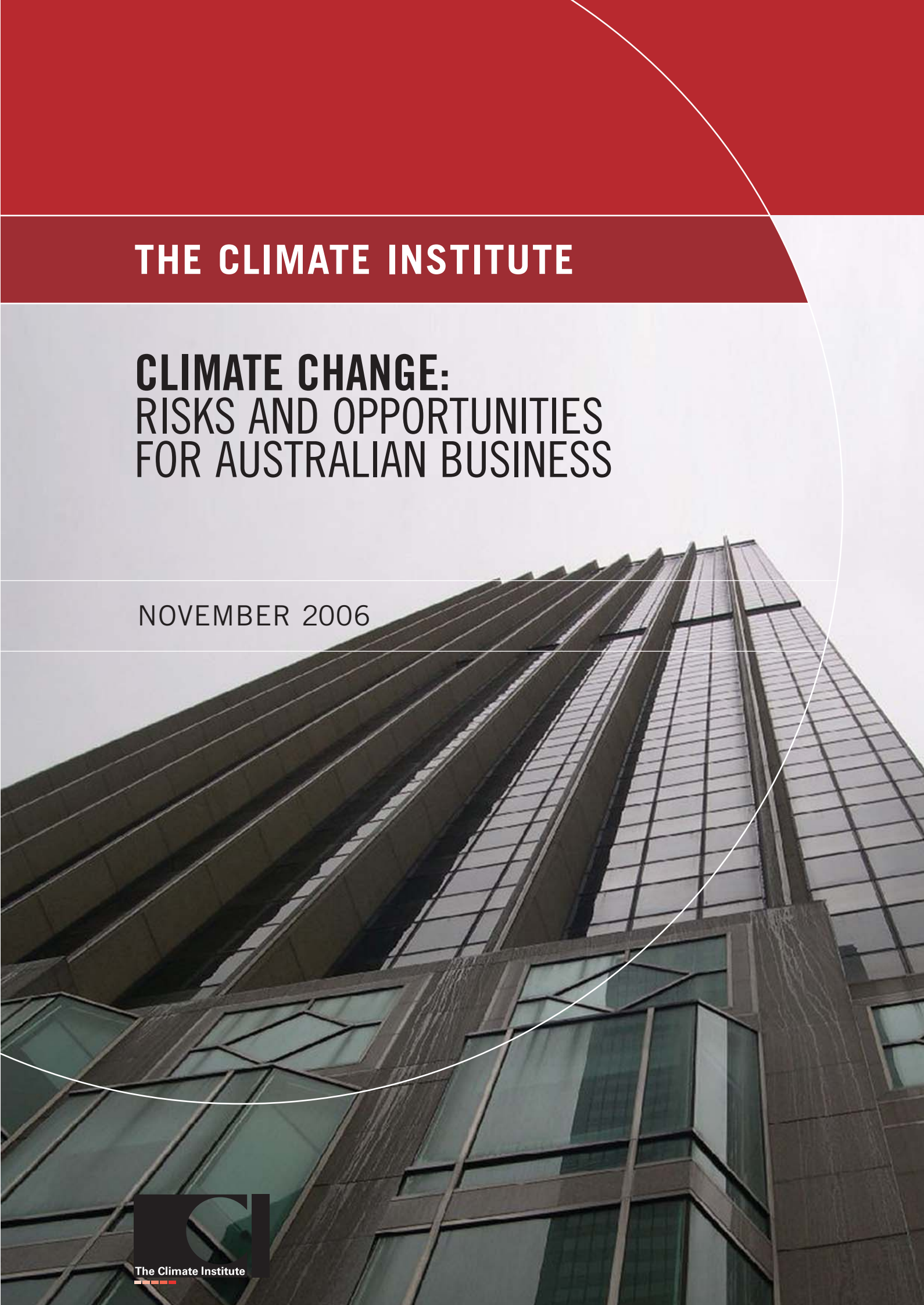
THE CLIMATE INSTITUTE

CLIMATE CHANGE:
RISKS AND OPPORTUNITIES FOR AUSTRALIAN BUSINESS

NOVEMBER 2006



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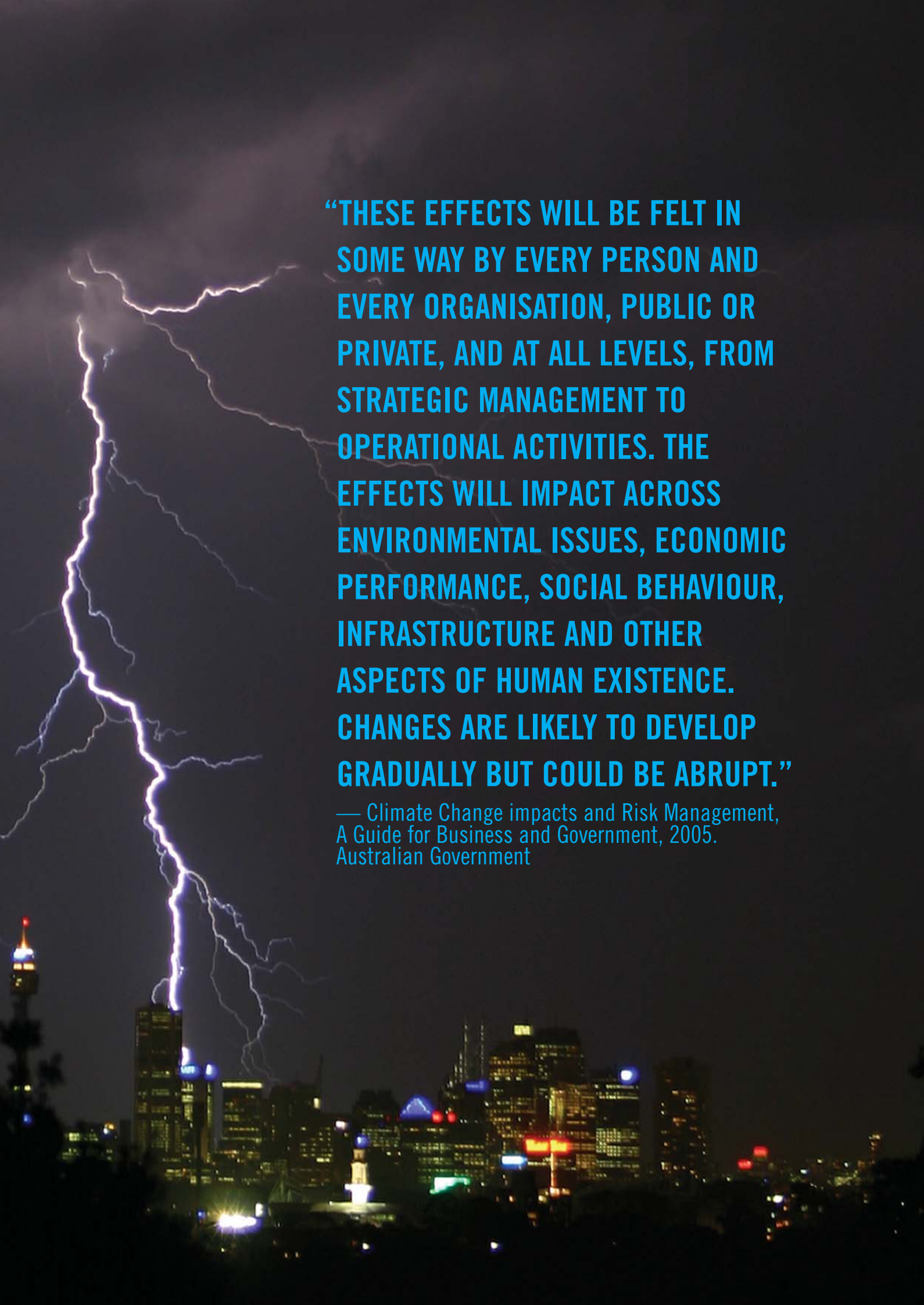

"THESE EFFECTS WILL BE FELT IN SOME WAY BY EVERY PERSON AND EVERY ORGANISATION, PUBLIC OR PRIVATE, AND AT ALL LEVELS, FROM STRATEGIC MANAGEMENT TO OPERATIONAL ACTIVITIES. THE EFFECTS WILL IMPACT ACROSS ENVIRONMENTAL ISSUES, ECONOMIC PERFORMANCE, SOCIAL BEHAVIOUR, INFRASTRUCTURE AND OTHER ASPECTS OF HUMAN EXISTENCE. CHANGES ARE LIKELY TO DEVELOP GRADUALLY BUT COULD BE ABRUPT."

— Climate Change impacts and Risk Management, A Guide for Business and Government, 2005. Australian Government

OVERVIEW

1 In recent months climate change has become a front page story, sparking a political denabe across Australia in recent months. The issue has reached a tipping point, so how should the Australian business community respond ?

2 Climate change represents an enormous, yet under-appreciated risk to the Australian business community. The principal driver of risk is the global and national need to respond.

3 Risks to business include physical impacts, regulation, competition, changing markets, investment, effects on the price of energy, energy infrastructure, litigation and shareholder activism. All sectors will be affected. Finance, property, insurance, agriculture, energy infrastructure, tourism, property and energy users are sectors likely to have the highest exposure. These risks arise from the physical impacts of climate change itself and the responses of governments, investors, shareholders, competitors, customers, consumers, the public and the media.

