughout this guide, we have sought to identify practical examples of investment models currently being applied or with the potential to be adopted to meet the challenges to adaptation investment identified through this consultation process. By looking at what works today, we are better able to identify solutions for scaling up investment.

"Meeting the 1.5°C target would mean completely decarbonizing the global economy in 10 years. The Paris Agreement is equal to saying we will put a man on the moon in 1960."

Barriers to Investing in adaptation

Investors identified the following gaps as major barriers to adaptation investment, including lack of:

- A clearly defined project scope where the adaptation component is made explicit
- A credible project proponent or counterparty
- A revenue stream and commercial investment return
- Adequate project scale
- An accepted framework for allocating financial benefit (value add)
- Effective coordination across different levels of government.

Potential solutions for increasing investment in adaptation

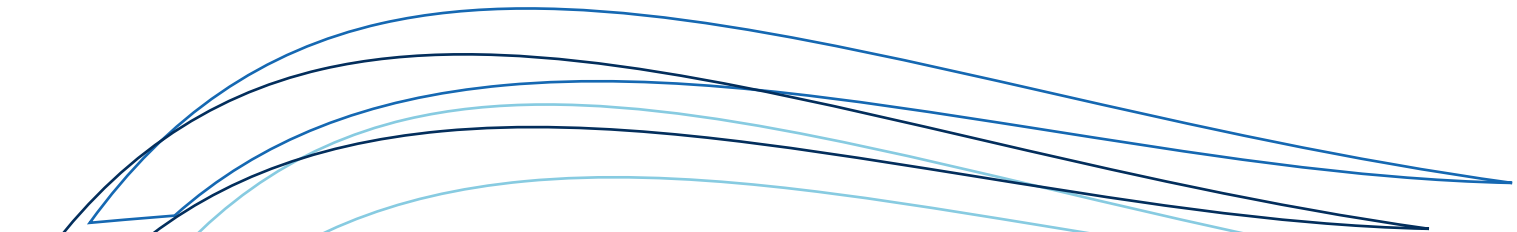
Investors identified the following steps as potential solutions for increasing adaptation investment:

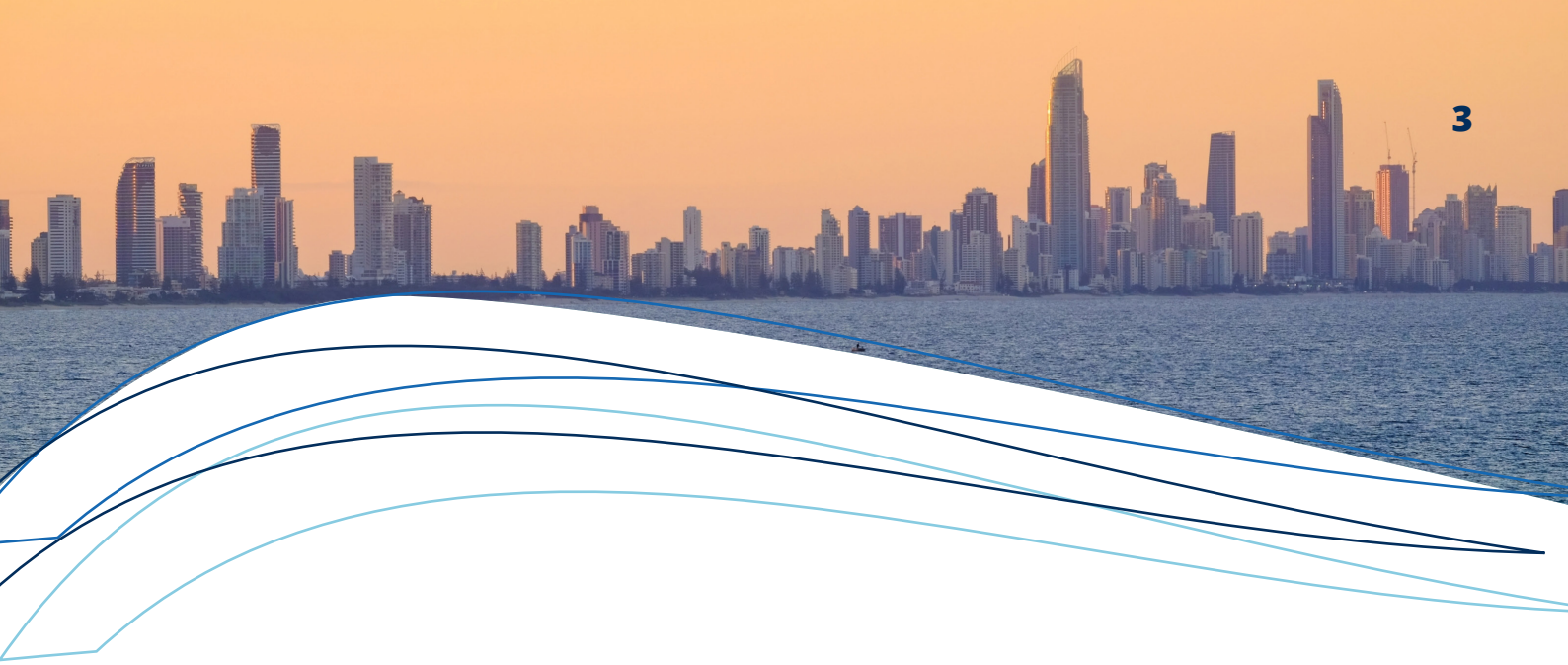
- Adopt blended mitigation and adaptation investment solutions to generate commercial return and adaptation outcomes
- Build on the experience of mitigation finance, particularly through aggregation models to achieve investment scale
- Work with carbon finance agencies to develop investable measurement models for resilience outcomes
- Seek a more coordinated approach to cross-government ownership of adaptation funding and implementation
- Build on lessons learnt from social impact bonds and impact investment in adopting a collaborative approach to project scoping and development.

IGCC believes that there are a number of areas where further work can be undertaken to promote greater investment into adaptation.

1. IGCC would encourage all levels of government to collaborate on the development of a framework clearly setting out levels of government coordination and responsibility for adaptation in Australia.
2. Australia needs an up to date national assessment of infrastructure at risk to the effects of climate change and an indicative quantification of the investment required for adaptation.
3. All levels of government should collaborate in the establishment of an expert advisory group to work with the finance sector on promoting adaptation investment across Australia.
4. IGCC will engage with global climate finance bodies on the development of an adaptation and resilience measurement framework.
5. Investors should actively seek opportunities to blend adaptation outcomes into green or climate investment structures, where possible and appropriate.
6. Investors should seek to engage further with public climate finance bodies to identify opportunities to apply mitigation investment structures to adaptation projects.

This report builds on IGCC's 2015 publication, *Investing through an adaptation lens – A practical guide for investors*, which described the risks, opportunities and associated interdependencies related to climate change that investors need to consider in order to adapt. The guide addressed these issues for investment in three sectors: direct property investments, direct infrastructure investments and listed equities.





1 INTRODUCTION

The need for adaptation

The 2015 Paris Agreement commitment to limit global warming to 2°C and move towards 1.5°C degrees, is a milestone in global climate policy. The Agreement provides a mandate for governments to increase action on climate change policy and enables business to plan and mobilise for a low carbon economy faster and more forcefully than ever before.

However, despite the Paris Agreement and other international efforts to reduce emissions of greenhouse gases, a certain degree of climate change is already locked into the system. Even if all global carbon emissions cease tomorrow, science tells us that sea levels will continue to rise, oceans will continue to warm, weather patterns will change, and extreme weather events will continue to devastate communities more often and in different ways than in the past.

Currently, we are not actually on track to achieve the targets set out in the Paris Agreement. We know that 2016 was the hottest year on record, with global average temperatures already having risen 1.1°C above pre-industrial baselines. The UN has warned that, even if all of the national commitments detailed under the Paris Agreement were fully implemented we would still be on track for global warming of 2.6°C or more. However the scientific community warns that, under current policy commitments the Paris Agreement targets are highly unlikely to be met and global temperatures are more likely to rise by 3°C or more by the end of the century (Steffen 2016). [1]

"We have to think about how fast the system is shifting, as the rates of change we are seeing are unprecedented, and overwhelming adaptive capacity."

Figure 1 below shows the risks that are likely to occur at 2°C and 4°C temperature increases (aligned with our current trajectory), and that these risks increase the more scientists learn about the impacts of climate change.

Even at 1.5°C of warming the risks and impacts remain high.

A recent poll could not find one leading climate scientist who thought that the 2°C target was likely to be met. https://www.theguardian.com/environment/2017/jan/19/cat-in-hells-chance-why-losing-battle-keep-global-warming-2c-climate-change?CMP=Share_iOSApp_Other

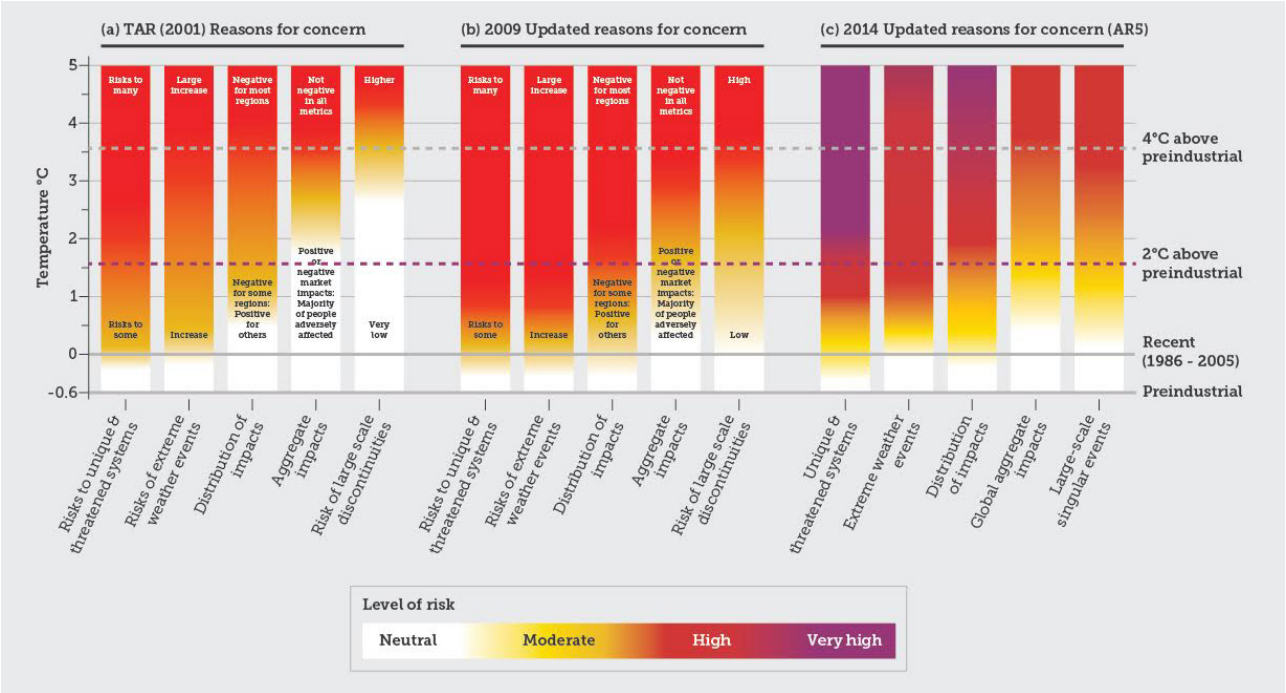


Figure 1. Each reiteration of the Intergovernmental Panel on Climate Change shows increased risks likely to result from rising global mean temperatures.

Source: Climate Council of Australia (2015), based on Smith et al. (2001), Smith et al. (2009), and (IPCC 2014).

What is climate change adaptation?

Climate change *adaptation* is the process of adjustment to actual or expected climate change and its effects (IPCC 2014), while *mitigation* refers to actions to address the causes of climate change, principally by reducing greenhouse gas emissions. *Resilience* is a term that is also used interchangeably with adaptation. Resilience indicates preparation and readiness to respond to adverse impacts and future challenges.

