

**The
Climate
Institute**



**Australia's Financial System
and Climate Risk**

Australia's Financial System and Climate Risk

Discussion Paper • July 2015

Contents

Summary	1
Introduction	3
Awareness of climate risk is growing rapidly	5
Where does climate risk occur in financial systems?	7
Implications for the Australian financial system	10
How Australia manages financial system risk	13
Conclusion	14



Acknowledgements

This policy brief was written by Kate Mackenzie. The Institute would like to thank the expert reviewers who commented on early drafts, including Martin Parkinson, Emma Herd, Jack Gray, Shannon Lewis, Karen McWilliams, and Sharanjit Paddam. All viewpoints expressed and any errors are our own.

Summary

Does climate change pose a risk to financial system stability?

Numerous authorities, including governments, regulators, central banks and supra-national bodies have decided that this is a question deserving formal investigation.

In Australia, there has been no official examination of how climate change might affect our financial system. Yet an 0.9°C observed increase in Australian average temperatures since 1910 has already been directly linked to increasingly frequent and intense heatwaves, and is likely linked to changing rainfall patterns observed in recent years.¹

This paper explores where characteristics of Australia's own financial system may intersect with identified risks relating to climate change. It highlights areas where existing financial system safeguards may not address these specific and unique risks.

Drawing on studies and regulatory decisions from overseas and Australia, we set out why climate change deserves careful consideration from authorities charged with maintaining financial system stability.

Key points

This paper covers the following:

Broad categories of climate financial risk (see Box 2 for more detail):

- + Carbon risk, which includes financial exposure to the risk of carbon emissions or carbon-intensive assets being priced, regulated, stranded by technology, or incurring legal risk.
- + Climate impact risk, where assets are damaged or devalued as a result of climate change itself.

How climate risk may originate:

- + Efforts to avoid climate change, including domestic, foreign and international policy measures
- + Shifting demand for carbon-intensive exports
- + Shifting investor appetite for carbon-intensive assets
- + Fiscal risk from unfunded public contingent liabilities arising from the effects of climate change
- + Uninsured or uninsurable assets exposed to increasingly probable catastrophic disasters
- + Individuals and institutions are incentivised to ignore risks

Points of transmission and amplification:

How the effects of climate risk may magnify and spread throughout Australia's financial system. These include:

- + Australian sovereign debt, if affected by factors including macro outlook changes due to our carbon-intensive economy (carbon risk); and fiscal position shifts due to our exposure to climate change itself (climate impact risk)
- + Exposure of Australian banks to carbon-intensive assets via their business loan books (carbon risk)
- + Exposure of Australian banks and parts of the insurance sector to climate impacts via their concentration in residential property & mortgage debt (climate impact and carbon risk)
- + Exposure of large superannuation (pension) asset pools, due to concentration in domestic assets of a carbon-intensive,

climate impact-exposed economy (carbon risk and climate impact risk)

- + Shortage of low-carbon assets potentially leading to over-inflation of such assets

Information barriers and opacity:

- + Scientific climate models are subject to uncertainty; however this is improving.
- + Information is unevenly distributed, with some key financial agents lacking visibility of climate risk which may expose them to loss
- + Both public and private disaster mapping data and modelling is unco-ordinated and difficult to access

Next steps

The paper identifies how new and emerging risks to the financial system are typically addressed; by the Reserve Bank of Australia (RBA) and the Australian Prudential Regulation Authority (APRA), under the auspices of the Council of Financial Regulators (CFR). The paper recommends that Australian financial authorities conduct an in depth review of these risks and factors, in order to understand the nature of climate risk and to determine how to best manage it.

BOX 1: What is financial stability?

While a universal definition of financial stability is elusive, there are some common elements, including a view of the broad financial system rather than a single institution, and the effect of that system on the real economy.²

Financial systems perform a key role in modern economies, facilitating the smooth flow of funds between savers and investors.

A risk to financial stability is a risk that affects more than one financial institutional. It is also distinct from the idea of sectoral “winners and losers” – for example, the decline of coal mining or the rise of mobile telephony.

Historically, regulatory attention has tended to focus on systemically-important individual institutions; however it is increasingly seen as requiring a broader view that considers the interconnectedness of the financial system.³

Broadly accepted characteristics of financial stability risk:

- + Disrupts the smooth flow of funds between savers and investors
- + “Amplification” and “contagion” – single effect is magnified and spread by linkages in the financial system
- + Effects ripples out beyond one institution
- + Poses a threat to the broader economy, due to the key role of the financial system
- + Not limited to a particular financial institution, asset class, or particular sector

The RBA describes financial instability as “a material disruption” to the smooth flow of funds between savers and investors which is normally facilitated by financial institutions and markets. Such instability poses “potentially damaging implications for the real economy”.

“From this perspective, the safeguarding of financial stability can be seen to be a forward-looking task – one that seeks to identify vulnerabilities within the financial system and, where possible, take mitigating action. Some of these vulnerabilities have a macroeconomic dimension, such as changes in the condition of household and corporate sector balance sheets, and developments in credit and asset markets, all of which have the potential to affect the level and distribution of financial risk within the economy. Other vulnerabilities relate to the way in which financial intermediaries and financial market participants price and manage their various risks.”

Reserve Bank of Australia

Introduction

Climate change is already having wide-ranging economic effects, which are expected to become more intense. The exact nature and severity of these effects will be largely determined both by efforts to curb greenhouse gas emissions, and to prepare for changing climate patterns. Unabated emissions⁴ following the recent trajectory will likely have significant and irreversible effects.⁵

Intensive efforts to meet the internationally-agreed goal of avoiding 2°C of warming would likely avoid the worst effects of climate change. However, even in optimal scenarios for avoiding 2°C of warming, great shifts would need to occur in capital allocation that would have uneven effects for different sectors, investors, and individuals.⁶

Despite the challenges⁷ in forecasting exactly how climate change will play out over the coming decades, some market participants are already attempting to factor climate change scenarios into investment decisions.

In turn, there is a growing body of research pointing to possible ways in which financial systems themselves may be vulnerable to climate risk. Many of these are outlined below, with reference to risks that may be particularly relevant to Australia.⁸

BOX 2: What does “climate risk” mean in a financial context?

Climate change poses a number of risks to financial markets and participants. This paper uses the following two broad categories:

Carbon risk

In 2009, 192 countries agreed to keep temperature increases below 2°C. This is a challenging goal as average temperatures have already increased by 0.85°C⁹ and even with ambitious action, 1.5°C is probably already locked into the earth’s atmospheric system¹⁰).