4 Regulatory uncertainty is one of the greatest risks. Australian business face greater uncertainty over future climate policy and regulation than perhaps any other OECD country. Current Government commitments under Kyoto to limit greenhouse gases only extend to 2012. Beyond that, the situation is unclear, but it is "*inevitable*" that there will be "*increasing and uniform regulatory action to reduce greenhouse gas emissions*" according to AMP Capitals' Head of Investment Strategy and Chief Economist Shane Oliver[1].

5 Future climate policy will inevitably affect a wide range of business activities, including increased electricity prices, tradable emission permits and carbon taxes, technology transformations, mandatory emission and energy standards, and targets to reduce emissions. In capital-intensive industries, where turnover for replacing equipment can take decades and cost hundreds of millions of dollars, this lack of long-term regulatory certainty raises questions of sovereign risk to investments and stranded assets. This uncertainty will grow in the future, as debate on how to tackle the problem intensifies, and emissions reductions beyond the first commitment period of the Kyoto Protocol remain unknown.

6 This issue is particularly acute in the electricity sector where uncertainty about the future direction of climate change policy and future carbon pricing mechanisms impedes and delays optimal decision making on the new infrastructure that is needed to meet growing electricity demand. A delay in new electricity infrastructure development has economy wide implications.

7 The lack of a nationally consistent regulatory framework to respond to climate change is driving various levels of governments to pursue different and changing policies, creating multiple compliance costs to businesses. As the climate issue become of greater concern across community, political and media circles, governments are moving to introduce an even greater variety of initiatives, responses, inquiries, programmes, funding and R&D schemes — this patchwork only increases regulatory complexity and costs to business.