The physical impacts of climate change are also frequently referred to as *physical risk*, and often further differentiated between acute and chronic physical risks depending on whether it is for immediate impacts or change occurring over a longer time frame. However, adaptation, remains the process of adjustment or response to these identified risks.

The World Economic Forum's (WEF) *Global Risk Report 2017* lists "Failure of climate-change mitigation and adaptation and water crises" as the third most significant global risk identified. In addition, the WEF lists climate change as one of the top five determinants of future Global Development. To put this into a local context, Sydney and Melbourne are both participants in the Rockefeller Foundation's 100 Resilient Cities Program. As part of this process, they both found that their 'top shocks' needing to be addressed, stem from climate change. The top shock identified for Sydney was extreme weather events, particularly heatwaves, but also bushfires, storms and localised flooding. For Melbourne, it was natural disasters, including bushfires, floods and heatwaves, while top chronic stresses include climate change. Thus, successful adaptation to climate change is a key aspect of building a resilient city (City of Melbourne 2016; City of Sydney 2016).

Climate change impacts in Australia

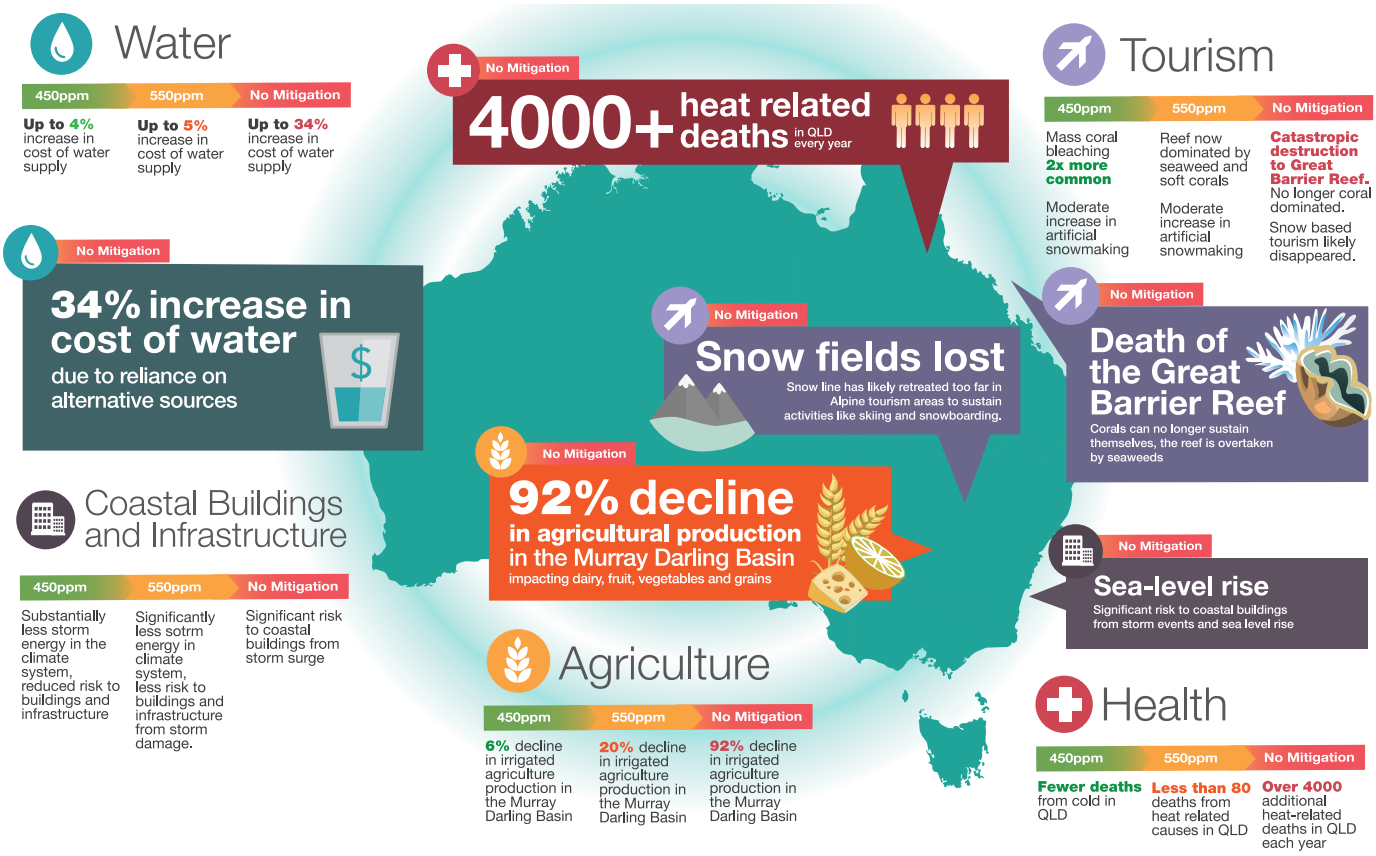


Figure 2. Climate change impacts in Australia: projections for the year 2100 under different emissions scenarios based on information from Garnaut 2008 and IPCC 2014.

Australia is one of the most vulnerable developed countries in the world to the impacts of climate change. Climate change is expected to increase the frequency and intensity of extreme weather events, while rising sea levels pose a significant risk to coastal communities and infrastructure. Australia faces significant environmental and economic impacts across a number of sectors, including water security, agriculture, coastal communities, and infrastructure. Decisions made today about infrastructure, health, water management, agriculture and biodiversity will have lasting consequences for future generations.

Adaptation will continue to be an important consideration by all levels of government, and for business, industry, and the community. Adaptation planning is underway in many instances, but there is a long way to go in determining what actions are required, and when and how they should be implemented. Importantly, the scale of the challenge means that costs will be high, and we need to consider how adaptation can be funded, as a large share of adaptation measures will need to be financed by private capital.

Extreme heat and heatwaves in Australia

The international commitment to limit global warming to below 2°C above pre-industrial levels (with a move towards 1.5°C) can be somewhat of a misnomer when talking about climate impacts such as heat. A 2°C target refers to an increase in global average temperature (which is currently 15°C), relative to a pre-industrial baseline. 2°C warming does not simply translate into an increase of 2°C in maximum temperature, but rather shifts the temperature distribution. Warm monthly daytime temperatures that occurred just 2% of the time during 1951-1980 for instance, now occur 11% of the time (Bureau of Meteorology, 2016).

This has a significant effect for heatwaves, one of the most devastating climate impacts for Australia. Major heatwaves in Australia have caused more deaths than storms, bushfires, flooding and earthquakes combined (Climate Council, 2017).

Heatwaves in Australia are already becoming hotter, longer, more frequent and occurring earlier, as experienced during the 2016-2017 summer.

Sydney, Brisbane and Canberra all experienced their hottest summer on record in 2017, with 205 weather records broken in 90 days across Australia (Climate Council, 2017). The mid February heatwave saw temperatures in western Sydney reach 47°C.

As well as human health impacts, this has implications for critical infrastructure, with excessive stress on the electricity grid and disruptions to transport networks. In January 2017, Queensland recorded an all time peak electricity demand and NSW neared peak demand (Energy Council, 2017). In February, New South Wales narrowly avoided widespread blackouts, requiring shedding of 580 MW of load from the Tomago aluminium smelter (Climate Council, 2017).

These temperature extremes also have implications for the “critical thresholds” to which infrastructure needs to be designed, and the effect of interdependencies.

Heatwaves also have large economic impacts. Heatwaves during 2013 – 2014 cost approximately $8 billion, through absenteeism and a reduction in work productivity, equivalent to 0.33% to 0.47% of Australia’s GDP (Climate Council, 2017).

Responsibility for adaptation in Australia

Two forms of adaptation can be distinguished: public and private adaptation. Private adaptation is initiated and undertaken by the private sector which includes individuals, households and privately owned companies (UNEP 2016). In Australia, responsibility for adaptation of privately owned assets is assumed by the private sector. The protection of public assets (public sector adaptation) including the protection of public assets from the impacts of climate change, is a government obligation (COAG 2012).

The opportunity exists for private sector funding into both private and public adaptation but the characteristics of funding are likely to be very different for each.

The impacts of climate change vary by region, and the approaches to adaptation need to reflect local values; consequently adaptation requires a local response. This means that adaptation is typically regarded as a local government responsibility in Australia (similarly to many other countries where several levels of governments operate).

Currently, there are over 500 local governments in Australia whose powers, responsibilities and modus operandi are determined by the States through legislation (such as Local Government Acts). Traditionally, local governments were responsible for building and maintaining infrastructure such as waste, sewage and roads and collecting rates. Over the years the scope of responsibilities has extended to include community health services, cultural experience (community libraries) and pollution control, among others. Adaptation to climate change presents an additional burden for local governments.

Typically, institutional investors have had limited contact with local governments in Australia, which makes governance an important issue for private sector involvement in adaptation finance. From the financier's perspective, it is important to recognise that state prescribed regulations determine how local governments can access funding, or raise revenue.

Figure 3. shows the proportion of different sources of revenues for local governments in Australia. Although there are differences among states and territories, the figure indicates a heavy reliance on the revenue from rates and the sales of goods and services.

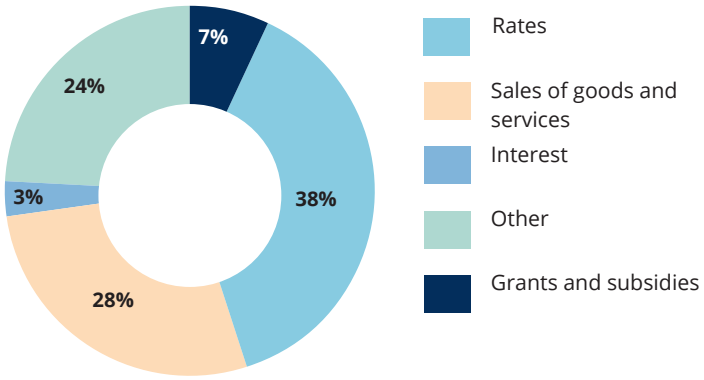
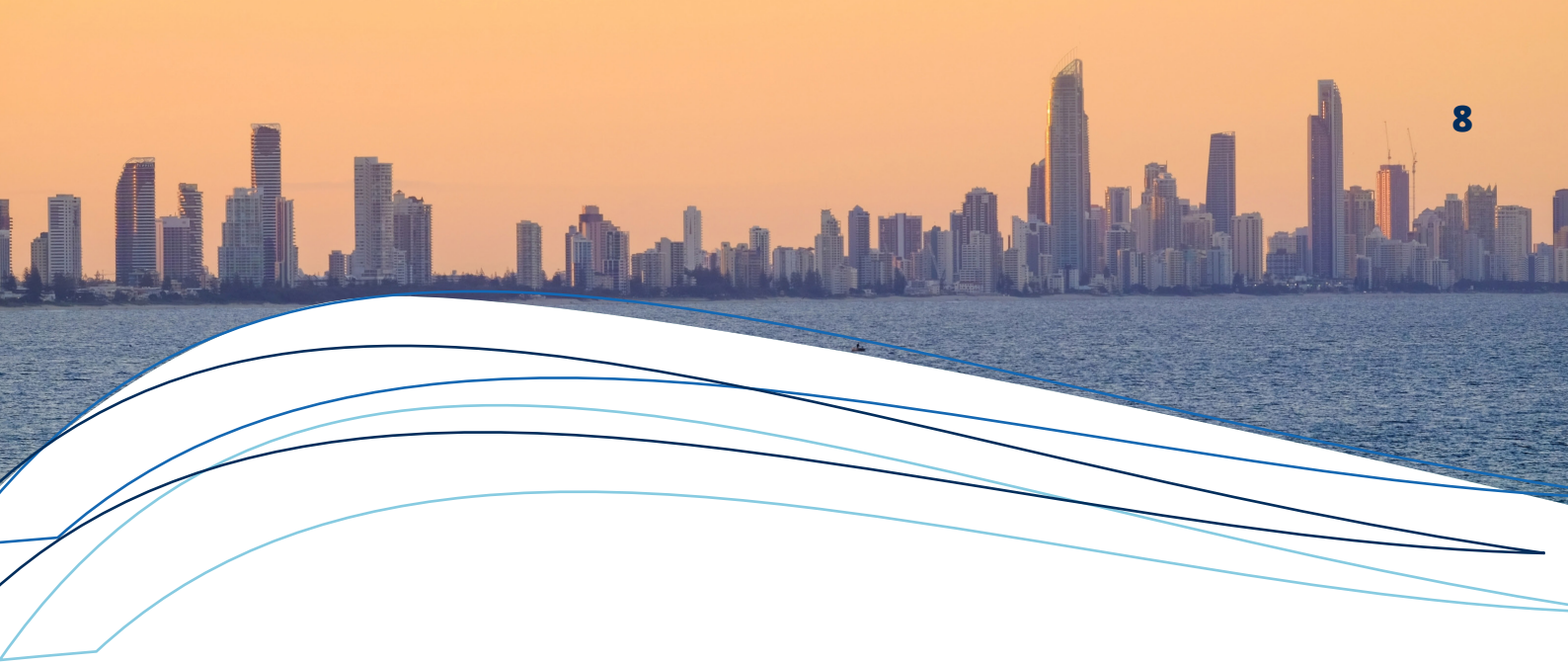


Figure 3. Relative contribution of different types of revenue sources for local governments in Australia (all States and Territories) (2013-2014)
(Adapted from DIRD 2015).