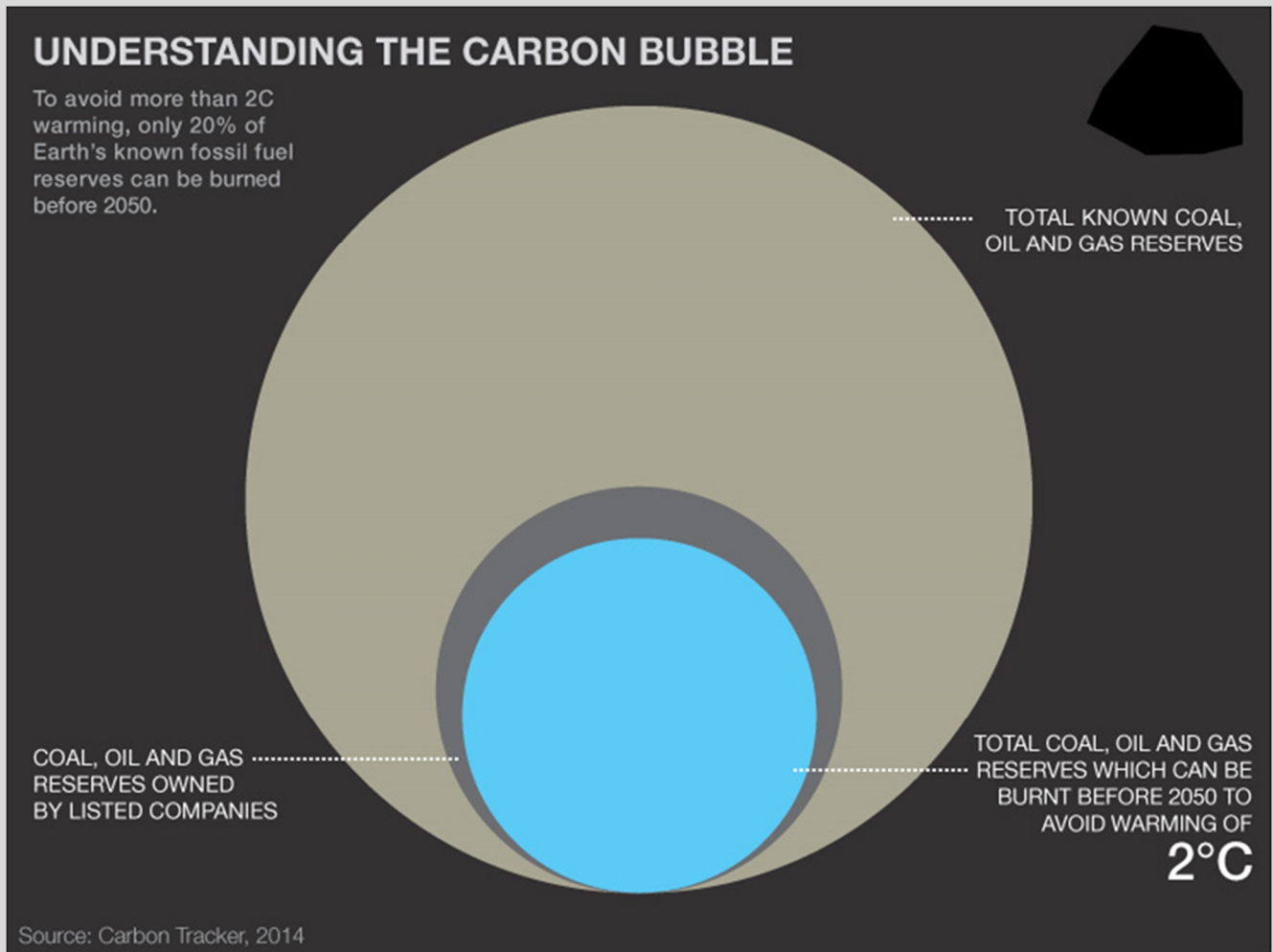
In order to have a good chance of remaining within this range, the majority of fossil fuel reserves currently identified by private, listed, and government entities will need to remain unburned (see diagram below).

The International Energy Agency in 2014 identified that some existing fossil fuel investments, including power generation plants and exploration costs, will need to be retired early or written down to meet this 2°C target. Yet more of these sorts of at-risk investments are still being planned.

Carbon risk goes beyond just fossil fuel reserves and infrastructure. Industries may be more exposed not just due to their own emissions-intensity, but also to their exposure to regulatory risk, technological change and shifts in market sentiment that might arise from climate change.

Climate impact risk

The targets above are derived from work published by the Intergovernmental Panel on Climate Change, which projects that on the current emissions trajectory, average global temperatures will rise up to 2°C by the end of this century.



Australia has been identified as having a high level of vulnerability to the effects of climate change, with average daytime temperatures rising 0.9°C since 1910, and Research published by the CSIRO and the Bureau of Meteorology shows that this figure could reach as much as 5.1°C by 2090.¹¹

From the work conducted by thousands of scientists under the auspices of the IPCC, we know that the impacts of such an increase would be severe and far-reaching.

Awareness of climate risk is growing rapidly

Climate-specific regulatory responses are emerging worldwide

In April 2015, the G20 asked the Financial Stability Board (FSB) to convene a review of how the financial sector “can take account of climate-related issues”.¹² The FSB was formed to monitor and address vulnerabilities in the global financial system, and it comprises key financial authorities including, from Australia, the Treasury and the Reserve Bank.

The G20’s request was made at a time when many national financial regulators around the world were already examining how climate risk affects their mandates, and in some cases are already formulating responses. The most pertinent example for Australia is the Bank of England, which has overall responsibility for financial system stability in the UK. It is considering the ramifications of climate change in its regular financial policy meetings, and is in the process of assessing climate risk for the insurance sector.¹³ Other examples of national climate-related actions by financial regulators and central banks, from countries including the Eurozone, Brazil, India, Bangladesh and China, have been chronicled by the United Nations Environment Programme.¹⁴

The nature of climate regulatory risk is changing

Discussion of regulatory risk related to climate change has usually focused on exposure to a future price on greenhouse gas emissions (GHGs).

A number of large companies include a “shadow” carbon price estimate when evaluating new projects,¹⁵ however the methods used to estimate the price are neither uniform nor transparent, and consideration of this risk is by no means universal. Some companies and market participants likely discount the possibility of a co-ordinated, uniform global price on carbon in the near future, due to

the ponderous nature of climate negotiations and, in Australia particularly, uncertainty over the policy outlook.

This is risky for several reasons. Most obviously, long-term business and investment decisions that discount the possibility of concerted action on climate change may simply prove to be mistaken. Energy companies which make this assumption are making a “major fatal error” in the words of the IEA’s chief economist,¹⁶ yet many of these companies and their investors continue to do so.

Secondly, the focus on the presence or absence of a uniform carbon price or coordinated global action overlooks a recent trend towards other types of national regulations that affect carbon-intensive assets. Such regulations are sometimes introduced with little warning, or are misread by markets. Rules in the US and China aimed at pollution or climate risk have already affected global coal markets, for example;¹⁷ while subsidies that support renewable energy have also affected demand for the most polluting fuels.¹⁸ Meanwhile, significant carbon pricing initiatives are still being introduced at the national and sub-national level, for example in South Korea, Mexico, California and China.¹⁹ As countries consider and then implement their post-2020 emissions reductions goals as part of the Paris negotiations, additional policies will be launched at the national level.