8 As a hot, dry country with environmental extremes, Australia is more vulnerable than most developed nations to the physical impacts of climate change, affecting all investors — from institutional to personal — who face significant risk in measuring the security of their assets. This is most readily apparent in agriculture, with the significant impact of the recent drought. Australia has also seen recent flow-through effects to the food supply chain from crop damage caused by tropical cyclone Larry. Every major mainland city in Australia already faces water stress and this will be exacerbated by climate change. This is likely to create increased competition for an increasingly scare resource and significant restrictions on water use. In addition, the tourism sector is likely to face severe impacts as climate change damages prime destinations such as the Great Barrier Reef, Kakadu and the highland regions of north-eastern and south-eastern Australia.

9 As climate change has emerged as a business risk, the move to a carbon-constrained global economy is ushering in opportunities. There is a growing consensus amongst global companies that taking concerted action on climate change represents strategic opportunities — such as building new markets, corporate positioning, gaining regulatory intelligence, and competitive advantage. For example, the recent explosion of multi-billion-dollar opportunities in carbon trading and clean energy markets. These two sectors have a combined global annual market in excess of AUS$100 billion. For the business sector, climate change has moved beyond a neutral issue and is creating winners and losers. As the world's economy becomes carbon constrained, our rate of restructuring and market-based experience in emission reductions lags behind that of other countries, which could place our businesses at a competitive disadvantage globally.

10 In Australia, few companies appear strategically well positioned to manage and capitalise on the risks and opportunities of climate change. Business dialogue with Government over climate policy formation and implementation has largely been restricted to a small group of large companies and their industry associations. Given the broad range of impacts which will affect business, there is an acute need for all industries and sectors to be active participants in the debate.

11 Increasingly, the Australian business community is recognising that it can no longer afford to be a back-seat passenger in what has been described as one of our greatest challenges. A proactive stance is now necessary in strategic and operational decision making, and for the Australian economy as a whole.

12 To investigate this issue in more depth, the Climate Institute has sponsored a national forum on climate change and business organised by CEDA (Committee for Economic Development of Australia). The principal question is "How much action is needed and what steps can we take?" This report is designed to inform participants of the risks and opportunities accompanying climate change, to stimulate discussion on this critical issue, and to mobilise business as an active participant.

— Corin Millais, Chief Executive, The Climate Institute

REGULATORY RISK

"CLIMATE CHANGE IS A MAJOR BUSINESS RISK. UNCERTAINTY ABOUT THE FUTURE OF CLIMATE POLICY HEIGHTENS THE RISKS ASSOCIATED WITH INVESTMENT".

— Australian Business Roundtable on Climate Change 2006[2].

Policy instability presents a major business risk in Australia with greater uncertainty here over future climate policy and regulation than perhaps any other OECD country. Regulatory uncertainty is perhaps the greatest single risk. Paradoxically, as the issue gathers pace, the policy environment becomes more uncertain whilst greater regulation is inevitable. International climate regulations will also have an increasing impact on Australia.

Current Government commitments under Kyoto to limit greenhouse gases only extend to 2012. Beyond that, the situation is unclear, but it is "inevitable" that there will be "increasing and uniform regulatory action to reduce greenhouse gas emissions" according to AMP Capitals' Head of Investment Strategy and Chief Economist Shane Oliver[3]. Future climate policy will inevitably affect a wide range of business activities, including increased electricity prices, tradable emission permits and carbon taxes, technology transformations, mandatory emission and energy standards, and targets to reduce emissions. In capital-intensive industries, where turnover for replacing equipment can take decades and cost hundreds of millions of dollars, this lack of long-term regulatory certainty raises questions of sovereign risk to investments and stranded assets. This uncertainty will grow in the future, as debate on how to tackle the problem intensifies, and emissions reductions beyond the first commitment period of the Kyoto Protocol remain unknown.

This issue is particularly acute in the electricity sector where uncertainty about the future direction of climate change policy and future carbon pricing mechanisms impedes and delays optimal decision making on the new infrastructure that is needed to meet growing electricity demand. A delay in new electricity infrastructure development has economy wide implications.

The lack of a nationally consistent regulatory framework to respond to climate change is driving various levels of governments to pursue different and changing policies. As the climate issue become of greater concern across community, political and media circles, governments are moving to introduce an even greater variety of initiatives, responses, inquiries, programmes, funding and R&D schemes, this patchwork only increases regulatory complexity and costs to business. The various government expenditure programmes at a State and Federal level amount to billions of dollars. Paradoxically, policy is becoming more uncertain as the issue gathers pace.

At the national level, energy policy in a state of flux. The Government's Energy White Paper, released in 2004 provides insufficient certainty. The Government has this year announced an inquiry into the nuclear industry, including the potential for nuclear power, an inquiry into the potential for geo-sequestration, and an inquiry into carbon trading.

The Federal Government, the States and local Governments are pursuing different policies on

climate change, with the result that business faces the prospect of operating under a multitude of different regulatory requirements. In response to what they perceive as a lack of national leadership, the States have proposed a state-based carbon emissions trading market, and Victoria and NSW are introducing legislation to increase the share of renewable energy.

In a report to the Business Council of Australia, Port Jackson Partners states that: *"The very different greenhouse policies and stated intentions by various governments are a major impediment to investment in [energy] generation. Indeed, it could over time be the largest impediment"*[4]

The Energy Supply Association of Australia (ESAA) concludes[5] that *"One of the most significant policy challenges facing the stationary energy sector is the future treatment of greenhouse gas emissions. While currently there are few direct financial implications from emitting greenhouse gases, an uncertain future policy environment for greenhouse gas abatement means that decisions on the technology and fuel type for new and refurbished generation facilities are very difficult. Achieving greater clarity on greenhouse gas emission policy in Australia during the period to 2030 and beyond is therefore very important in securing timely and appropriate investment in new baseload generation capacity"*.