While revenue-generating abilities may be limited, local governments in all states have highly favorable assets to liability ratios and very limited debt.

Although differences exist across states, local government finances generally exhibit low liabilities and borrowing compared to total assets. From the financiers' perspective, local governments in Australia possess some appealing features including the capacity to borrow against stable predictable revenue streams. The reality, however, is that the cost of implementing adaptation is beyond the revenue generating capacity of local governments in Australia and this gap in funding presents a window of opportunity for investors to create a mutually beneficial relationship with local governments.



2 FINANCING ADAPTATION

Adaptation finance assists society to adjust to actual or expected climate change impacts or effects (NAB 2016; UNEP FI 2016). For investors, the key considerations for adaptation finance are risk and return. On the one hand, the risks posed by climate change and inaction must be sufficient to justify investment in adaptation. But on the other hand, the adaptation investment or response should be appropriate, effective and able to generate a revenue or return.

The economic cost of climate change

Determining the cost of climate change, and the amount of investment required for adaptation, can be challenging and is still at a relatively early stage.

The costs associated with the impacts of climate change will be substantial. An OECD (2014) study estimates losses from the result of climate change inaction in the range of 0.7% - 2.5% of global GDP for a temperature rise of 2.5°C (expected by 2060), resulting in estimated cumulative losses of GDP from climate impacts from 2015 - 2060 of US$2 trillion to US$72 trillion (depending on discount rates and scenarios used). If emissions continue to rise after 2060 these losses could reach up to 5% of GDP (Citi, 2015).

"The international commitment to mobilize US$100 billion a year by 2020 to assist developing countries both mitigate and adapt can't be met with public finance alone, we will need to use Government money to work out how to leverage private money."

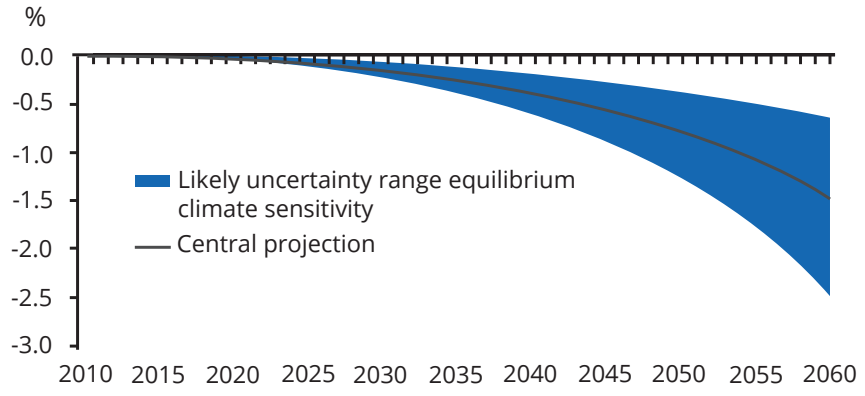


Figure 4. Climate Change Impact on Global GDP

Source: OECD (2014), in Citi (2015)

A recent Citi report (2015) estimated the damage to GDP from the negative effects of climate change in the order of US$20 trillion with 1.5°C warming; US$44 trillion with 2.5°C and US$72 trillion with 4.5°C warming.

These calculations relate to the economic impacts of climate change, such as sea level rise, health, ecosystems, crop yields, tourism flows, energy demand and fisheries. They do *not* however include economic damages from extreme weather events or catastrophic risks, which have large economic impacts, and will require increasing levels of adaptation. Thus changes in GDP projection underestimate the total economic impacts of climate change.

Adaptation costs should cover the full range of adaptation activities, which include planning, preparing for, facilitating, and implementing adaptation measures, including transaction costs (UNEP 2016).

Calculating projected costs of physical climate change impacts resulting from extreme weather events, sea level rise and other climate hazards is extremely challenging, given that the timing and magnitude of these risks is uncertain and extreme events are unpredictable.

"Adaptation is a $140-300 billion per year opportunity."

What level of investment is required?

The level of investment needed to respond to climate change in Australia has not been calculated. In other words, we do not know how much investment is needed, how much has already been invested, or when the investment is needed.

It is estimated the level of global investment required for adaptation to climate change in developing countries alone ranges from US$140 billion per year to US$300 billion per year by 2030 under a 2°C warming scenario, doubling by 2050. Under a 3°C - 4°C warming scenario, these costs would be considerably higher (UNEP 2016).

While it remains difficult to track past global finance flows for adaptation, UNEP estimates that total bilateral and multilateral finance for climate change adaptation reached US$25 billion in 2014, of which US$22.5 billion targeted developing countries. UNEP also notes that private sector adaptation finance, while comprising a large component of developing country finance flows, is difficult to quantify as climate-resilience activities are often integrated into development interventions or business activities, and therefore rarely stand-alone (UNEP 2016).

Recent estimates highlight a US$120 - 277 billion global adaptation finance gap per year to 2030 and US$260 - 478 billion gap per year until 2050 (UNEP 2016). This translates to a need to increase investment into adaptation 6 to 13-fold over the next 15 years (UNEP 2016).

Global figures illustrate the immediate need to scale up investment into adaptation and the considerable opportunity this presents for investors. It also highlights the need for a national assessment of the anticipated cost of climate change and the investment in adaptation measures required.

The role of insurance

Insurance is currently the key risk management strategy for weather-related events linked to climate change. Insurance provides a price signal on risk and thereby incentivises adaptation measures to reduce insurance costs.

Climate change presents a range of risks but not all of these are covered by insurance products. Insurance mechanisms are typically suitable for events that are considered to be unpredictable and are usually offered when events have a low probability of occurring (such as extreme events like cyclones or tornadoes, for example). When the frequency of loss becomes too high, insurance costs are the same as replacement costs and there is effectively no risk transfer.

Sea level rise associated with climate change is predictable and inevitable, and so isn't generally covered by short term insurance contracts. Sea level rise is expected to occur, even though its extent and timing is not exactly known. Current estimates are for 0.8 - 1.1m rises by 2100 along Australia's coast (IPCC 5AR). Estimates are that more than 50% of Australia's coastline is vulnerable to recession as a result of sea-level rise (Climate Council 2017). This currently represents 'uninsurable' risk (Banhalmi-Zakar et al 2016).

To date, there are no sea level rise insurance products available on the market. One potential way insurance could be used as a mechanism against sea level rise is a 'whole of life' insurance cover for a home. Annual premiums are paid into a fund which then pays out when the home is no longer inhabitable due to sea level rise. This would be similar to current life insurance products (Bell and Lovelock 2016).

Another example of asset exposure to 'uninsurable' risk linked to extreme weather events that offers some lessons are the Queensland floods of 2010-2011. Approximately 29,000 homes and businesses experienced some form of flooding and the estimated economic cost of the flooding was over $5 billion. Flood insurance has typically been a grey area. Many policy holders were devastated to find out that their home and contents 'flood insurance' clause did not cover the damages because they only pertained to certain types of flooding, such as flash flooding, or flooding from precipitation but not flooding from rivers. Consequently, the government introduced a standard definition of flood and required insurers to offer flood cover. Today, many policyholders do not realise that they are not covered for coastal inundation, and it is likely we will see similar issues emerge when sea levels rise.

At the same time, repeated floods in some parts of Queensland, such as Roma, resulted in Suncorp insurance withdrawing its business from entire towns. The company worked with the local council to make the case for a new government-funded levee to be erected to protect homes (Hales et al 2016). Once the levee was raised, it was possible to insure the properties once again at a substantial discount to the pre-levee prices.

These examples demonstrate that climate change can present new challenges for the finance sector and that asset holders and investors need to consider carefully how climate-related risks can be mitigated through insurance, and how insurance can be used to drive adaptation.

Climate-related risks and opportunities for the finance sector

The Financial Stability Board Task Force on Climate-related Financial Disclosure (TCFD) was formed to assist the finance, investment and insurance community to better understand, assess, manage and communicate their climate-related financial risks and their impacts. Climate change translates into financial risk when it results in damage to property, or disrupts business processes, reducing the value of financial assets, or manifests as insurance liabilities (FSB 2015). Climate-related financial risks include physical risks, which are caused by the physical impacts of a changing climate (ie. cyclones, flooding, sea level rise), and transition risks which are associated with the process of moving to a lower carbon economy.

In addition to risk, climate change presents the financial sector with opportunity. Opportunities can be leveraged by investment in resource efficiency, new energy sources, development and extension of low-emission products and services, new markets and increasing resilience of organisations (TCFD 2016). While 'opportunities in adaptation' are not distinguished from other climate change related opportunities, adaptation can be an additional factor of any of the above, particularly when it increases the resilience of existing and/or new assets (including low-emission technologies) and communities.

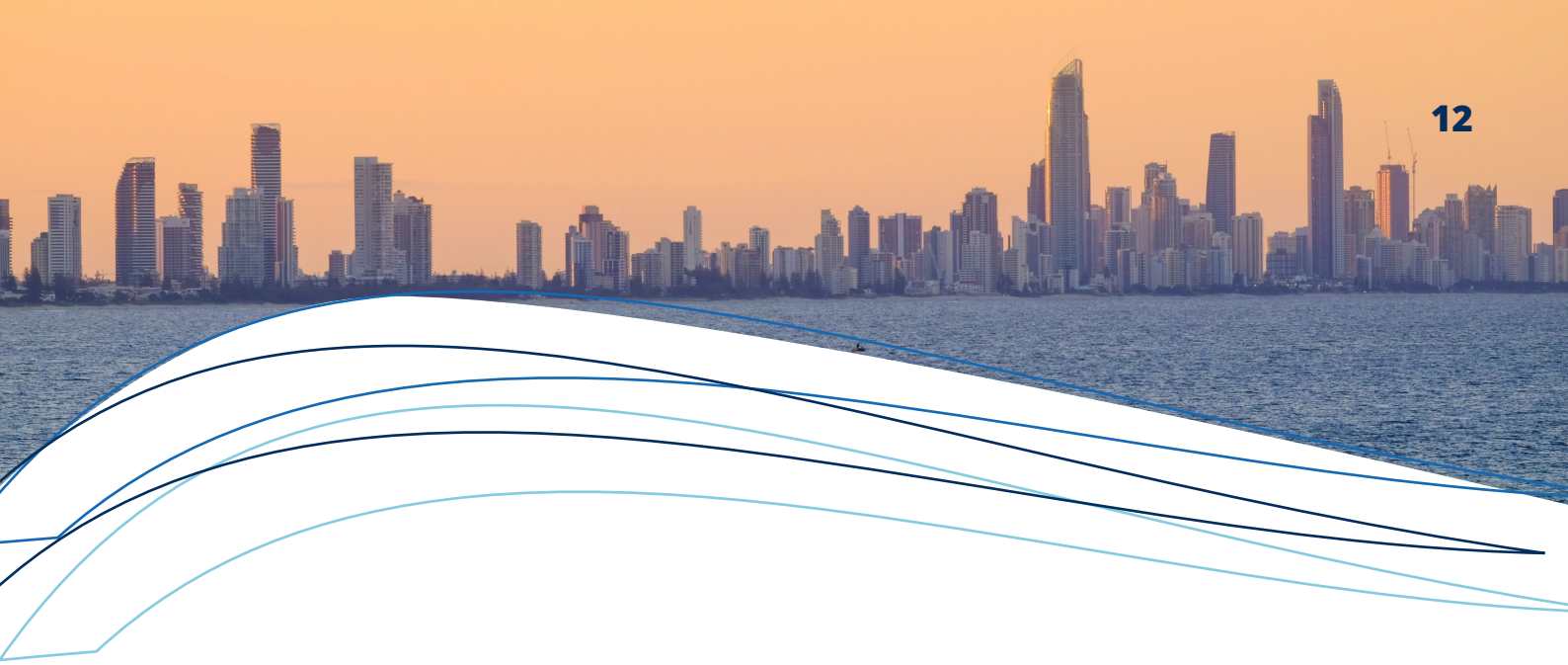
There are a number of adaptation options available. Private sector financing may be best leveraged to fill the gaps where there is a current lack of funding available.