Some investors are already acting on climate risk

Several large and influential investors are incorporating climate change into their core decisions. Some of these are ethical decisions by endowments and charities, and are related to the fossil fuel divestment movement, which is growing at an unprecedented rate.²⁰ However a distinct pattern is emerging of investment managers with long-term horizons or fiduciary duties considering the effects of climate change on their members.

For example, global insurer Axa plans to sell more than \$500bn worth of coal stocks, and in Australia several superannuation funds, such as HESTA and LG Super, are “screening” some fossil fuel investments.

The world’s biggest equities investor, Norway’s Government Pension Fund Global, will widen its fossil fuel screening to include not just producers of thermal coal, but also large consumers such as power generators.

A surge in investor concern about climate risk is evident in the number of announcements and initiatives, such as the Montreal Pledge and the Portfolio Decarbonisation Project, Low Carbon Investment Registry and CERES’ Carbon Asset Risk Initiative. Participating investors in these projects represent trillions of dollars’ worth of assets.²¹

It is important to understand the motivation for this. Although much media coverage has focused on ethical motivations, similar to divestments over Apartheid or tobacco stocks, climate change has far wider-ranging implications for investment.

Clarity over the importance of the 2°C limit and its implications for future fossil fuel consumption have brought the issue into sharp relief for investors, particularly as it has been expressed in the “carbon bubble” theory.

Increasingly, those charged with managing long-term investments see climate change as both a financial and legal risk which they must consciously address in order to fulfil their fiduciary duties.

The knowledge that much of the world’s known fossil fuel reserves cannot be used without triggering dangerous levels of climate change now forms the basis of a credible legal risk for boards and trustees with fiduciary duties. This view has been expressed by a number of legal experts from firms including Freshfields Bruckhaus Deringer,²² the United Nations Environment Programme,²³ Baker & McKenzie,²⁴ and Minter Ellison.²⁵

However, time horizon problems persist

Despite the actions of some investors, the investment sector more broadly remains beset by the problem of “short-termism”, as identified by the UK’s Kay Review²⁶. This problem also applies to asset owners²⁷ and is present in Australia (see, for example, the Centre for International Finance and Regulation’s recent report on this subject²⁸).

Climate risk then becomes a “tragedy of the horizons”, according to Mark Carney Bank of England governor and Financial Stability Board chair²⁹.

Where does climate risk occur in financial systems?

“Here the time frames are much longer but, unlike the financial crisis, we do not have a “climate bailout option” up our sleeves. Interestingly, and despite all the press attention given to climate deniers, our understanding of the scale of the risk is much better developed than our understanding of the financial risks pre-crisis. It is not based on financial models but on several decades of extraordinary research and – here models do come in – trying to understand the consequences of how it may evolve.”

Angel Gurría, OECD Secretary-General, October 9 2013 ³⁰

Climate change can interact with the financial system in a number of ways which could pose a risk to the financial system.

Climate risk has implications for multiple sectors and asset classes

Intuitively, climate risk is particularly relevant to the fossil fuels production and power generation sectors. However the integral role of fossil fuels in today's world mean that the implications of a “carbon-constrained” future go well beyond one particular sector.

This is illustrated by the “Low Carbon Economy” products from FTSE, a leading global financial index provider. The products attempt to capture these changes for investors by categorising eight sectors and 60 sub-sectors of opportunity. Almost all relate to energy, natural resources, and transport.³¹ Such information services are proliferating; albeit with different approaches. MSCI, another leading index provider, now provides a range of fossil fuel-free exclusion indexes, while Bloomberg offers a “Carbon Risk Valuation Tool”.³²

Climate risk is not just a concern for corporate securities. Standard & Poor's, the credit rating agency, has stated that climate risk will affect sovereign debt ratings³³ and has specifically raised this with regard to Australia in its submission to the 2014 Financial System Inquiry.³⁴ Mercer's 2015 climate investing study identifies climate risk across a range of asset classes.

Misaligned incentives

Financial actors who recognise the financial risks relating to climate change may be impeded from acting on this conviction, as discussed by Schoemaker and colleagues.³⁵ The reasons include the “tragedy of the horizons”, as Bank of England governor and FSB chairman Mark Carney described it. Indeed, new international standards on capital levels such as Solvency II tend to place a premium on liquidity that may mitigate against the types of long-term assets indicated by an investment theory that incorporates climate risk.³⁶ Meanwhile, the fundamental climate problem of unpriced externalities means there is a) a “moral hazard” problem, as investors assume they will not incur the costs of greenhouse gas emissions, and b) general constraints on investing according to fundamental analysis when the “herd” is moving in another direction in the short term,

Market participants have limited visibility of carbon risk

Related to the issue of asset values being impacted by climate-related risks is the question of whether market participants can access information to allow an orderly response to climate-related risks. Identifying the carbon exposure of an individual company is challenging, although many companies have attempted to do so, particularly on their own operations, as the 20-year CDP³⁷ initiative demonstrates. However, thoroughly measuring carbon risk exposure is

particularly challenging for financial institutions, particularly in parts of their businesses that don't directly involve physical assets, such as underwriting share issues, arranging syndicated loans and providing services relating to derivatives markets. Some initiatives to address this are emerging from within the financial sector; for example the Montreal Pledge in which investors commit to "carbon footprinting" their portfolios. Australian banks are piloting the development of a carbon-footprinting methodology for financial institutions.³⁸ Again, however, it is not clear whether these initiatives will be sufficiently comprehensive, timely or widely-adopted to facilitate an orderly transition away from carbon-intensive assets.

Market participants have limited visibility of climate impact risk

Advances in climate modelling are also occurring, although financial sector use and deployment of such data appears to vary widely. In Australia, public data on natural disaster risk, including climate risk data, is piecemeal and poorly co-ordinated, with a few notable exceptions, such as NSW's "AdaptNSW" and the CSIRO-Department of Environment's "Climate Change in Australia". Access to more granular data is often obstructed - even to fee-paying companies.³⁹ Members of the insurance and investment sectors have raised concerns over "lack of coverage, accessibility, provenance (supporting credibility), consistency and interpretation of key data sets (e.g. hazard and impact mapping)".⁴⁰

How risks could manifest as a threat to stability

Whether and how climate risks described above could precipitate a threat to financial stability is a complex matter which this paper cannot conclusively address - indeed, its purpose is to point out possible factors deserving of closer examination. Crises are notoriously hard to predict; even the most informed observers failed to appreciate how US housing debt would trigger a crisis in the financial system.⁴¹

Orderly versus disorderly transition

A key determinant of whether these factors result in a crisis is whether the transition to a low-carbon economy is effected in a timely and smooth manner. Such a transition will be complex, and incur significant upfront costs.