AMP Capital Investors concludes that[6] *"The long lifespan of power generation infrastructure results in significant inertia to change and changes to the sector will have to start immediately to avoid stranded assets or significant step change impacts on the sector and the economy. There will be increasing pressure to shut-down older and higher emission intensity power sectors…Long-term targets with respect to improvements in energy efficiency, renewable energy and greenhouse gas emissions and strong policy mechanisms (ie emissions trading) are needed to facilitate the appropriate private sector investment if significant cuts in greenhouse gas emissions are to be achieved in Australia. Given the required near term investment in the sector, there is a significant level of regulatory risks for investments in long-life assets, if these policies are not developed as a matter of urgency."*

In this environment, how should investors factor future carbon constraints into their decision making, especially for long-lived assets such as energy infrastructure? In other countries, carbon emissions trading schemes and long-term emission reduction targets are helping to provide investors with certainty about future energy costs.

An important additional complexity of regulation is the often fast –paced nature of international rules and regulations that impact on Australian business, particularly those with global exposure. Recent proposals raised by the French Government to tax or levy imports from non-Kyoto signatories highlight that Australian businesses could face a form of 'carbon trade levy' due to the national policy.

Baker and McKenzie warns that the rapid emergence of climate laws in a range of jurisdictions means that companies must be aware of:

- any existing laws
- the extent to which they will impact on the day-to-day operations of a company, including any liabilities imposed or pending
- how they affect mergers, acquisitions, fundraising, market capitalisation, investments and new projects

- the opportunities they present in terms of cost reductions, climate competitive products, the creation of carbon assets, access to carbon finance and boosting the value of company goodwill, and
- that they will need to manage these issues in the most appropriate manner[7].

A recent report by the Global Framework for Climate Risk Disclosure[8], a group of leading investors from around the world, lists four elements of disclosure that are needed:

- total historical, current, and projected greenhouse gas emissions
- strategic analysis of climate risk and emissions management
- assessment of physical risks of climate change
- analysis of risk related to the regulation of greenhouse gas emissions.

The investors strongly encouraged companies to apply this new framework through existing reporting mechanisms such as:

- mandatory financial reporting
- The Carbon Disclosure Project
- The Global Reporting Initiative, and
- other forms of disclosure such as analyst briefings and sustainability reports[9].

THE AUSTRALIA NEW ZEALAND CARBON DISCLOSURE PROJECT 2006

In 2006 the Carbon Disclosure Project asked 225 Australian and New Zealand investors for investment relevant information about their greenhouse gas emissions and climate change stance. These were their findings:

- There is overwhelming evidence that human activities are causing climate change, the impacts of which will affect many aspects of our lives and economies.
- Climate change can significantly impact investment value.
- The nature and extent of exposure to climate change related risks and opportunities varies between companies and, most significantly, between industry sectors.
- Australian and New Zealand companies are responsive to investor interest in climate change related issues.
- Companies are generally aware of climate change related risks, but implementation appears limited.
- Regulatory uncertainty is an issue for many companies.
- Strategic and financial impacts of future climate change regulation are complicated and difficult to quantify for many companies.
- Extreme weather events and other physical risks significantly impact (often adversely) many Australian and New Zealand companies.
- The majority of companies do not have clearly defined internal accountabilities for climate change related issues.
- Few companies fully quantify and verify emissions from owned and controlled entities.
- Most emission reduction initiatives do not have clearly defined targets and timelines.
- Low participation in emissions trading schemes. Few companies demonstrated a sophisticated understanding of the implications of energy pricing changes on profitability.

— *Carbon Disclosure Report 2006 Australia & New Zealand.* The Investor Group on Climate Change (IGCC) represents total funds under management of $200 billion. Respondent companies to the survey covered 57% of Australian companies and 39% for New Zealand companies.

Insight into company responses

% of respondents	Response
94%	Recognise the potential for climate change related issues to impact future earnings, liabilities or the company's general risk profile
83%	Recognise physical risks associated with climate change (e.g. drought, extreme weather events) that impact upon their business operations
31%	Have established clear internal accountabilities for climate change related issues
9%	Fully disclosed their emissions profile from owned and controlled entities (with 3rd party verification)
9%	Have established formal GHG emission reduction targets with clearly articulated timelines
9%	Provided quantified total energy costs and demonstrated a clear understanding of potential impact on profitability of changes in energy pricing

COMPETITIVE RISK AND OPPORTUNITIES

"WE BELIEVE THAT CLIMATE CHANGE, AND THE NEED TO CUT GLOBAL GREENHOUSE GAS EMISSIONS, IS UNIVERSALLY ACKNOWLEDGED AS POSING VARIOUS RISKS TO BUSINESS. IN A CARBON-CONSTRAINED MARKETPLACE, GREENHOUSE GAS EMISSIONS WILL BECOME FINANCIAL LIABILITIES ON MANY COMPANIES' BALANCE SHEETS. AT THE SAME TIME, CARBON IS BECOMING A TRADABLE COMMODITY, ALLOWING COMPANIES TO HEDGE THEIR RISKS, PROFIT FROM EMISSIONS ASSETS AND TURN THIS NEW DISCIPLINE INTO A COMPETITIVE ADVANTAGE."

— David Morgan, Chief Executive, Westpac Bank 2004[10]

As climate change has emerged as a business risk, the move to a carbon-constrained economy is ushering in opportunities. There is a growing consensus amongst global companies that taking concerted action on climate change represents strategic opportunities — such as building new markets, corporate positioning, gaining regulatory intelligence, and competitive advantage. For example, the recent explosion of billion-dollar opportunities in carbon trading and clean energy markets. These two sectors have a combined annual market in excess of AUS$100 billion and are driven mainly by the private sector.

For the business sector, climate change has moved beyond a neutral issue and is creating an arena of winners and losers. Companies that fail to rise to the challenge of reducing greenhouse emissions may find themselves at a competitive disadvantage.