"Once we start paying for adaptation, investment in mitigation will seem like very good value."

What kinds of adaptation projects require investment?

Adaptation projects can be categorised as 'soft' and 'hard'. Soft options are generally those which are cheaper, less engineered and generate associated social or environmental benefits. Examples include creating and maintaining urban forests to combat heat waves, education programs to increase adaptive capacity, and planting vegetation on sand dunes to stabilise sediment and prevent erosion. Hard, or engineered solutions are more costly infrastructure based solutions which are required to deal with or mitigate against more extreme effects or impacts. These may include:

- ***Construction of new hard structures*** such as seawalls to protect coastal or flood affected areas from inundation due to sea level rise or localised flooding; dams or replacing gravel roads that are washed away during heavy rain or floods with concrete structures
- ***Upgrading existing hard structures and technologies*** including infrastructure, such as replacing or widening stormwater pits, pipework or runoff systems to improve drainage and eliminate localised flooding, adopting higher standards for new and existing high-rise buildings to withstand extreme winds, implementing built surfaces that reflect heat which also decrease operational costs and improve energy efficiency; improved permeability of landscaped areas and sun shading.
- ***Developing and implementing broad management schemes*** to protect coasts and beaches that involve a combination of building revetments or groynes, placing sandbags on beaches, constructing sand pumps.
- ***Upgrade existing transmission and distribution infrastructure*** to withstand extreme storm events and heat stress caused by increased numbers of days above 35°C including grid energy storage systems to improve network capacity.



3 ADAPTATION FINANCE IN AUSTRALIA

The state of adaptation finance and investment in Australia, in many ways mirrors global activity. While efforts have been made to quantify potential costs, little to no work has been undertaken focused on quantifying the resulting size of required investment to respond to the effects of climate change.

Investor activity to date has been predominantly focused on risk identification and reduction, whether at the asset level or at the portfolio level. Climate related investment that is moving is principally focused on emissions reduction activities, where the finance sector has spent a number of years developing the frameworks, structures and solutions to overcome barriers to investment. Investors have only recently begun to review adaptation investment requirements.

In many cases, local government authorities have also undertaken substantive planning and risk review, but are only now beginning to translate the outcomes of these activities into investable projects.

Adaptation investment aims to bridge the gap, and drive capital towards better adaptation outcomes.

Calculating the level of adaptation investment required for Australia

To date no comprehensive estimates seem to exist on the cost of climate change impacts in Australia and the likely level of investment required for adaptation measures. This makes cost benefit analysis of climate change adaptation at an aggregated level impossible to quantify.

Some estimates of the cost of natural disasters have been drawn from hazard data and property valuations. These reports highlight that Australia is particularly susceptible to large and frequent natural disasters that adversely impact property and infrastructure and disrupt business and communities, even without the exacerbating effects of a warmer climate and rising sea levels.

The Actuaries Institute (2016) estimated the current cost of natural disasters, including social costs, at approximately $11 billion in 2016.

"Adaptation is bigger than mitigation, both in the size of the asset class and as a societal challenge."

Deloitte Access Economic's 2016 estimate forecast the cost of natural disasters to increase from (a slightly lower) $9.6 billion per annum, to $33 billion per annum by 2050, due to an increase in the number and value of assets, resulting from population growth, infrastructure density and internal migration. Notably, both estimates specifically exclude the impact of climate change.

Also notable is that, of these figures, less than 40% is pre-funded by insurance, highlighting that insurance cannot be relied upon as the key adaptation measure.

Table 1. Breakdown of differing cost estimates of adaptation impacts

	Deloitte Report	Actuaries Institute
Privately insured	$2.3bn	$3.7bn
Direct and indirect tangible costs	$2.5bn	$2.5bn
Intangible costs	$4.8bn	$4.8bn
Total	$9.6bn	$11bn

Adapted from Actuaries Institute (2016) and Deloitte Access Economics (2016)

These costs are forecast to rise over time, particularly as the impacts of climate change are increasingly felt.

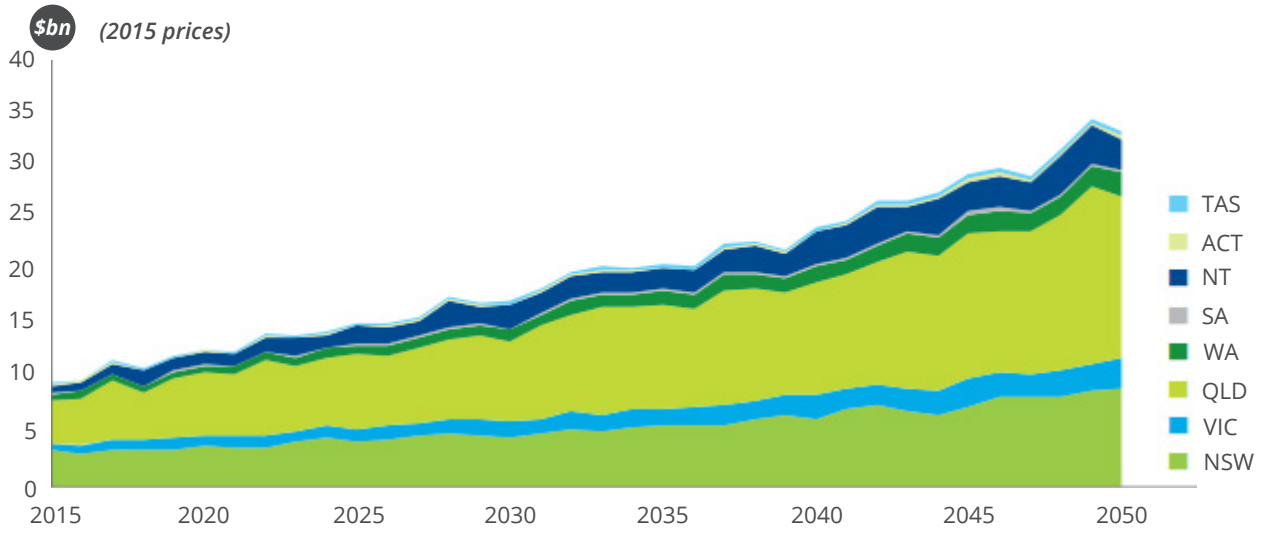


Figure 5. 2015 - 2050 forecast of the total economic cost of natural disasters, for each state

Source: Deloitte Access Economics (2016)

Around 11% of the economic costs of natural disasters are borne by the State and Federal Governments collectively. Each year the Federal Government spends an estimated $560 million on post-disaster relief and recovery, compared to the $50 million a year invested in pre-disaster resilience measures: a ratio of more than 10 to 1. Without investment in resilience, post-disaster recovery costs are expected to increase to $2.3 billion a year, by 2050 (Deloitte Access Economics, 2013).

Deloitte Access Economics (2013) calculated that carefully targeted programs of resilience spending in the order of $250 million per year could see Australian and State Government spending reduce by more than 50% by 2050.

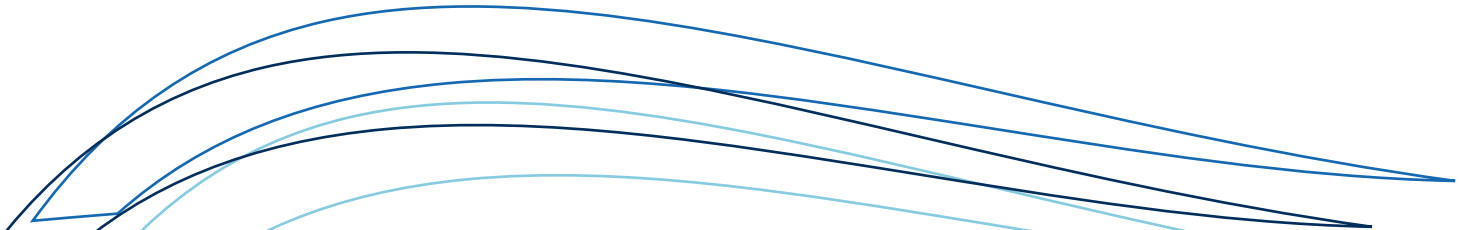
Table 2 provides a summary of the key areas of adaptation that currently exist in Australia to improve pre-disaster resilience.

"Disaster risk and climate risk are now treated as a continuous spectrum."

Adaptation area		Effectiveness	Cost	Current Usage	Key gaps
Land planning	Zoning of new development	Most effective adaptation option for new properties	Direct costs are very low but indirect costs can be very high, e.g. economic growth opportunity cost of disallowing development of multi-story residential building	Majority of councils incorporate natural perils risk in their zoning process	New developments are still allowed to be constructed in high risk areas. Lack of clear and simple rules exposes councils to legal risk and creates inconsistency between councils
	Relocating properties	Most effective adaptation option for existing properties	Costs are very high, driven largely by the price of land	Not widely used due to high costs involved. Only used for very high risk properties	No funding available
Building standards		Very effective adaptation option for new properties	Costs can be high, not all improvements will have a favourable benefit-cost ratio	Australia-wide building standards are more stringent in areas exposed to natural perils	Building standards focus on health and safety whilst minimising property damage is not an objective
Retrofitting existing properties		Can be very effective for existing properties	Costs are relatively high. Generally more expensive than cost of building new houses to the same standard	Not widely used due to high upfront costs and lack of government grants or incentives	No funding available
Infrastructure to reduce frequency and severity of individual natural perils		Effective for localised perils (flood, bushfire and storm surge). Not effective for other perils such as cyclone and eathquake. Effectiveness is often compromised due to conflicting priorities (e.g. dams being used for both water supply and flood adaptation) and poor maintenance over time	Cost are high. Key costs are construction costs and regular maintenance costs	Some infrastructure such as flood levels and seawalls are used extensively. Other infrastructure such as underground power lines are less common	No funding available
All adaptation areas					Lack of government adaptation funding. Framework to prioritise adaptation projects and funding can be strengthened

Table 2. Options to increase natural disaster resilience in Australia

Source: Actuaries Institute's Natural Disaster Working Group (2016)



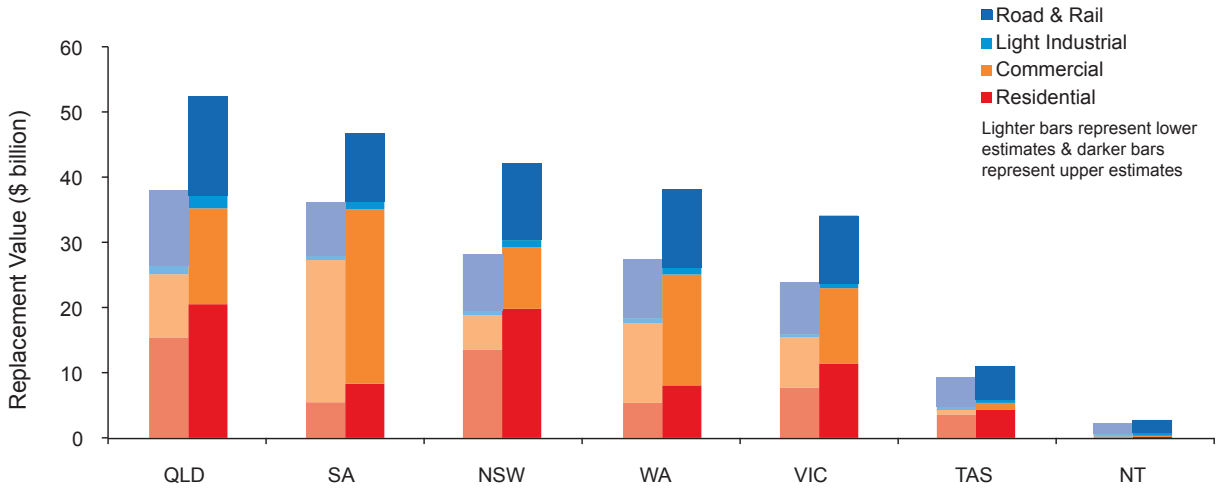


Figure 6. The estimated replacement value ($ billion in 2008) for residential, commercial and transport infrastructure for a 1.1 metre sea level rise

Source: Commonwealth of Australia (2011)

Another measure to quantify the cost of climate change is to assess the value of assets at risk from climate change. The last national assessment to examine the replacement cost of coastal buildings and infrastructure at risk from climate change found that the cost of related impacts is expected to reach $226 billion in total, under a 1.1 m sea level rise scenario (Figure 6). However, these estimates do not cover other coastal assets such as non-land-based infrastructure, social infrastructure or natural systems (Commonwealth of Australia 2011).