The International Energy Agency has made clear that longer the transition is delayed, the higher the upfront costs are likely to be, and the higher the likelihood that it will entail a disorderly market response.⁴²⁻⁴³

The risks of delayed action have been recognised by a broad range of Australian business and civil society groups.⁴⁴ The IEA estimates that about \$300bn worth of fossil fuel production assets will be "stranded" if emissions are sufficiently constrained to limit climate change below 2°C, but by its own reckoning, those estimates are likely very conservative:

"The values for stranded investment assets given here assume a high degree of clarity for investors over the evolution of climate policies and their impact on demand and prices. In practice, however, investors can misread signals from policymakers, receive misleading signals from them, and/or misjudge the way that markets will evolve."

IEA, World Energy Investment Outlook 2014

The risk is that a disorderly transition becomes a "rush for the exit" in which owners of many carbon-intensive assets seek to sell all at once.

History suggests that such a might not precipitate a crisis if it were limited to one sector. However, in a carbon-constrained scenario other sectors would also be affected - likely, those that rely upon fossil fuels, and/or have the least scope for reducing that reliance. This is highlighted by a paper from the Duisenberg School of Finance, which considers whether and how financial supervision should address ecological risk (emphasis ours):

"A sudden transition will be a shock to all sectors using fossil fuels as an input either in the production or in the use of their products and services. There will be strong adjustments between sectors (electricity powered high speed trains versus fossil fuel jet planes) and within sectors (car manufacturers that specialise in electric cars versus heavy car manufacturers). The financial impact will therefore be much greater than the numbers here indicate. So far, however, no research has been undertaken in this field."

Schoenmaker et al., Duisenberg School of Finance ⁴⁵

Schoenmaker and his co-authors also identify several characteristics common to asset classes that pose a risk to financial stability. "Ecology", like housing, is capital-intensive, debt-financed, long-lived and likely accounts for a large share of the economy (see Table below).

HOW DOES CLIMATE RISK COMPARE?

Economists at the Duisenberg School of Finance identified four criteria for financial system risks that can arise from the "real economy". They compared housing, the shipping and technology sectors, and ecological assets - primarily greenhouse gas emissions, along with resource scarcity.

CRITERIA	ASSET CLASS <i>both production and ownership</i>			
	HOUSING	SHIPPING	TECH	ECOLOGICAL
LONG LIVED ASSET	✓	✓	✗	✓
CAPITAL INTENSIVE	✓	✓	✓	✓
ECONOMIC SHARE	✓	✗	✓	✓?
DEBT-FINANCED	✓	✓	✗	✓
CRISIS PRONE	YES	NO	NO	YES?

Adapted from Schoenmaker *et al.*, 2015, Duisenberg School of Finance.

What if no policy action is taken?

Several high-profile companies such as Exxon and Chevron have argued that climate change will not affect their businesses, as adequate action is unlikely.⁴⁶ The soundness of such assumptions is questionable, considering the shifts in policy, energy markets and consumption that have taken place recently that have already begun to affect some sectors, such as European electricity generation.⁴⁷

Planning for little or no action on greenhouse gas emissions also ignores the likely effects of unmitigated climate change itself, which have been well-documented by Stern and Garnaut, among others. A 2014 paper for the European Parliament outlined three scenarios: a smooth transition (where policy signals are clear and timely); an uncertain transition (delayed, unclear policies), and a "Carbon Renaissance" – in which emissions continue to grow apace.

Because climate change itself will affect many assets, the paper found that the latter scenario would in fact be the most threatening to financial systems. Increased insurance payouts and exposure of financial institutions to affected property, infrastructure, and businesses are the key reasons cited.⁴⁸

Perhaps more problematic is the uncertainty itself over such outcomes, as economists Gernot Wagner and Martin Weitzman point out.⁴⁹ They estimate that there is a 5 to 10 per cent chance of temperatures rising by 6°C or more; which would likely entail almost unimaginable outcomes.

Implications for the Australian financial system

As noted above, the FSB is examining how the financial system can address climate risk, and many countries are also considering this question. This is unlikely however to address Australia's particular situation with regard to climate risk and financial stability. Although several submissions to the Financial System Inquiry in 2014 referred to climate risk, the inquiry's final report made no mention of climate risk. The FSI concluded that Australian regulatory framework is broadly adequate regarding financial stability and systemic risk. This leaves the consideration of unique, unprecedented risks such as climate change at the discretion of regulators.

Here, we outline elements of Australia's financial systems which are exposed to the effects of climate risk.

Banking

Australia's biggest banks form an integral part of the country's financial system. They are systemically important through their standard functions of credit intermediation and payment processing; along with their implicit and explicit government support, and their substantial representation in the stock market indexes.

Carbon risk: There is some evidence banks may be exposed to risk. MSCI estimates that as of 2014, around 10 per cent of the syndicated loan books of Australia's big four banks were comprised of borrowers with stranded assets risks.⁵⁰ However, a consistent methodology for identifying bank exposure is still being developed.⁵¹

Physical climate risk: Australia's banks are heavily concentrated in residential property,⁵² with mortgages making up about 66 per cent of their assets. The property market is also embedded in Australia's financial system in even more direct ways. For example, a shortage of government

bonds has led the RBA to develop a "Committed Liquidity Facility", which allows banks, for a fee, to instead use their mortgage assets to meet liquidity ratios.

- + As a country with mostly coastal dwellings, these assets could collectively have a high exposure to the effects of climate damage. Increased precipitation could also lead to economically destructive events away from the coast, such as the Queensland floods of 2011.⁵³
- + Many properties in Australia are believed to be under-insured⁵⁴ and vulnerable properties are more likely to be under-insured.
- + Two recent Productivity Commission reports indicate that arrangements for provisions and funding of damage incurred from extreme weather events are inadequate.⁵⁵
- + Banks themselves may have limited visibility of their exposure to this risk, due to the lack of property insurance verification beyond the first year of the mortgage.⁵⁶⁻⁵⁷
- + Infrastructure vulnerability and contingent liability provision are similarly problematic and potentially very costly.⁵⁸
- + This raises the prospect of the government as "insurer of last resort", rescuing financial institutions, individuals, and/or other governments (e.g. federal government bailing out state and local).