PriceWaterhouseCoopers is concerned about economic impacts[11]. *"It is also critical for corporations to be aware of the way in which global capital — especially within the investment and insurance industries — is reassessing investments for carbon risk, and the growing reluctance of shareholders to tolerate corporate non performance on greenhouse matter"*, it states.

Policy and regulatory responses to climate change are being developed at all levels of government around the world. For example, 49 countries have renewable energy laws, and 165 countries have ratified the Kyoto Protocol. Australia's pace of change in economic restructuring lags behind that of almost all other OECD countries, however, and places our businesses at a potential competitive disadvantage in new markets.

The International Energy Agency in its review of Australia's energy policy concludes that while Australia's policy has some benefits[12], *"A [carbon emission] trading system is an effective means of introducing a price signal and fits in well with the Country's overall market approach... While some other industrialised countries and their industries develop the institutions and experience with emissions trading and project-based crediting mechanisms, Australia does not … it could be argued that at some point in the future Australian industry may need to compete with other firms that have already developed significant expertise."*

The Carbon Disclosure Project (CDP)[13] 2005 found that parallel regulations and policies had emerged in multiple non-Kyoto countries, and warned that this portended a shift towards a carbon-constrained economy. Thiry-five per cent of Fortune 500 companies it canvassed reported taking early action in emissions trading. It noted that: *"Many companies have wasted no time positioning themselves to be winners under the new carbon regulations"* and that each industry sector seemed to contain a vanguard of leading firms.

In March 2005, PriceWaterhouseCoopers detailed the risks and opportunities that were likely to accompany the introduction of the European Emissions Trading Scheme[14]. Their report predicted that the scheme would add more than €15 billion (AU$25 billion) of assets and liabilities to company balance sheets in 2005 (at March 2005 prices), and that price changes could lead to significant volatility in earnings.

CARBON OPPORTUNITIES

"COMPANIES THAT DO NOT RISE QUICKLY TO THIS CHALLENGE MAY ULTIMATELY PLACE SHAREHOLDER VALUE AT RISK."

— PriceWaterhouseCoopers 2005.

Next to regulations that limit greenhouse gas emissions, placing a price on carbon is the principal macro-economic driver of a wide array of market opportunities. It is forecast that in the not too distant future, carbon is likely to be one of the world's biggest commodity markets. The Head of the UNFCCC recently stated that the CDM mechanism of the Kyoto Protocol could generate annual turnover of AU$133 billion in "green investment flow to developing countries"[15]. There is no national carbon market in Australia to date.

The global carbon market has exploded in the last two years, largely driven by the Kyoto Protocol and the introduction of the European Union Emissions Trading Scheme. The carbon market was worth over US$10 billion (AU$13 billion) in 2005. In the period to September 2006, overall transactions were worth US$22 billion (AU$29 billion)[16].

The Clean Development Mechanism has 750 projects in the pipeline across 58 countries, with a value to the developing world of US$0.9 billion (AU$1.2 billion) in the first quarter of 2006[17]. This market is forecast to leverage investment of $133 billion by 2012.

A substantial body of companies has grown up around these markets to provide services in trading, broking, consulting, legal assistance, risk management, monitoring, verification, validation, information technology, software development and project development.

These volumes indicate not just the opportunities for investment in emission reductions, but also the potential competitive risk for investors.

In Australia, one sector that could benefit is the agriculture sector. Analysis by the Climate Institute and Allens Consulting shows that farmers could receive an annual income of $2.5 billion dollars[18] if the Kyoto Protocol was signed and a domestic emissions trading scheme was in place.

CLEAN ENERGY MARKETS

Clean energy technologies are the main beneficiaries of climate change policies. In 2005, the global market for clean energy was US$56 billion (AU$74 billion)[19]. Worldwide employment in this sector was 1.7 million. Valuation of listed renewables companies doubled in 2005 to AU$65 billion.

From 2005 to 2015, the annual market of the four leading technologies in the clean energy sector is predicted to grow fourfold — from US$39.9 (AU$53.2) per annum to US$167.2 billion (AU$223 billion) per annum.

The global wind business — one of the leading technologies — is predicted to be worth AU$359 billion by 2015.

A recent trend has been the rise in prominence of US and Asian clean energy markets. China topped the global league table of investment at $9.2 billion in 2005, and the market for renewable energy there is estimated to be US$200 billion (AU$266 billion) in the next 15 years. China already has 40 million households with solar collectors.

CORPORATE RESPONSIBILITY RISK

"FIRST IT WAS TOBACCO AND ASBESTOS. THEN IT WAS THE TURN OF THE FOOD SECTOR. NOW LITIGATORS HAVE A NEW TARGET IN THEIR SIGHTS; THOSE RESPONSIBLE FOR CLIMATE CHANGE."

— Financial Times, July 2003[20]

A refusal by corporations to respond appropriately to increasing evidence of climate change may constitute a breach of fiduciary duty and deter institutional investors. Shareholders are attempting to force companies to disclose their contribution to climate change and lower their greenhouse emissions. Non-performing corporations may face litigation or suffer damage to their reputation or brand-name. Company directors and officers therefore have a duty of care to inform themselves of material risks and consequential losses that climate change could pose to their business, and to factor these into decision-making.

There is increasing awareness of the threat of litigation based on a company or nation's record on climate change. In July 2003, the Climate Action Network Australia served notice to the directors of over 130 major Australian companies about the risks presented by climate change and their legal obligations to deal with those risks appropriately[21].