Local government-owned public assets at risk from climate change have been valued at $212 billion, identifying roads as the majority of assets under threat (Balston et al 2013).

While the figures presented only provide an indicative value of assets at risk from climate change, or the costs of inaction, they do provide the starting point for thinking and estimating overall adaptation costs and potential investment needs.

At a project level, local governments are moving to assess and calculate the sum of adaptation investment required. For example, Queensland's Coastal Hazard Adaptation Program, known as QCoast-2100, provides financial and technical support for coastal councils to identify and define coastal hazards, assess risks, define a strategy and propose projects that will protect vulnerable coastal assets (LGAQ 2017). Over 40 councils are eligible to take part in the program, which should include the identification and evaluation of a number of adaptation projects. Economic assessment, environmental considerations and community engagement are all integral components of newly developed Coastal Hazard Adaptation Strategies.

Many councils have already developed some form of 'adaptation plans' or 'coastal hazard strategies' that can be important precursors for feasibility studies for seeking finance for specific adaptation projects. Across Australia, some jurisdictions have more advanced capabilities in planning for adaptation and have already collected extensive information on the risks that climate change poses, assessed available options, and conducted economic evaluation.

Three examples are presented here, all operating at different scales to illustrate the nature of adaptation projects and investment potential for the finance community.

Image: A visualisation of the possible future 'greening' of Melbourne.

The Melbourne Urban Forest Strategy

Investment needs: $250 million - $500 million

While the concept of urban forests is not new, recognising trees, and vegetation more broadly, as assets that can deliver environmental, social and economic benefits and needing effective management, is a relatively new idea. The Resilient Melbourne strategy is an initiative across Melbourne's 32 councils. It looks to take to scale work done by the single municipality of the City Of Melbourne. Although it makes up less than half a percent of the total metropolitan land mass, nonetheless, City Of Melbourne's urban forest includes 70,000 council-owned trees, 20 000 trees on private land, and other forms of vegetation, including the soil and water that support them, in the city's municipality. As a green infrastructure asset City Of Melbourne's urban forest has a current value estimated at $650 million. One of the important functions of the urban forest is to provide shading and cooling, to help combat the challenges of climate change and the urban heat island effect. The city of Melbourne can be up to 7 °C hotter than outlying areas. Increasing tree canopy throughout the city could reduce the urban heat island effect by 4-6°C and improve thermal comfort at street level for pedestrians. Increased water sensitive urban design can also help manage inundation and provide soil moisture for vegetation.

This asset is currently at risk, as 27% of the current tree population could be lost in the next decade and 44% in the next 20 years. In response, the City of Melbourne developed the Urban Forest Strategy setting specific targets, such as increasing the city's canopy cover to 40% by 2020, increasing diversity of tree species, improving the health of tree stock, increasing permeable surfaces to allow rainwater to reach roots, linking with biodiversity strategies, and enhancing community awareness for the strategy.

Investment is currently being explored to access land, and a range of necessary inputs, such as water management assets, vegetation stock including trees as well as other plants. Possible options may include:

i) setting up a metropolitan-wide scheme where revenues could be directed from a range of sectors (e.g. via levies) to support the development of the urban forest;

ii) a type of special purpose vehicle (e.g. a trust) that investors would directly engage with, in which case returns would be tightly connected with delivery of the Urban Forest itself.

Source: City of Melbourne (2012) and Resilent Melbourne (2016)

Image: Townsville marina, showing the proximity of buildings to the coastline and views of Castle Hill

At the city level: Protecting areas at risk within Townsville

Investment needs: $217 million

Townsville's Coastal Hazard Adaptation Strategy (CHAS) was a pilot project that involved a comprehensive study to identify which areas of Townsville were exposed to risk from climate change, and propose and assess potential adaptation options to 2100. A wide range of adaptation options were considered, including the construction of sea levees, and storm tide gates, as well as house raising and planned retreat (these are often referred to as 'defend', 'retreat' and 'accommodate' scenarios).

The assessment revealed that it was economically viable (i.e. positive project NPV) to protect several areas of Townsville under threat by implementing 'defend' options, such as beach nourishment, dune construction, dykes and storm tide barriers, as well as maintaining the existing use or intensifying development on the land, for a total cost of $217 million, with an implementation date of 2027. This includes the inner suburbs (at a cost of $190 million), some of the northern suburbs, areas along the Ross River and on Magnetic Island (at a cost of $27 million). At an additional cost of $183 million, it was deemed economically viable to implement adaptation options for another 17 districts, which would include largely 'retreat' options (relocation through land swaps, land purchase or rezoning) but also some 'defend' and 'accommodate' measures (such as construction of coastal protection works like seawalls to reduce erosion and property raising to improve flood resilience from storm tide), to be implemented between approximately 2027 - 2080.

The report is a valuable resource that provides detailed information that can be used to pilot the development of city-scale investments to protect Australian cities exposed to coastal hazards.

Source: GHD (2012).

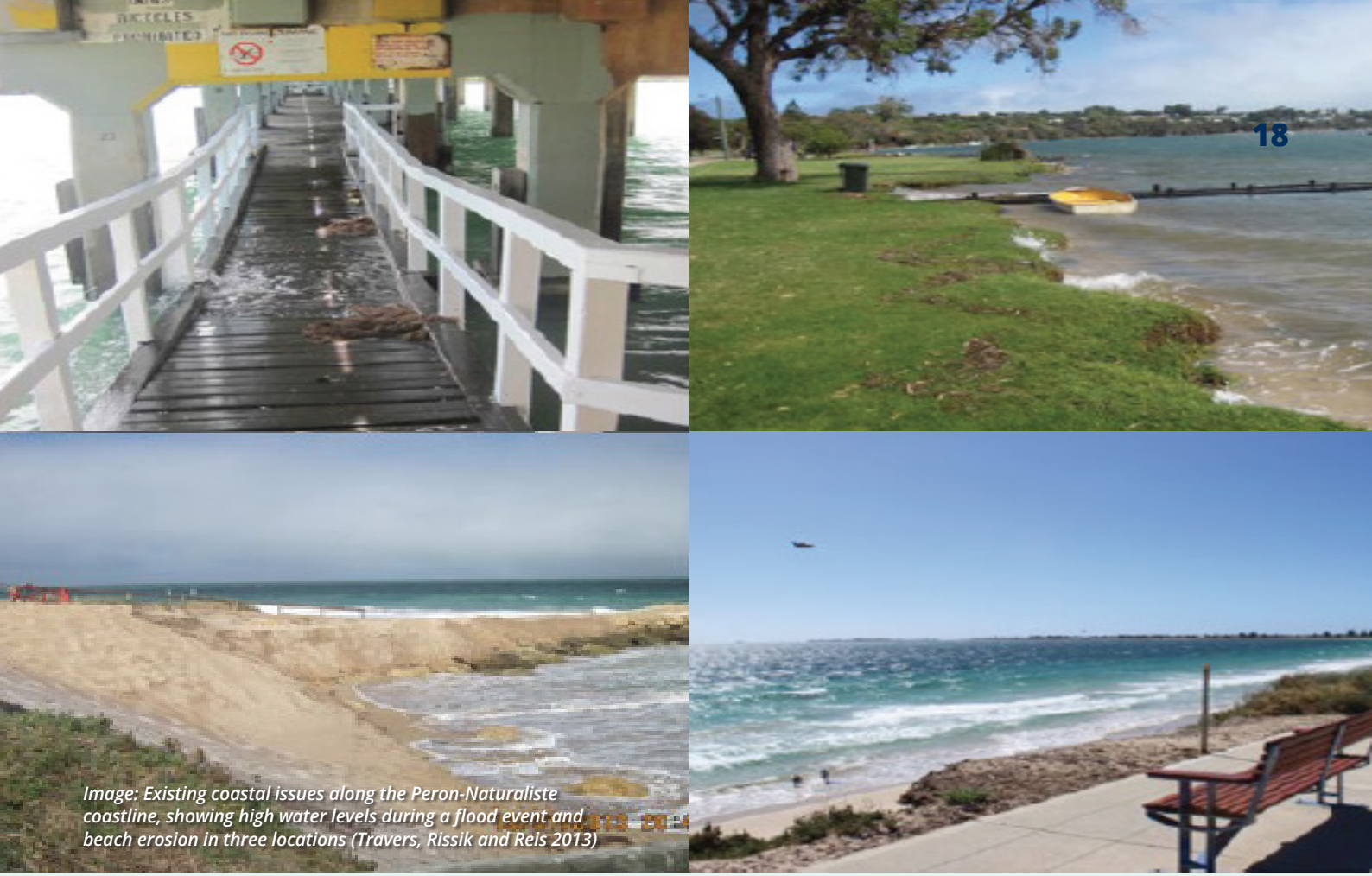


Image: Existing coastal issues along the Peron-Naturaliste coastline, showing high water levels during a flood event and beach erosion in three locations (Travers, Rissik and Reis 2013)

Coastal adaptation on a regional scale: the Peron-Naturaliste coast

Investment needs: $120 million

The Peron-Naturaliste Partnership (PNP) is an incorporated collective of nine local governments (Bunbury, Busselton, Capel, Dardanup, Harvey, Mandurah, Murray, Rockingham, Waroona) in the southwest of Western Australia.

The PNP completed an economic-based regional analysis of adaptation options to determine what coastal assets are under threat from climate change and evaluate different options from a feasibility perspective. The project revealed that erosion presented a greater threat than flooding to 2100. A 200m strip along the 213km coastline is at risk from erosion, as well as 800 ha of residential land at risk from flooding. This amounted to $1.2 billion worth of assets at risk from climate change. The economic analysis by ACIL Tasman showed that with a $120 million investment, a large proportion (about $1.1 billion) of assets could be protected.

The investment needs identified would primarily fund engineering options that include physical structures, such as seawalls (at a cost of approximately $2500 per linear meter on average), a raised road or a drainage culvert. Coastal protection through planning controls and market interventions via land acquisition were deemed incapable of stopping coastal erosion.

The PNP has not identified options to fund coastal protection yet and is currently open to starting a dialogue about investment options with the private and public sectors. Some potential schemes may include investment through green bonds, if aggregation is possible, or investing in smaller projects where sufficient scale of return on investment can be identified.

Source: Peron-Naturaliste Partnership (2017).

The current state of adaptation finance in Australia

Adaptation finance is not currently part of the mainstream investment market in Australia and is difficult to quantify on an aggregated basis.