Insurance

- + As disaster risk modelling is core to the general insurance business model, the insurance industry appears to be most active on climate risk – primarily on “physical” risk or “adaptation” risk, rather than through exposure via their portfolios. However the sector may be uneven in its handling of climate change, particularly for institutions that rely upon historical data without incorporating recent or likely future changing climate patterns.⁵⁹⁻⁶¹
- + Variance in utilisation of disaster data is evident among Australian insurers, raising the questions about risk pricing and capital adequacy.⁶²
- + Insurers do not spread risk across geographic areas, but calculate premiums based on the risk they calculate for a specific area, down to the address where possible.⁶³
- + Because of this, insurers will tend to respond quickly to changes in risks. Home insurance premiums in North Queensland rose rapidly since 2005-06, triggering an outcry among residents there. However the Australian Government Actuary identified higher cyclone payouts as a primary cause of the dramatic premium increases.⁶⁴ Although this cyclone risk itself was not linked to climate change, it demonstrates that insurers will not redistribute higher risks from some households, but will instead leave some properties uninsurable.
- + Even when insurers and re-insurers do calculate climate-related risks in their own business, there are barriers to this information being transmitted to other segments of the economy or to policymakers. This is particularly clear in property insurance, which is generally only extended for 12-month periods, while the mortgager has exposure for the life of the mortgage.

Superannuation asset allocation and funds management

- + Australia has a relatively large (in relative and absolute terms) pool of commercially-managed pension assets. Domestic assets make up the vast majority of these investments, with a heavy weighting towards equities. The carbon intensive nature of Australia’s economy⁶⁵ and stock market⁶⁶ indicates our pensions are exposed to higher carbon risks than the international mean.
- + Some of these pension fund managers are beginning to consider and act upon climate risk that may affect the long-term interests of their members, as demonstrated by initiatives such as the Asset Owners’ Disclosure Project (AODP) and Investor Group on Climate Change (IGCC).⁶⁷ This may have equity implications for members of funds that are not acting.
- + A significant number of Australians may be exposed to climate-related risk through their superannuation. While industry efforts to manage this risk remain voluntary and non-standardised, individuals may have limited ability to make informed decisions.

Resources sector

Australia’s economy is highly exposed to demand for its main export commodities. These demand patterns have had significant implications for Australian monetary policy in the past decade.⁶⁸ More recently, prices for some commodities have fallen sooner and more dramatically than anticipated. These falls have, in turn, put downward pressure on the Australian dollar, as the RBA has acknowledged.⁶⁹

There is evidence that Australia is already suffering from the imposition of rules relating to pollution as global seaborne coal prices have fallen. Wood Mackenzie, whose forecasts are widely used in the energy and mining industries, in January 2015 noted that tighter environmental regulations were already limiting industrial coal-burn, and the development of such regulations would continue to “increase pressure on coal use”.⁷⁰

The Mercer report on climate investing identifies Australian, UK and Canadian equities as being “more sensitive” to climate risk, due to their higher exposure to carbon-intensive sectors. Australian equities are particularly singled out for additional sensitivity due to “the greater level of policy uncertainty in this market”.⁷¹

Sovereign debt and capital markets

The fiscal policy implications of changes in commodity prices are relatively simple to project through impacts on tax receipts and capital inflows. The direct and indirect effects on financial systems, however, are less well understood.

On the macro economy, several recent reports estimate Australia's carbon risk, including by the University of Oxford's Smith School,⁷² Carbon Tracker Initiative and The Climate Institute,⁷³ and Nature. These reports all indicate Australia has a relatively high exposure to this type of risk, compared to other developed markets.

These macro-economic risks might not, in themselves, pose a threat to financial stability. However, as Australia's financial system is closely linked with foreign capital markets, a point underlined by the Financial System Inquiry, which states Australia's "high interconnectivity domestically and with the rest of the world, and its dependence on importing capital" are characteristics which "give rise to particular risks".

It's conceivable that macro-economic shifts arising from climate change might have implications for Australian sovereign debt; something which has been noted by ratings agency Standard & Poor's:

"Similar to the long-term challenges facing most other countries, Australia will need to adapt to the economic impacts of an ageing population and climate change... In our view, long term mega-trends of aging populations and climate change will, over time, adversely impact government revenues, while the social needs, society's expectations, and the costs of delivering social outcomes will all likely rise."

Standard and Poor's, second submission to Financial System Inquiry, 2014 ⁷⁴

Advisory firm Mercer also highlights Australian sovereign risk, in a June 2015 report on climate change and investment:

"We believe that the Australian economy is more susceptible to a policy shock than other developed markets given the uncertainty surrounding its national climate change policy, which currently lags other developed markets, combined with the level of dependency of the Australian economy on carbon-intensive sectors."

Mercer ⁷⁵

Among developed market sovereign bonds, only Japan, New Zealand and Australia are singled out by Mercer in this way.

Infrastructure

Far-reaching changes to the energy system and related infrastructure such as transport are inevitable in the coming decades. Climate change will serve as a key driver for this change, which will likely be brought about through both policy and technology mechanisms. For example, the IEA states on current investment trends, by 2017, enough carbon-intensive infrastructure will already be in place to guarantee the 2°C limit. That would indicate two possibilities for infrastructure built after that date: either it must all be zero-emissions infrastructure; or it would need to be fully offset by carbon capture and storage, if the assets are to be fully utilised. A third option is that some of those assets become "stranded".⁷⁶

"...attention needs be given to issues such as managing employment loss in the shift away from coal mining and handling high-emissions assets which become "stranded" in the transition to a low-carbon economy."

International Energy Agency, WEO Special Report on Energy and Climate Change, June 2015

How Australia manages financial system risk

Responsibility for financial system stability lies primarily with the Reserve Bank of Australia (RBA) and the Australian Prudential Regulatory Authority (APRA). The RBA and APRA each take some responsibility for *system-wide oversight*, although each agency has “different, but overlapping and complementary, powers and responsibilities”.

The Reserve Bank’s duties include contributing to the stability of the currency, full employment, and the economic prosperity and welfare of the Australian people. To achieve this, its regular activities include setting monetary policy, overseeing the payments system, and managing the country’s gold and foreign exchange reserves.

“Given the serious damage to employment and economic prosperity that can occur in times of financial instability, the [Reserve Bank Act 1959] has long been interpreted to imply a mandate to pursue financial stability. This implicit goal has been made more explicit by successive governments.”

RBA and APRA, 2012 ⁷⁷

APRA supervises financial institutions in Australia. It does this with “an industry-wide or systemic perspective, as is consistent with its mandate”.

However there are mechanisms for addressing issues of system risk that fall between or across different agency mandates.