Professor Joseph Smith, University of Adelaide[22] concluded that *"The potential grounds of liability are now quiet clear and the scientific evidence is at a point where, in many cases, it is sufficient to meet legal requirements regarding civil standards of proof. This is an issue that companies in high-risk industries world-wide need to be monitoring closely, particularly in view of recent developments in the US."*

Shareholders are growing increasingly intolerant of corporate non-performance on greenhouse gas emissions. According to the Environmental Grantmakers Association, investors filed climate change-related resolutions with 25 companies this year, including ExxonMobil, General Motors, Peabody, Liberty Property Trust, Standard Pacific and Whole Foods[23].

In September 2006 California filed a law suit in the US District Court against six major car manufacturers seeking monetary damages for their alleged contribution to global warming and the harm it is causing California's environment, economy and public health. In March, the US Supreme Court allowed an appeal to proceed against the US Environment Protection Agency over an alleged failure to regulate greenhouse gas emissions, setting up what could be one of the Court's most important environmental decisions to date[24].

Ceres[26] launched and coordinates the Investor Network on Climate Risk (INCR), an alliance of 48 leading US and European institutional investors, with assets of over US$2.7 trillion. Through INCR, Ceres has mobilised major institutional investors to press companies for climate risk analysis and disclosure. The Ceres Sustainable Governance Project 2005[25] stated that: *"in the absence of preventative and adaptive measures [to climate change], multi-billion dollar financial losses are distinctly possible if not probable… The more information on climate-related damage accumulates, the more the refusal to examine these risks carries the potential for breach of fiduciary duty."*

Baker & McKenzie covers the issue of climate litigation in some detail and canvasses the option of apportioning liability according to a product's carbon content or market share. It suggests that there are *"numerous potential avenues from which climate related litigation could emerge, including tort law, trade practices law and corporations law,"* and regards general state environmental legislation as a real basis for legal action[26].

Companies that actively lobby against legislative measures to lower their emissions, or try to frustrate measures to reduce global warming and address climate change, face an even higher risk of attracting the attention of potential litigants and NGOs. Conversely, companies that take steps to mitigate climate risk may create a competitive advantage over the rest of their sector.

Failure to act on climate change can affect the reputation of a company. A consultancy report released in 2002 suggested that ExxonMobil faced losses of US$2-$3 billion through damage to its brand due to its position on climate change, and further losses of US$10-50 billion in areas such as staff motivation and political access because of its damaged reputation[27].

SOCIAL RISK

Companies are susceptible to shifts in two key social trends: media coverage and public opinion, both of which drive policy and political agendas. Both have changed markedly in recent months.

Media coverage of climate change in Australia is at an all time high. A global spike in the quality and quantity of media coverage of climate change has helped to bring climate change to the forefront of public awareness. The international trend picked up pace at the Montreal Kyoto meeting 12 months ago, the first Kyoto meeting held in North America. Not only did this coverage far exceed that of past years, but it also included far more in-depth, explanatory and comprehensive articles across all aspects of the issue.

In the US, nearly 600 stories ran on the issue in The New York Times and The Washington Post in 2005 alone. This coverage has helped tip the issue to a new level of public awareness, particularly as the US lagged behind other developed nations. Given that the US media is syndicated and distributed globally and is the most widely available free on-line, its penetration is far greater than that of other national media.

Globally, a 2006 Angus Reid Global Scan poll covering 30 countries found that 65% of those polled thought that global warming was a very serious problem while 25% thought it was a somewhat serious problem[28].

Recent polling in Australia by the Lowy Institute found that 68% of the public believe *"global warming is a serious and pressing problem"*[29], results that are reflected in other national polls.

PHYSICAL RISK

"IN AUSTRALIA, THE MOST VULNERABLE REGIONS THAT CAN BE IDENTIFIED AND GIVEN PRIORITY FOR ADAPTATION PLANNING ARE CAIRNS AND THE GREAT BARRIER REEF, THE MURRAY-DARLING BASIN, AND SOUTH-WESTERN WESTERN AUSTRALIA. OTHER VULNERABLE AREAS AND COMMUNITIES INCLUDE LOW-LYING COASTAL AREAS, TROPICAL AND SUB-TROPICAL POPULATION CENTRES, ALPINE REGIONS, CENTRES WITH A HIGH DEPENDENCE ON AGRICULTURAL AND/OR ECO-TOURISM ACTIVITIES, REMOTE INDIGENOUS COMMUNITIES, AND AREAS OF SOUTHERN AUSTRALIA FACING ACUTE WATER SHORTAGES AND SUPPLY CONSTRAINTS".

— Australian Greenhouse Office 2005[30]

As a hot, dry country with environmental extremes, Australia is more vulnerable than most developed nations to the physical impacts of climate change, affecting all investors — from institutional to personal — who face significant risk in measuring the security of their assets. This is most readily apparent in agriculture, with the consequences of the recent drought and tropical cyclone Larry.

The Greenhouse Office warns that: *"Any climate change signal will be overlaid on an Australian climate that is already highly variable and where there is more work to do in identifying and attributing such changes as have already happened"*. Recent climate events, such as the drought conditions affecting Australia, heatwaves, bushfires, storms and the hurricane events of Florida and the Caribbean, have taught us what sorts of stresses will be placed on natural and human systems by a climate driven by progressively warmer temperatures[31].

Examples of these risks include:

- In Australia's $32 billion tourism industry, which is highly climate dependent, a 2-3°C increase in temperature could cause bleaching in 97% of the coral on the Great Barrier Reef, and threaten a destination worth $1.5 billion.
- The $17 billion livestock export industry faces risks from more heat stress, more pests and disease, and a temperature increase of 2°C would cut national carrying capacity by 40%. Agriculture overall represents a $72 billion dollar industry, and the recent drought - which was exacerbated by climate change — has cost the country over $6 billion to date.
- Water flows in the Murray-Darling Basin and to Melbourne would drop by about 15% with a 2°C increase in temperature. If irrigation allocations were reduced by 20%, GDP would fall by around $750 million in 2009/10[32].