The majority of climate change investment is focussed on mitigation projects, which seek to reduce carbon emissions, rather than protect against climate change impacts. These investments have a clear funding advantage over adaptation projects because demonstrating the environmental benefit is relatively simple - carbon emissions are a widely accepted unit of measurement and clear methodologies exist for defining emissions saved. A comparable benefit or unit of measurement for adaptation outcomes has not yet been identified, and frequently the benefits from investment in adaptation only become apparent over long time periods.

Adaptation actions are being included and funded in larger infrastructure developments such as airports, (Brisbane Airport), highways (new Pacific Highway development) and some large buildings (Barangaroo South). But outside of these large corporate assets, adaptation is patchy or opaque.

In many cases adaptation is embedded into project design and engineering (this is particularly the case for transport infrastructure). However the fact that the adaptation component is often not able to be separated, or treated as an add-on feature, hinders the ability to pinpoint the exact flow of funds to adaptation, particularly from private sources.

The lack of a single coherent framework for calculating the cost of climate change in Australia and the level of investment required, the inability of many local governments or project developers to measure and pursue consistent adaptation performance outcomes and the complex and fragmented approach to developing adaptation planning are all inhibiting investment in greater resilience and adaptation outcomes across the Australian economy.

Despite the challenges, there are several large-scale and iconic developments that have incorporated adaptation features into their design. These cases demonstrate that progress is being made and that adaptation risk is being embedded and considered.

Lendlease's Barangaroo South (Sydney) involved the development of a Climate Change Adaptation and Community Resilience Plan, complete with a risk assessment that informed the building design and construction to ensure major risks were avoided (Lendlease 2016).

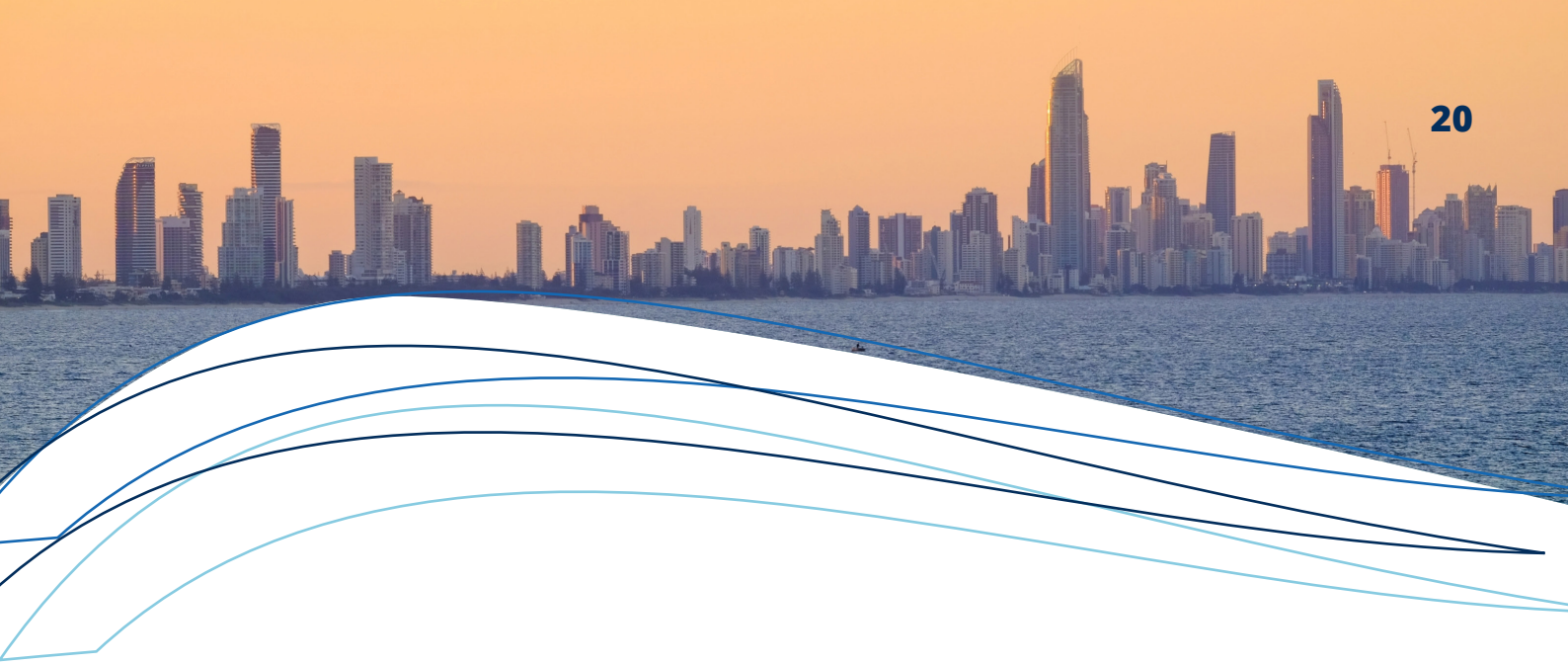
The construction of the parallel runway at Brisbane Airport also anticipated future climatic impacts, resulting in the decision to elevate the runway by an additional 40 cm (Rissik and Reis 2013). These case studies were highlighted in IGCC's *Investing through an adaptation lens* report.

Risk assessment for coastal adaptation

CoastAdapt

CoastAdapt is one resource to support users in coastal Australia to know more about the impacts of climate change, to determine the risks faced by their organisations and stakeholders, and to plan for and take practical actions to adapt to these risks.

CoastAdapt provides information, access to relevant national data, and detailed guidance on adaptation planning and implementation, including tools to support risk assessments and case studies in Australia and abroad. CoastAdapt was delivered by the National Climate Change Adaptation Research Facility (NCCARF) with funding from the Australian Government.



4 PATH TO MARKET: SHIFTING INVESTMENT INTO ADAPTATION

In examining how to drive greater levels of investment into adaptation outcomes across Australia, it quickly became apparent that there are many lessons which can be learnt, and applied, from experience with mitigation projects aimed at reducing greenhouse gas emissions.

At the same time, there are clearly unique and distinct challenges associated with adaptation which need to be addressed. These include differences of scope, scale, and outcome, along with a whole new set of project partners.

Over the course of 2016, IGCC convened a broad cross section of policy, environment and finance experts to work through real life examples of success and failure, to better understand the barriers to finance and what practical solutions can be identified to drive capital into adaptation.

From this process a set of core recommendations emerged, aimed at unlocking the path to market for investment into adaptation.

Matching adaptation projects to finance

Many local governments have already laid down the foundations for meaningful engagement and partnership with the finance community by completing comprehensive adaptation plans or strategies that map climate-related risks to assets and set priorities for action.

While many of the current project examples involve adaptation finance by the private sector, we see significant opportunities for investment into public adaptation options as well. However, attracting private sector adaptation poses a number of challenges.

"It is essential to get the risk and return profile right to attract private sector investment. "

A study commissioned by the National Climate Change Adaptation Research Facility (NCCARF) identified eleven features of adaptation projects that are important for investors because they can impact the finance and/or funding options available to realise adaptation.

Table 3. Features of adaptation initiatives that impact finance/funding options

Feature	Spectrum		
Size/capital requirement	Small (<$25 million)	Medium ($25-$50 million)	Large ($50+ million)
Lifespan of project/ initiative	Short-term (now to 2030)	Medium-term (2030-2070)	Long-term (beyond 2070)
Physicality	Soft measure/initiative (e.g. plan, community capacity building, etc.)	Scheme (e.g. partnership)	Engineered structure
Discreteness	Part of new structure	Upgrading existing structure	New stand-alone investment
Ownership	Local government	Public-private-partnership	Private
Scalability	Not scalable	Scalable to some extent	Scalable to a large extent
Beneficiaries	Single/few company/ individuals	Some (countable)	Many/wider community
Financial return	Unable to generate	Able to generate, unable to distinguish/quantify	Calculable and demonstrable
Return on investment timescale	Short-term (<2 years)	Medium-term (2-7 years)	Long-term (7+ years)
Risk reduction	Difficult to demonstrate risk reduction	Small-scale risk reduction compared to overall project/business	Demonstrated ability to reduce substantial risk
Insurability	Uninsurable	Partly insurable	Insurable

Source: Banhalmi-Zakar et al (2016)

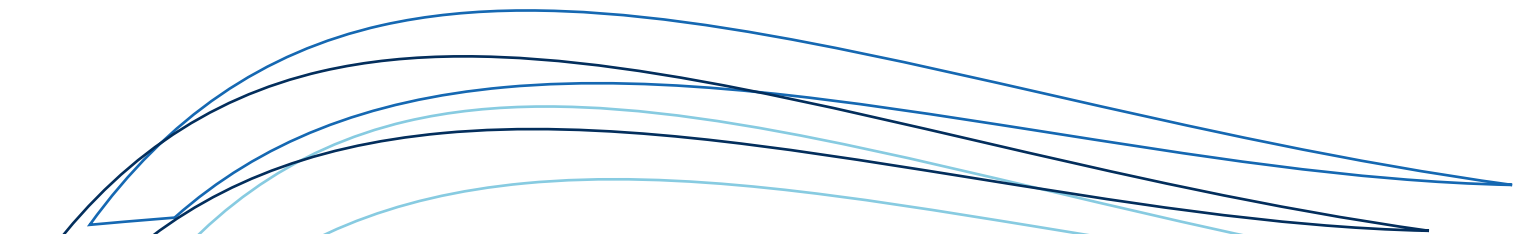
There are various innovative finance mechanisms or traditional schemes than could be transformed to fund adaptation, at various scales. Mechanisms that operate at a scale that would be relevant for the investor community are described in Table 4.

Table 4. Potential mechanisms for adaptation finance

Type of finance mechanism	General description	Examples	Features	Limitations	Applicability
Bonds: Specifically green bonds, climate bonds, social impact bonds, resilience bonds*, municipal bonds**	Used to fund groups of projects that satisfy criteria demonstrating 'green credentials' or social impact	ANZ Green Bond, NAB Climate Bond, World Bank Kangaroo Green Bond, also municipal bonds (USA)	Must be as economically viable as standard ('vanilla') bonds, with environmental benefit as added bonus	Requires standards that can be applied to show that projects meet environmental criteria, there are no standards for adaptation	All institutional investors, including super funds, fund managers, insurance companies, corporate investors, REITs, with major banks acting as arrangers
Project finance	Lending that funds large-scale complex projects, including public-private partnerships	Very common form of finance for infrastructure projects, particularly in the energy sector	A type of finance where the future cash-flow will be used as repayments, involves creation of a 'special purpose vehicle' for the project	Only suitable for large projects that can generate substantial revenue to repay the loan	Major banks and other financial institutions with good track records in PPPs
Impact investing, social impact investing	New form of finance that targets preventative programs that address social challenges and which can create future cost savings	Various companies exist in Australia, including Social Outcomes, Social Ventures Australia	Works with NGO and government sector to define strong evidence-base and often requires a case-by-case approach to structure the investment	Often involves non-traditional techniques, can be time consuming to create evidence-base	All institutional investors, albeit usually those with a social mandate

**Resilience bonds are purely conceptual at this stage (for more information see Leveraging Catastrophe Bonds: As a Mechanism for Resilient Infrastructure Project Finance).*

***Municipal bonds do not exist in Australia, but have been used in the USA to fund various infrastructure projects, including those targeting resilience.*