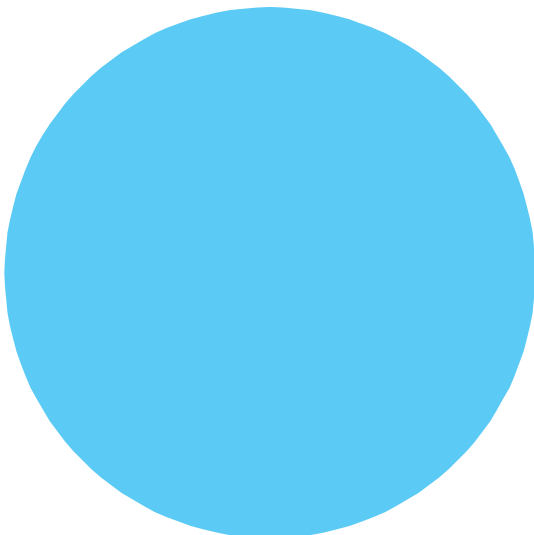
Coordination and co-operation between APRA and the RBA, together with ASIC and Treasury, is achieved through the Council of Financial Regulators (CFR). The CFR is a non-statutory body that meets quarterly and is chaired by the RBA Governor. It “provides a forum for identifying important issues and trends in the financial system, including those that may impinge upon overall financial stability”. ⁷⁸

Conclusion

The characteristics of climate risk could interact with Australia's financial system in some or all of the ways outlined above, or in other ways that are not yet clear. There are gaps in the industry's own understanding of its exposure to climate-related risks; however some market participants – particularly investors – are endeavouring to bridge those gaps. The actions of regulators, investors and market agents around the world indicates this area warrants further exploration, if Australia's financial systems are to remain resilient in the face of emerging climate risks.

Where to next?

Climate change presents challenges to the financial system that are complex and unprecedented. Foreign and international attempts to scope and address these challenges are under way, but they will not adequately cater to each country's financial system. With exposure to climate risk in so many parts of the financial system and the economy, there is a pressing need for focused regulatory attention. Regulators can play a role in ensuring that investors and other financial market participants can obtain information that allows to act on climate risk. This would require a thorough appraisal of the implications of climate risk to Australian financial system stability.



Endnotes

- ¹ Braganza, K., B. Murphy, B. Timbal, P. Hope, A. Dowdy, K. Hennessy, J. Bhend and D. Kirono, 2015, "Understanding recent Australian climate", in *Climate Change in Australia Information for Australia's Natural Resource Management Regions: Technical Report*, CSIRO and Bureau of Meteorology, Australia.
- ² Borio, C. and M. Drehmann, 2009, "Assessing the risk of banking crises – revisited", BIS Quarterly Review, Bank for International Settlements, March 2009, http://www.bis.org/publ/qtrpdf/r_qt0903e.pdf.
- ³ For example, Rosengren, E., 2011, "Defining Financial Stability, and Some Policy Implications of Applying the Definition", speech to the Stanford Finance Forum, <https://www.bostonfed.org/news/speeches/rosengren/2011/060311/060311.pdf>.
- ⁴ We assume that 2 degree/450ppm mitigation targets are "adequate", per international agreement in Copenhagen in 2009.
- ⁵ The Stern review and the Garnaut reviews estimate costs of unmitigated climate change to economic growth. Stern, N., 2007, *The Economics of Climate Change: The Stern Review*, Cambridge University Press; Garnaut, R., 2008, *The Garnaut Climate Change Review*, Cambridge University Press, Port Melbourne, <http://www.garnautreview.org.au/2008-review.html>; Garnaut, R., 2011, *The Garnaut Review 2011: Australia in the global response to climate change*, Cambridge University Press, Port Melbourne <http://www.garnautreview.org.au/update-2011/garnaut-review-2011/garnaut-review-2011.pdf>.
- ⁶ Sustainable Development Solutions Network and Institute for Sustainable Development and International Relations, 2014, "Pathways to deep decarbonisation: 2014 report", SDSN and IDDRI, http://www.climateworksaustralia.org/sites/default/files/documents/publications/ddpp_2014_report_australia_chapter.pdf.
- ⁷ Freeman, M.C., G. Wagner, and R.J. Zeckhauser, "Climate Sensitivity Uncertainty: When is Good News Bad?", NBER Working Paper No 20900, *NBER Papers in Environmental and Energy Economics*, January 2015, doi: 10.3386/w20900.
- ⁸ For example, the Low Carbon Investment Registry and recent launch of new products focused on carbon and climate risk from service providers such as Bloomberg, MSCI and FTSE. Bloomberg New Energy Finance, 2013, "Bloomberg Carbon Risk Valuation Tool", November 25, http://about.bnef.com/content/uploads/sites/4/2013/12/BNEF_WP_2013-11-25_Carbon-Risk-Valuation-Tool.pdf; MSCI, 2015, MSCI ACWI ex fossil fuels index, https://www.msci.com/resources/factsheets/index_fact_sheet/msci-acwi-ex-fossil-fuels-index-gbp-gross.pdf; FTSE, FTSE Developed ex Fossil Fuel Index Series. http://www.ftse.com/products/downloads/FTSE_Stranded_Assets.pdf.
- ⁹ IPCC, 2013, "Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change", Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, doi:10.1017/CBO9781107415324.
- ¹⁰ World Bank, 2014, "Turn Down the Heat: Confronting the New Climate Change Normal", <https://openknowledge.worldbank.org/handle/10986/20595>.
- ¹¹ Braganza K. *et al.*, 2015, Op Cit.
- ¹² G20, Communique: G20 Finance Ministers and Central Bank Governors Meeting, <https://g20.org/wp-content/uploads/2015/04/April-G20-FMCSBG-Communique-Final.pdf>.
- ¹³ Bank of England Prudential Regulatory Authority, "Supervisory Activities - Climate Change Adaptation Reporting", www.bankofengland.co.uk/pr/Pages/supervision/activities/climatechange.aspx.
- ¹⁴ United Nations Environment Programme, Inquiry: Design of a Sustainable Financial System, Reports 1, 2, 3 and 4, <http://web.unep.org/inquiry>.
- ¹⁵ CDP, "Global corporate use of carbon pricing: Disclosures to investors", September 2014, <https://www.cdp.net/CDPResults/global-price-on-carbon-report-2014.pdf>.
- ¹⁶ Clark, P., "Renewable power will overtake coal if climate pledges are kept", *Financial Times*, June 15, 2015.
- ¹⁷ Cornot-Gandolphe, S., "China's Coal Market: Can Beijing Tame King Coal?", OIES paper CL1, Oxford Institute for Energy Studies, December 2014, 23-27.
- ¹⁸ The Economist Intelligence Unit, "Coal Downturn", *The Economist*, January 15, 2015, <http://www.eiu.com/industry/article/742664258/coal-downturn/2015-01-15>.
- ¹⁹ Nachmany, M., S. Fankhauser, T. Townshend, M. Collins, T. Landesman, A. Matthews, C. Pavese, K. Rietig, P. Schleifer and J. Setzer, 2014, "The GLOBE Climate Legislation Study: A Review of Climate Change Legislation in 66 Countries (4th ed)", World Summit of Legislators and The London School of Economics and Political Science, http://www.academia.edu/6214974/The_GLOBE_Climate_Legislation_Study_A_Review_of_Climate_Change_Legislation_in_66_Countries_4th_Ed._Nachmany_Michael_Fankhauser_Sam_Townshend_Terry_Collins_Murray_Landesman_Tucker_Matthews_Adam_Pavese_Carolina_Rietig_Katharina_Schleifer_Philip_and_Setzer_Joana.