HEAT AND HEATWAVES

- 2005 was the world's and also Australia's warmest year on record[33]. Australian mean temperatures have increased by approximately 0.9°C since 1910[34].
- The rise in mean temperatures will increase the probability of heatwaves. From 1-22 February 2004, eastern Australia experienced mean maximum temperatures 5-6°C above average during a heatwave, reaching up to 7°C above average in parts of NSW. The number of successive hot days and nights set a new record[35].

WATER

- Every major mainland city in Australia already faces severe water stress, with the impacts of lower than average rainfall exacerbated by higher rates of evaporation because of higher temperatures.
- After several major droughts, water availability has become a controversial topic in Australia. The water supply in Goulburn in NSW has been below 40% since March 2004, and dropped to about 10% in May 2005. The city has had Level 5 water restrictions in place since October 2004.
- CSIRO research predicts that winter-spring rainfall will decrease over the southern half of Australia. As reductions in water supply are more likely there than in the north, competition for water will increase. Evaporation will increase, which means that moisture balance (rainfall minus evaporation) will decrease across most of Australia[36].
- According to CSIRO projections, annual average rainfall is likely to decrease in the south-west of Australia by as much as 20% by 2030.[37].

SEA LEVEL RISE

- Global average sea level rose by 10-20 cm over the 20th century, and is projected to rise by between 9 and 88 cm by 2100.
- In 2003 the Australian Greenhouse Office warned that: *"sea level rise linked with increasing intensity of tropical cyclones and storm surges could put some population and tourist centres such as Cairns, Broome, Darwin and Townsville, as well as remote communities, at considerably increased risk."*

STORMS

- Tropical cyclones are expected to become more intense with higher peak winds and rainfall intensities[38].
- Northern Australia experienced two category 5 cyclones in 2006 — Larry and Monica. There has been more category 4 and 5 cyclones in recent years. CSIRO modelling shows that cyclones will become stronger under the effects of climate change; stronger cyclones will greatly increase coastal inundation, coral damage, and property damage and beach erosion.

BUSHFIRES

- A CSIRO report into climate change impacts on fire weather in south-east Australia projects a combined increase of 4-25% by 2020 in the days with very high and extreme Forest Fire Danger Index ratings across 17 sites in south-east Australia. For example, Canberra is likely to have an annual average of 25.6-28.6 very high or extreme fire danger days by 2020 and 27.9-38.3 days by 2050, compared to a present average of 23.1 days[39].

DROUGHT

- Further warming will mean that droughts will "inexorably intensify"[40]. The 2002 and current drought's severity and impacts are exacerbated by high temperatures concurrent with low rainfall, with enhanced evaporation a contributory factor.

SNOW DECLINE

- Snow coverage is expected to decrease in the Australian Alps because of climate change. This is discussed further in the Tourism section.

SPECIFIC SECTORS

FINANCE

"AUSTRALIAN SUPERANNUATION FUNDS IN PARTICULAR, WHICH ARE LARGE AND LONG-TERM INVESTORS AND COLLECTIVELY OWN SIGNIFICANT SLICES OF THE INVESTMENT MARKET, HELD $574 BILLION IN ASSETS IN 2004. AUSTRALIA AND NEW ZEALAND INVESTORS GROUP ON CLIMATE CHANGE (IGCC) BELIEVES THAT ANY IMPACT OF CLIMATE CHANGE ON THE COMPANIES COMPRISING THESE ASSETS WILL SIGNIFICANTLY AFFECT THE PERFORMANCE OF THE FUNDS".

— Bob Welsh, Chairman, Investor Group on Climate Change

According to Mercer Investment, consulting for the Australian Investor Group on Climate Change, *"The impact of climate change will be felt directly by investors — rising sea levels, droughts, floods and the possibility of sudden major climatic events — in terms of damage to agriculture, forestry, water and real estate, and the profitability of Australian markets and companies".*[41]

The Carbon Disclosure Project, which is perhaps the most significant initiative to identify risks to the finance community, is raising awareness of climate change among investors and the firms in which they invest. This report has been summarised in the chapter on regulatory risk.

ENERGY INFRASTRUCTURE

"RELIANCE ON CARBON CAPTURE AND STORAGE TECHNOLOGY TO MEET ALL THE DESIRED CUTS BY 2050 APPEARS TO HAVE A HIGH LEVEL OF RISK, AS IT REQUIRES NEARLY THE WHOLESALE REPLACEMENT OF GENERATION CAPACITY POST 2030 AND LIMITING THE LIFE OF ANY EXISTING GENERATING PLANT TO 30 YEARS. THEREFORE, OTHER TECHNOLOGIES OR APPROACHES WILL BE REQUIRED TO ACHIEVE ANY EMISSION TARGETS…. IT IS LIKELY THAT [A BUSINESS AS USUAL] APPROACH [IN AUSTRALIA] WOULD LEAD TO A NEGATIVE RESPONSE FROM OTHER COUNTRIES, CAUSING SIGNIFICANT MARKET RISK FOR EXPORT-ORIENTED, RESOURCE-BASED COMPANIES. THEREFORE, IN CONSIDERING THE FUTURE FOR THE POWER GENERATION SECTOR, IT IS IMPORTANT FOR INVESTORS TO CONSIDER POTENTIAL GREENHOUSE GAS EMISSION CONSTRAINTS ON THE INDUSTRY".

— AMP Capital Investors 2005[42]

The Energy Networks Association values the assets of Australia's electricity and gas distribution network at $28 billion. Network businesses undertake $2 billion per year in capital investment for network reinforcement[43].