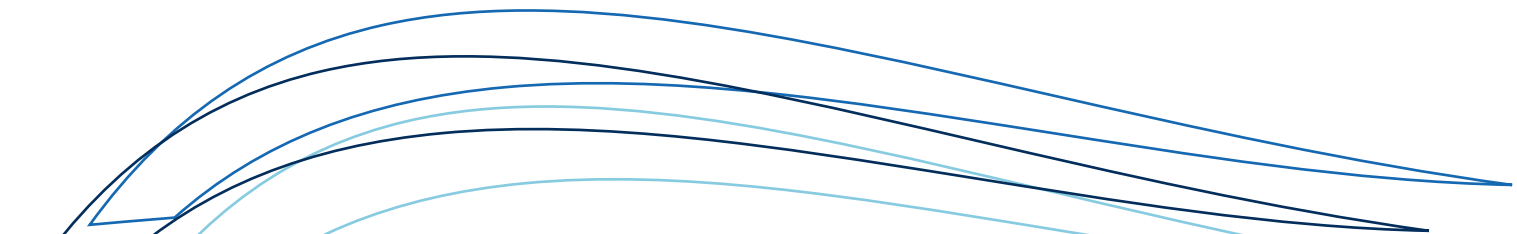


Type of finance mechanism	General description	Examples	Features	Limitations	Applicability
Corporate finance (balance-sheet based)	Lending for existing companies for upgrades or building a new project at another site	Offered by most banks and the prime mechanism local governments currently use to borrow from Treasuries	New project is added onto the company's existing 'books', allows channelling of funds within a company, would allow local governments to use revenues (rates, user-charges, etc.) to repay loan	Not a particularly desirable form of finance as it is difficult for financiers to track exactly where funds flow	Lenders with PPP experience, mostly banks
Environmental Upgrade Agreements	Funds energy efficiency upgrades of existing commercial buildings and the installation of renewables which is repaid by the building owner through the Council rates mechanism. Can conceptually be applied to adaptation measures	Used as the funding mechanism by Frasers for the Central Park Trigeneration Plant. Large range of office upgrades have been financed and the pipeline includes works to industrial and retail premises	State Government program which facilitates private sector financiers working with building owners and Local Government. The only mechanism that allows building owners to utilise the energy, water and waste savings from their tenants to repay the finance	Currently only legislated in New South Wales, Victoria and South Australia	Financiers and investors active in the real estate sector, including the Clean Energy Finance Corporation (CEFC), fund managers, REITs (note that currently restricted to commercial buildings)
Energy-efficient loan schemes (bonuses)	Smaller scale equipment-finance type scheme that provides reduced interest on loan for specific energy efficiency projects	NAB's Energy Efficient Bonus, Commonwealth Bank's Energy Efficient Loans	Relies on industry and government standards (for pre-approval or eligibility) and support (co-financing) from the CEFC	Pre-approval is based on existing standards, which currently do not exist for adaptation	Lenders that are able to manage several small scale loans efficiently (i.e. usually those involved in corporate finance)

Type of finance mechanism	General description	Examples	Features	Limitations	Applicability
Yieldcos	Publicly traded, yield-based investment vehicles that own operating assets with predictable cash flows	Similar to REITs and master limited partnerships (in US)	Allows separation of predictable cash-flow generating operations from more volatile operational issues and can offset the risks associated with regulatory uncertainty	No long-term financial track record for instrument and has not been applied to adaptation	Suitable for any institutional investor with a desire for innovation. Can seek to apply this structure to adaptation
Asset contingent loan	Commercial loan, capped at the market price of a home not at risk from coastal inundation, backed by government as guarantor	None, but resembles income-contingent loans (e.g. HECS)	Purchase of a new or eligible homes for owners of homes at risk of inundation but without the means to buy a new home, government could sell the property upon the owners death or retain the net benefit from the sale of the property if the owner sells	Only conceptual in nature	Lenders involved in mortgage lending, REITs

Source: Adapted from Banhalmi-Zakar et al (2016)

Microfinance and *crowdfunding* were also identified as other mechanisms that could potentially be used to fund adaptation measures at a smaller scale, however they are not discussed in detail here as they are not generally applicable to institutional investors.



Barriers to investing in adaptation

During the course of the past 18 months, IGCC has been focussed on identifying a short list of practical recommendations for mobilising investor capital into adaptation projects.

This culminated in a workshop in September 2016, where members of the investment community, representatives from all levels of government, NGOs, industry stakeholders and academia considered the issue of private sector investment in adaptation. From this a list of core barriers to increasing investment into adaptation was identified.

Barriers to investing in adaptation

Investors identified the following gaps as major barriers to adaptation investment, including lack of:

- A clearly defined project scope where the adaptation component is made explicit
- A credible project proponent or counterparty
- A revenue stream and commercial investment return
- Adequate project scale
- An accepted framework for allocating financial benefit (value add)
- Effective coordination across different levels of government.

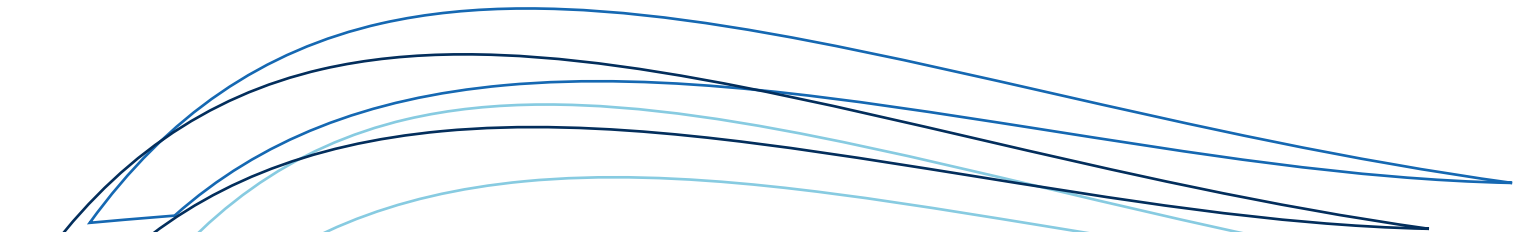
Clearly defining the project scope and making the adaptation component explicit: The project details and the financing needs of climate change adaptation projects are generally not clearly articulated. Project proponents (whether representing the private sector, local, state governments or regional partnerships) need to make adaptation needs and specific activities more transparent to potential funders. Adaptation encompasses new and potentially different types of projects from what investors may have funded in the past.

The finance sector has relatively little experience in identifying and targeting adaptation activities, so it will be important to partner with a body that has experience dealing with adaptation projects and the established networks and relationships needed to connect with adaptation projects.

A credible project proponent or counterparty: Adaptation finance is sought by both public and private actors. Private sector proponents would typically include infrastructure developers who are familiar to investors active in infrastructure finance. Public sector proponents would include local and state governments or 'special purpose vehicles' such as a trust created specifically to undertake the adaptation project.

Adaptation projects generally occur at the regional or local government level but very few local government representatives understand investment requirements or have experience dealing with the finance or investment sectors. Overcoming governance and project finance skills gaps at the local government level is likely to be a significant barrier and needs attention.

A revenue stream and commercial investment return: Finding a revenue stream and commercial level of return is an absolute prerequisite for any type of private investment, including adaptation projects. For a large number of adaptation projects (for example sea walls protecting coastlines) it can be difficult to find a revenue stream or provide a commercial level of return. For institutional investors, adaptation projects that cannot clearly guarantee a commercial return will not be attractive investments. Debt finance or infrastructure (adaptation) bonds can support a much wider range of activities and is more likely to be an option compared to equity in a number of circumstances.



Adequate project scale: Investment for adaptation can only be leveraged if the project or initiative is of sufficient scale. Investors undertake due diligence assessment over all prospective investments which is a costly exercise. Due to the costs associated with due diligence, projects under $20-25 million are difficult to justify (Banhalmi-Zakar et al 2016). At the moment several large adaptation projects would need to be aggregated or pooled, seeking financing for the pool of projects via a Green Bond issue.

An accepted framework for allocating financial benefit (value add): Often the adaptation benefit or value add (resilience) of the adaptation project is difficult to quantify in financial terms. There is no accepted measurement framework used to price or put an asset value on the project or adaptation feature. Without an accepted methodology, it will remain difficult to attract private investment finance. For example, investment into renewable energy via a Green Bond requires a demonstration of savings in carbon emissions by avoiding the use of traditional fossil fuel power sources. This can be quantified as avoided emissions. However, to date, there are no agreed ways to demonstrate when a city, infrastructure or coast has successfully adapted to climate change (Banhalmi-Zakar and Rissik 2016).

Coordination across different levels of government: Well-coordinated action across tiers of government could 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 (Productivity Commission 2013). This lack of coordination and inconsistency of approach, signals uncertainty that will not help assure private investors about the investment potential of adaptation projects.

Potential solutions for increasing investment in adaptation

Adaptation projects will need to be realised at different scales. To meet this challenge, a range of finance schemes will need to be able to be leveraged for adaptation. While a number of potential finance mechanisms can be identified, each has different areas of application and limitations (Table 4).

IGCC has also undertaken significant consultation across industry aimed at identifying solutions, structures and enablers with the potential to unlock investment. These draw lessons learnt from both finance solutions designed to assist mitigation based finance, as well as other innovative emerging forms of impact investment.

Potential solutions for increasing investment in adaptation

Investors identified the following steps as potential solutions for increasing adaptation investment:

- Adopt blended mitigation and adaptation investment solutions to generate commercial return and adaptation outcomes
- Build on the experience of mitigation finance, particularly through aggregation models to achieve investment scale
- Develop measurement frameworks for adaptation and resilience
- Seek a more coordinated approach to cross-government ownership of adaptation funding and implementation
- Build on lessons learnt from social impact bonds and impact investment in adopting a collaborative approach to project scoping and development.

Adopt blended mitigation and adaptation investment solutions to generate commercial return and adaptation outcomes: This could well be the simplest way to harness opportunities in adaptation finance. By blending adaptation with mitigation finance, it is possible to generate return and reduce risks by increasing resilience. This also suits the way that many adaptation projects work, namely that adaptation (or resilience) features are imbedded into project design and difficult to separate.

Some examples include introducing an adaptation component in green or climate bonds, incorporating building resilience features in Environmental Upgrade Agreements (EUAs) or property/infrastructure development projects (there is evidence that the latter is occurring but adaptation or resilience features are often not singled out).

Build on the experience of mitigation finance to achieve investment scale: While this would be useful for driving adaptation finance forward generally, one specific area would be aggregation. The Clean Energy Finance Corporation (CEFC) has successfully applied pooled approaches to deliver scale for investment. While CEFC's efforts have focused on projects in the energy efficiency and energy distribution space, these approaches can provide important lessons for aggregating prospective adaptation projects. Other areas that also offer lessons are EUAs, which set a precedent for private sector financiers working with building owners and local government.

Develop measurement frameworks for adaptation and resilience: Another vital component to drive investment in adaptation is the need to be able to assure that adaptation projects meet adaptation targets. Robust standards for measuring adaptation and resilience are vital for introducing adaptation into the green and climate bond market.

Impact measurement frameworks in mitigation already exist, in the form of measuring avoided emissions. Many financial organisations already possess sophisticated knowledge of climate change impacts and carbon markets that should be leveraged now for adaptation. This includes but is not limited to reaching out to the Climate Bonds Initiative, the World Bank, and UNEPFI. The TCFD's recommendations on financial disclosure on physical risk should be applied as a starting point.

Seek a more coordinated approach to cross-government ownership of adaptation funding and implementation: Lack of clarity with respect to responsibility for adaptation implementation or funding is not conducive for private sector involvement. One way forward would be to establish a reference/advisory group with representatives from all three levels of government, adaptation experts and the investment/finance community to drive investment in adaptation outcomes. The Australian Government already initiated such dialogue with the private sector to protect the Great Barrier Reef. The Reef Trust's Partnerships for the Reef program seeks to engage a wide range of stakeholders including financial institutions and philanthropic sector to work together in developing joint ventures to protect the Reef (DEE 2017).

Build on lessons learnt from social impact bonds and impact investment in adopting a collaborative approach to project scoping and development: Social impact investment and social impact bonds are rapidly growing instruments. Understanding how they operate through project scoping and development involving collaborative approaches with government agencies can offer valuable insights.

Methodological issues around how project needs arise should also be investigated. For example, social impact investing differentiates between investment that responds to government commissioned services, financing social organisations, and financing social start-ups or incubators (EY 2016).