- ²⁰ Ansar, A., B. Caldecott and J. Tilbury, "Stranded assets and the fossil fuel divestment campaign: what does divestment mean for the valuation of fossil fuel assets?", Stranded Assets Programme, Smith School of Enterprise and the Environment, University of Oxford, October 2013, 49-51, <http://www.smithschool.ox.ac.uk/research/stranded-assets/SAP-divestment-report-final.pdf>.
- ²¹ Ceres and Carbon Tracker Carbon Asset Risk Initiative alone represents more than \$3tn of assets. Ceres and Carbon Tracker Carbon Asset Risk Initiative, <http://www.ceres.org/files/investor-files/car-factsheet>.
- ²² Freshfields Bruckhaus Deringer, 2005, "A Legal Framework for the integration of environmental, social and governance issues into institutional investment, produced for the Asset Management Working Group of the UNEP Finance Initiative, October, http://www.unepfi.org/fileadmin/documents/freshfields_legal_resp_20051123.pdf.
- ²³ United Nations Environment Programme, 2009, "Fiduciary Responsibility: Legal and practical aspects of integrating environmental, social and governance issues into institutional investment", produced for the Asset Management Working Group of the UNEP Finance Initiative, July, <http://www.unepfi.org/fileadmin/documents/fiduciaryll.pdf>.
- ²⁴ Baker & McKenzie, 2012, "Superannuation Trustees and Climate Change report", http://www.climateinstitute.org.au/verve/_resources/BakerandMcKenzie_SuperannuationTrusteesandClimateChangeReport_October2012.pdf.
- ²⁵ Girgis, M. and S. Barker, 2015, "Institutional investment, corporate governance and climate change: What is a trustee to do?", *Minter Ellison*, January, <http://www.minterellison.com/publications/articles/Institutional-investment-corporate-governance-and-climate-change-what-is-a-trustee-to-do/>.
- ²⁶ Kay, J., 2012, The Kay Review of UK Equity Markets and Long-Term Decision Making: Final Report, July 2012, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/253454/bis-12-917-kay-review-of-equity-markets-final-report.pdf.
- ²⁷ Clark, G.L., 2013, "The Kay Review on Long-Horizon Investing: A Guide for the Perplexed", *Rotman International Journal of Pension Management*, Vol. 6, No. 1, 2013.
- ²⁸ Centre for International Finance and Regulation, 2014: "Long-Term Investing: an Institutional Investor Perspective", [http://www.cifr.edu.au/assets/document/Long-Term%20Investing%20COMBINED%20\(CIFR,%20Oct%202014\).pdf](http://www.cifr.edu.au/assets/document/Long-Term%20Investing%20COMBINED%20(CIFR,%20Oct%202014).pdf).
- ²⁹ Hay, J. Emerging Markets, "Carney raises the heat on climate: you can't burn all the oil", <http://www.emergingmarkets.org/Article/3389530/Carney-raises-the-heat-on-climate-you-cant-burn-all-the-oil.html>.
- ³⁰ Gurria, A., 2013, "The Climate Challenge, achieving zero emissions", speech; London, October 9, <http://www.oecd.org/env/the-climate-challenge-achieving-zero-emissions.htm>.
- ³¹ FTSE, 2014, "Developing tools to transition to a low carbon economy", <http://www.ftseangle.com/2014/12/developing-tools-to-analyze-the-transition-to-a-low-carbon-economy/>; outlines the FTSE Low Carbon Economy products: These are separate to FTSE's fossil fuel screening products.
- ³² Bloomberg New Energy Finance, 2013, Op Cit.; MSCI, 2015, Op. Cit.
- ³³ Kraemer, M., L. Negrila, 2014, "Climate Change Is A Global Mega-Trend For Sovereign Risk", *Standard & Poor's*, May, http://fsi.gov.au/files/2014/09/Standard_Poors_Attachment_M.pdf.
- ³⁴ Fabienne Michaux, 2014, "Standard & Poor's Submission to Australia's Financial System Enquiry (Second Round Submission)", http://fsi.gov.au/files/2014/09/Standard_Poors.pdf.
- ³⁵ Schoenmaker, D.R. Van Tilburg and H. Wijffels, 2015, "What role for financial supervisors in addressing environmental systemic risks?", Duisenberg School of Finance, DSF Policy Paper Series.
- ³⁶ CFA Institute, 2013, "Issue brief: Long-term financing: Investor perspectives in Europe", September, http://www.cfainstitute.org/ethics/Documents/If_Issue_brief_final.pdf.
- ³⁷ CDP, formerly known as the Carbon Disclosure Project, facilitates company-wide measurement and disclosure of carbon emissions, www.cdp.net.
- ³⁸ See, for example, National Australia Bank's statement here: <http://cr.nab.com.au/what-we-do/carbon-risk-disclosure> which refers to this work.
- ³⁹ Deloitte Access Economics and the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2014, "Building an open platform for natural disaster resilience decisions", July, p.43, <http://australianbusinessroundtable.com.au/assets/Building%20an%20Open%20Platform%20for%20Natural%20Disaster%20Resilience%20Decisions%20CLEAN.pdf>.
- ⁴⁰ Webb, R. and J. Beh, 2013, "Leading adaptation practices and support strategies for Australia: An international and Australian review of products and tools", National Climate Change Adaptation Research Facility, Gold Coast, https://www.nccarf.edu.au/sites/default/files/attached_files_publications/Webb_2013_Leading_adaptation_practices_support.pdf.
- ⁴¹ Bernanke, B., 2012, "Some Reflections on the Crisis and the Policy Response", speech, New York, April 13, <http://www.federalreserve.gov/newsevents/speech/bernanke20120413a.htm>.
- ⁴² The IEA states that "the world's shrinking "carbon budget" means any delay in taking action will be costly". International Energy Agency, 2014, "IEA sets out pillars for success at COP21", <http://www.iea.org/newsroomandevents/pressreleases/2015/june/iea-sets-out-pillars-for-success-at-cop21.html>.
- ⁴³ International Energy Agency, 2014, "World Energy Investment Outlook", IEA, Paris.
- ⁴⁴ Australian Climate Roundtable, 2015, "Joint Principles for Climate Policy", Aluminium Council of Australia, Australian Conservation Foundation, ACOSS, ACTU, AiGroup, Business Council of Australia, ESAA, Investor Group on Climate Change, The Climate Institute, WWF, <http://www.bca.com.au/newsroom/broad-alliance-points-to-common-ground-on-climate-policy>.
- ⁴⁵ Schoenmaker *et al.*, 2015, Op. Cit.
- ⁴⁶ ExxonMobil, 2014, "Energy and Carbon – Managing the Risks", <http://cdn.exxonmobil.com/~media/global/files/other/2014/report---energy-and-carbon---managing-the-risks.pdf>.
- ⁴⁷ Vasagar, J., 2014, "Eon to spin off its fossil fuel assets as big losses loom", *Financial Times*, November 30, <http://www.ft.com/intl/cms/s/0/9c358caa-78cf-11e4-b518-00144feabdc0.html>.
- ⁴⁸ Weyzig, F., B. Kuepper, J.W. van Gelder, R. van Tilburg, 2014, "The Price of Doing Too Little Too Late: The impact of the carbon bubble on the EU financial system", February 2014, Green New Deal Series Volume 11, Green European Foundation.
- ⁴⁹ Wagner G., and M. Weitzman, 2015, *Climate Shock*, Princeton University Press, New Jersey.
- ⁵⁰ Vernon, C., 2015, "Australia's Fossil Fuel Projects: Dead in the Water?", MSCI, May, <https://www.msci.com/documents/10199/ff71c4d9-430e-4bbd-bc69-c9246f3ba9f0>.
- ⁵¹ Australian banks are piloting the development of such a methodology; see footnote 38.
- ⁵² Commonwealth of Australia, 2014, "Financial System Inquiry: Interim report", The Treasury, July, http://fsi.gov.au/files/2014/07/FSI_Report_Final_Reduced20140715.pdf.

- ⁵³ Stafford-Smith, M., 2014, CSIRO Submission 14/507: Inquiry into Natural Disaster Funding, Productivity Commission, Australian Government, June, <http://www.pc.gov.au/inquiries/completed/disaster-funding/submissions/submissions-test/submission-counter/sub072-disaster-funding.pdf>.
- ⁵⁴ Comprehensive and recent data on under-insurance is not available, but survey published by the Insurance Council of Australia in November 2013 indicates under-insurance is widespread and that 48 per cent of home owners are unaware of exclusions. Understand Insurance, 2013, "Underinsured and overexposed – most Australians risk financial hardship through underinsurance", November 28, <http://understandinsurance.com.au/mediarelease/plain/1>.
- ⁵⁵ Productivity Commission, 2014, Natural Disaster Funding Arrangements, Draft Inquiry Report, Canberra; Productivity Commission, 2012, Barriers to Effective Climate Change Adaptation, Report No. 59, Final Inquiry Report, Canberra.
- ⁵⁶ Panel 6, "Business and Markets", National Climate Change Adaptation Research Facility, October 1, 2014, Gold Coast Convention and Exhibition Centre.
- ⁵⁷ Conversations with industry participants under Chatham House rules.
- ⁵⁸ The Climate Institute, 2012, "Coming, Ready or Not: Can Australia's infrastructure handle climate change?", TCI, Sydney, http://www.climateinstitute.org.au/verve/_resources/TCI_ComingReadyorNot_ClimateRiskstoInfrastructure_October2012.pdf.
- ⁵⁹ Petkov, M., 2014, "Climate Change Could Sting Reinsurers That Underestimate Its Impact", *Standard & Poor's*, September 3, https://www.globalcreditportal.com/ratingsdirect/renderArticle.do?articleId=1356905&SctArtId=260148&from=CM&nsi_code=LIME&sourceObjectid=8706036&sourceRevId=1&fee_ind=N&exp_date=20240902-15:44:53&sf4482828=1.
- ⁶⁰ Harwood, J., S. Paddam, A. Pitman and J. Egan, 2014, "Can Actuaries Really Afford to Ignore Climate Change?", presented to the Actuaries Institute General Insurance Seminar, Sydney, November 2014, <http://www.actuaries.asn.au/Library/Events/GIS/2014/GIS2014EganEtAlClimateChangePres.pdf>.
- ⁶¹ Toumi, R., and L. Restell, 2014, Catastrophe Modelling and Climate Change, Lloyd's, <https://www.lloyds.com/-/media/lloyds/reports/emerging%20risk%20reports/cc%20and%20modelling%20template%20v6.pdf>. Premiums have risen as much as 400%.
- ⁶² Climate Risk Pty Ltd, 2014, Buyer Beware: Home Insurance, Extreme Weather and Climate Change, a report to The Climate Institute in partnership with CHOICE, http://climateinstitute.org.au/verve/_resources/BuyerBeware.pdf.
- ⁶³ Government of Australia, 2014, Report on home and contents insurance prices in North Queensland, Australian Government Actuary, http://www.aga.gov.au/publications/home_contents_nth_qld/downloads/Home-Contents-North-QLD.pdf.
- ⁶⁴ Ibid.
- ⁶⁵ Garnaut, 2008 and 2011, Op. Cit.
- ⁶⁶ Carbon Tracker Initiative and The Climate Institute, 2013, "Unburnable Carbon: Australia's carbon bubble", TCI, Sydney, http://climateinstitute.org.au/verve/_resources/TCI_PMTG_Targets_Submission_Final.pdf.
- ⁶⁷ See for example the Investor Group on Climate Change [igcc.org.au], or the Asset Owners' Disclosure Project, [aodproject.net] on how superannuation funds and other asset owners are acting on climate risk.
- ⁶⁸ Debelle, G., 2013, "Funding the Resources Investment Boom", address to Melbourne Institute Public Economic Forum, Canberra, April 16, <https://www.bis.org/review/r130416e.pdf>.
- ⁶⁹ Stevens, G., 2015, "Statement by Glenn Stevens, Governor: Monetary Policy Decision", Reserve Bank of Australia, April 7, <http://www.rba.gov.au/media-releases/2015/mr-15-05.html>.
- ⁷⁰ Wood Mackenzie, 2015, "China's GDP and energy demand decoupling: temporary or structural?", confidential report, January 22.
- ⁷¹ Mercer, 2015, "Investing in a time of climate change", <http://www.mercer.com.au/services/investments/sustainable-growth/climate-change-report-2015.html>.
- ⁷² Ben, C., G. Dericks and J Mitchell, 2015, "Subcritical coal in Australia: Risks to Investors and Implications for Policymakers", Smith School of Enterprise and the Environment, University of Oxford, March, http://www.smithschool.ox.ac.uk/research-programmes/stranded-assets/Subcritical%20Coal%20in%20Australia_Investors&Policymakers.pdf.
- ⁷³ Carbon Tracker Initiative and The Climate Institute, 2013, Op. Cit.
- ⁷⁴ Fabienne Michaux, 2014, Op. Cit.
- ⁷⁵ Mercer, 2015, Op. Cit.
- ⁷⁶ International Energy Agency, 2014, "Energy, Climate Change and Environment: 2014 Insights", IEA, Paris.
- ⁷⁷ Reserve Bank of Australia and Australian Prudential Regulation Authority, 2012, "Macroprudential Analysis and Policy in the Australian Financial Stability Framework", September, <http://www.rba.gov.au/fin-stability/resources/2012-09-map-aus-fsf/pdf/2012-09-map-aus-fsf.pdf>.
- ⁷⁸ Ibid.