Public Private Partnership (PPP) for adaptation

There is already some experience with PPPs in Australia that involves local governments. The complexity of most PPPs requires considerable expertise, a high degree of financial literacy, and experience on the part of local governments if it is to maximize the financial benefits from the transaction. Advisors must be appropriately incentivized to ensure their interests align with that of local governments. PPP requires an assessment of whether the public or private sector is best placed to manage construction and subsequent operation and maintenance of the project post completion. Given the difficulty of identifying a bankable income stream from most adaptation projects a Climate Adaptation PPP will often mean that the local government is best placed to capture the project's value from the broad range of project beneficiaries. A PPP can provide for the local government to pay a revenue stream to the private sector financiers after the project is completed, subject to satisfactory operation and/or maintenance of the project. If the council is small or financially stretched, the private sector will need a State Government guarantee. The additional complexity and transaction costs of the PPP model compared to other alternatives means it is warranted only for larger projects, generally above $300 million, which could be reached by aggregating a number of projects to reach this threshold.

Local government "value capture" opportunities

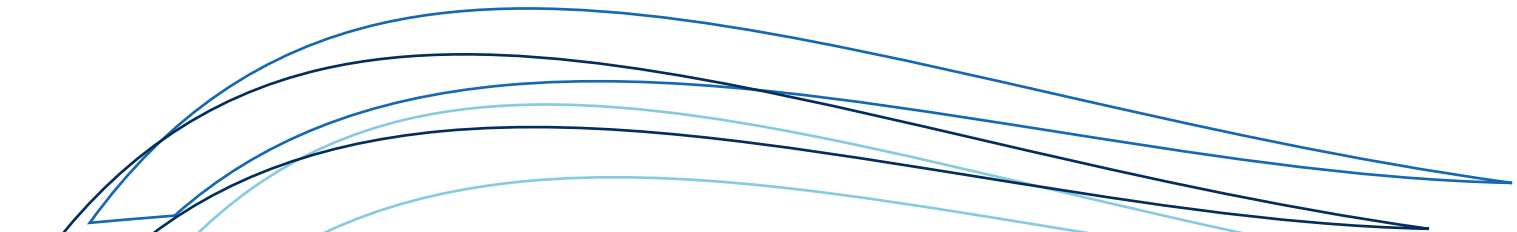
This is vital in generating revenue that involves recouping value that flows to the beneficiaries of the project expenditure. The primary beneficiaries of a sea wall will be the ratepayers on low-lying land whose homes will be protected and the local government could impose a levy on those ratepayers. Given the difficulty of identifying a bankable income stream from most climate adaptation projects a climate adaptation PPP will often mean that the local government is best placed to capture the project's value from the broad range of project beneficiaries.

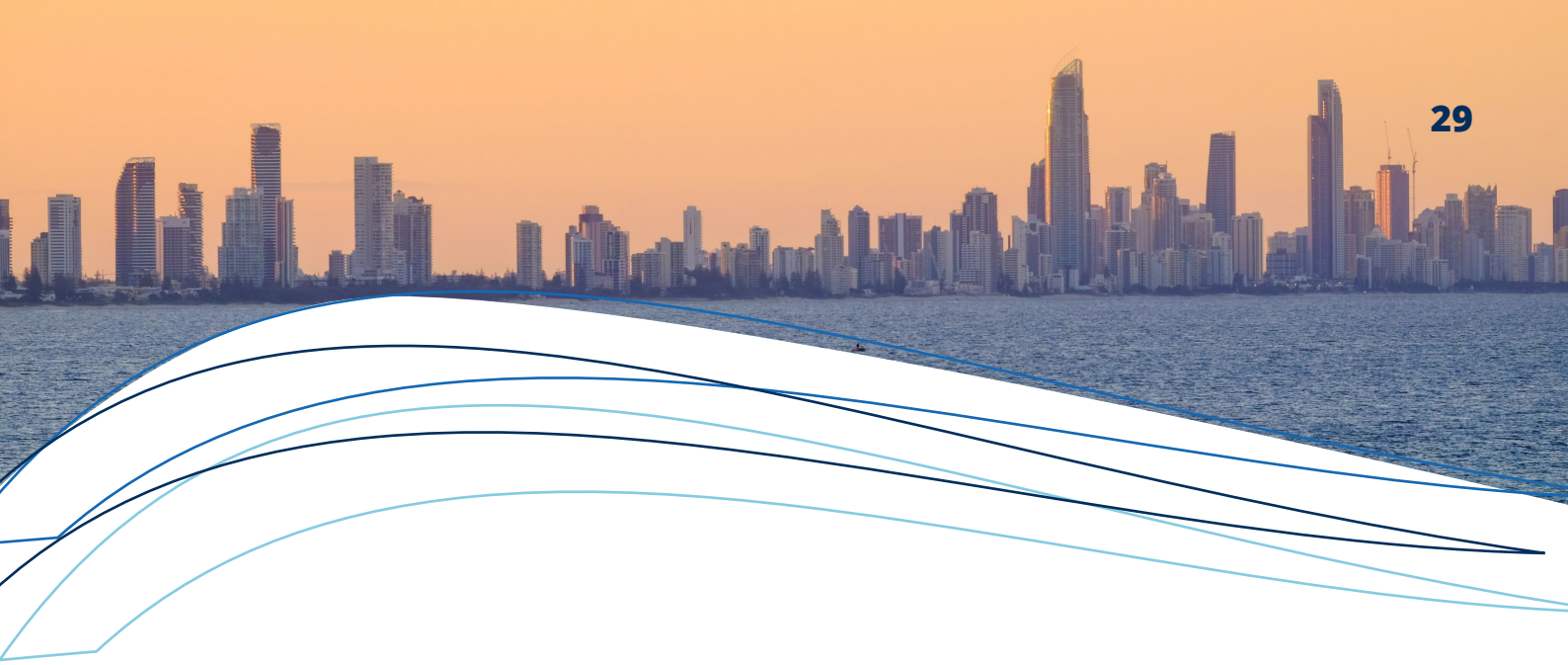
More broadly, it is worth noting that some finance mechanisms are traditionally used to fund specific type of projects. Lending, for example, requires that the borrower has access to a revenue stream that can repay the loan, but it does not necessarily mean that an individual project has to have a revenue stream attached. In the case of adaptation, project lending may be supported by future rate revenues if Councils recover the cost of the project through increasing the rates of businesses and residents in the local government area. Where a direct revenue stream does not underpin all of the cost and interest cost of the works then there would need to be security provided. In the case of a sea wall for example it is highly unlikely that a financier would take security over the asset itself given the highly illiquid nature of the asset and may need to take a charge over assets owned by the Council or indeed the Council itself as a legal entity.

How EUAs could potentially be used for adaptation measures

Eureka-Real Assets' Environmental Upgrade Finance has funded over $40 million worth of environmental upgrades and has further capital to invest. Any improvement to an existing commercial building that improves energy, water or waste efficiency or increases renewable energy is covered under this scheme, including a wide range of adaptation projects. The program allows commercial building owners to access finance to bring forward environmental works that is then repaid via the Council rates mechanism in fixed quarterly charges usually over a ten year period. Because the repayment is via Council rates the building owner is able to recover all or part of the charge from tenants via the outgoings mechanism to the extent that the tenant has received energy, water or waste savings. The tenants cannot be worse-off, as it is the energy savings that repay the finance. To date EUAs have been legislated in New South Wales, Victoria and South Australia.

The funding mechanism and security structure of the EUA via the local council rates mechanism could easily be applied more broadly for adaptation infrastructure with local councils as an issuer of Municipal Adaptation Bonds.





CONCLUSION AND RECOMMENDATIONS

Given that climate change has been such a dominant feature of global debate for over two decades now, it is perhaps surprising that the world is only now turning collective attention to the challenge of adaptation.

Within Australia, where we are highly vulnerable to the effects of climate change and have substantive investment sunk into infrastructure exposed to physical risk, it is only appropriate that we begin working through the practical challenges of increasing investment into adaptation.

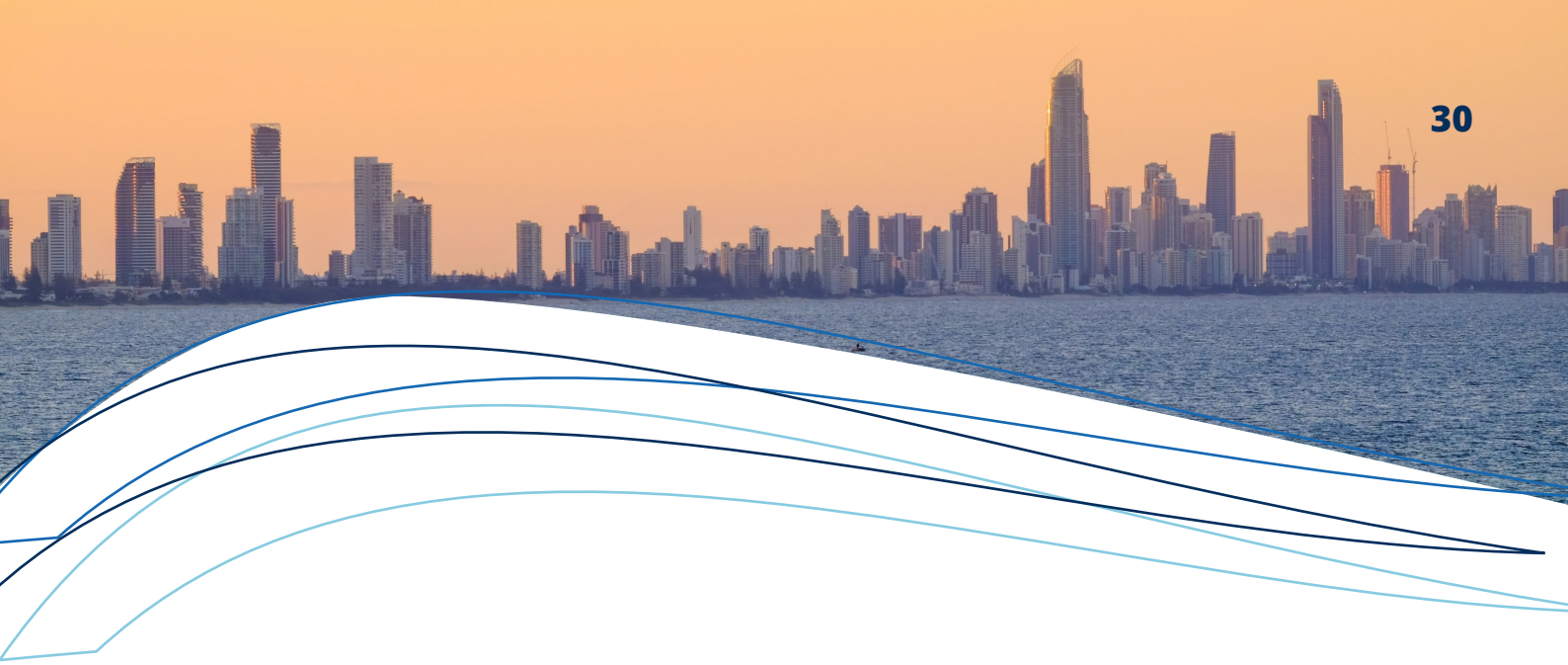
Having undertaken this extensive research and review process, IGCC believes that there are a number of areas where further work can be undertaken to promote greater investment into adaptation.

1. IGCC would encourage all levels of government to collaborate on the development of a framework clearly setting out levels of government coordination and responsibility for adaptation in Australia.
2. Australia needs an up to date national assessment of infrastructure at risk to the effects of climate change and an indicative quantification of the investment required for adaptation.
3. All levels of government should collaborate in the establishment of an expert advisory group to work with the finance sector on promoting adaptation investment across Australia.
4. IGCC will engage with global climate finance bodies on the development of an adaptation and resilience measurement framework.
5. Investors should actively seek opportunities to blend adaptation outcomes into green or climate investment structures, where possible and appropriate.
6. Investors should seek to engage further with public climate finance bodies to identify opportunities to apply mitigation investment structures to adaptation projects.

"Investors need to send clear signals about the kind of information they need to ensure their investments are climate resilient."

This report has sought to set out some of the critical insights that IGCC has derived through industry and government consultation. We aim to continue to develop this work further with policy, science and environment groups, and in partnership with the investment and finance community.

We welcome your feedback on this report.



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