According to the Australian Bureau of Agricultural and Resource Economics, electricity consumption is projected to grow by 73% by 2029-30[44]. The energy sector generates more greenhouse emissions than any other sector.

The Energy Supply Association of Australia (ESAA) believes that over $30 billion would need to be invested in additional capacity to meet energy demand growth over the next 15 years, over $10 billion of it for electricity infrastructure[45].

Energy use for purposes such as electricity generation and transport is the largest contributor to Australian greenhouse gas emissions, accounting for 68% of Australia's emissions in the 2004 National Greenhouse Gas Inventory[46].

CSIRO has identified an upward trend of 0.15°C per decade in NSW maximum temperatures from 1950 to 2003. Continued increases, combined with rising air-conditioner use, may contribute to higher summer demand peaks with consequent risk for network operators and network asset owners.

In March 2005, ESAA acknowledged that the future treatment of greenhouse gas emissions was one of the most significant policy challenges facing the stationary energy sector in Australia. It warned that *"While currently there are now few direct financial implications from emitting greenhouse gases, an uncertain future policy environment for greenhouse gas abatement means that decisions on the technology and fuel type for new and refurbished generation facilities are very difficult"*[47].

The Business Council of Australia has identified infrastructure as a key issue for its members, and expressed similar concern over regulatory uncertainty *"Greenhouse policies differ between jurisdictions, favour different technologies/portfolios and create investment uncertainty"*[48].

A 2005 AMP Capital Investors report into the risk to power sector investments from climate change listed existing risks as further competition, changes in electricity demand profile and water access constraints for new generating plants, and saw Australia's need to curb and eventually decrease its greenhouse gas emissions as a significant additional risk[49].

The report stated that:

- The Australian power generation sector will need to change significantly if Australia is to achieve even modest emission reductions. Depending on the nature and timing of government climate change policy, these changes will bring some significant negative and positive risks to investors.
- The long lifespan of power generation infrastructure means that changes to the sector must begin immediately to avoid stranded assets or significant step-change impacts on the sector and the economy. There will be increasing pressure to shut down older and higher-emission intensity power sectors.
- As emission intensity of new power stations would need to be less than 300 T CO_2/WG-hr, investment in coal-fired generation will be subject to significant downside risk.
- If Australia is to maintain greenhouse gas emissions at even 2004 levels, it will be almost impossible for conventional coal-fired power stations to contribute additional generation. However, natural gas emission infrastructure and generation would appear to have a significant upside.

- Demand-side management, energy efficiency and renewable strategies would benefit from a multifaceted holistic government policy approach to minimise the risk to investors and the economy in general.

In October 2003, the NSW Planning Minister rejected the proposed Redbank II waste coal power station on the grounds that its greenhouse gas emissions would be too high.

In light of the investment required and the risks involved, regulatory uncertainty poses a threat to the energy sector. In its 2004-5 annual review, ESAA sounded this warning: *…the industry position [is] that a single, national greenhouse gas abatement policy is needed that delivers investor confidence in the long term*. Its Chairman named greenhouse gas emissions policy as perhaps the industry's largest single challenge[50].

In their joint report, AGL, Frontier Economics and WWF canvassed approaches to uncertainty. It concluded that emission reductions needed to be pursued at a reasonable rate in order to limit the risk of stranding existing capital[51].

PROPERTY

Property is at risk, not only from the physical impact of climate change, but also from new building industry regulations covering energy efficiency and mandatory disclosure of energy efficiency rating, and a growing demand for greener buildings.

Climate change exposes property to physical impacts — such as higher wind speeds, storms, storm surges, bushfire, floods and hail — and the building industry to regulatory impacts such as climate change mitigation policies that affect transport or building energy efficiency.

$1,500 billion of Australia's wealth is locked up in homes, commercial buildings, ports and other physical assets[52].

Listed property trusts have a market capitalisation of $75 billion, making up 9.6% of the S&P/ASX200 Index. Rainmaker data shows that in December 2004 Australian superannuation funds had $131 billion invested in property, with $91 billion in unlisted property investment and $40 billion in property securities Insurance Australia Group.

Current Australian energy efficiency regulation includes the national Building Code of Australia (BCA), which prescribes minimum-performance energy efficiency design measures for new residential and commercial buildings.

NSW, Victoria, SA, the ACT and Queensland have each implemented separate and additional energy and water efficiency requirements such as solar hot water systems, energy efficient lighting, rainwater tanks and efficient water fixtures in new residential housing. Building industry regulators are also moving towards mandatory disclosure of energy efficiency rating, with the ACT trialling a point-of-sale disclosure scheme.

In addition to government requirements, large listed companies with a position on corporate social responsibility are demanding greener buildings. HSBC, ABN Amro and Swiss Re have committed to carbon-neutral global businesses, and firms such as Lend Lease, AMP Capital, Westpac and EnergyAustralia have established offices in buildings with 4-5 stars under the Australian Building Greenhouse Rating scheme[53].

TOURISM

Australia's $32 billion tourism industry is highly climate dependent. Coral reefs are endangered by coral bleaching, ski resorts by shrinking snow coverage, and Kakadu freshwater wetlands by rising sea levels.

Tourism is a critical industry to the national economy — it is one of Australia's highest export earners and stimulates nationwide development. In all, the $32 billion Australian tourism industry employs 6% of the population directly and a further 10% indirectly, and earns over 12% of total export dollars. The Great Barrier Reef alone supports a $1.5 billion industry.

A 2-3°C increase in temperature could cause bleaching in 97% of the coral on the Great Barrier Reef and threaten a $1.5 billion industry.

The snow industry in NSW and Victoria generate a total gross expenditure of almost $1 billion[54]. A CSIRO study commissioned by the snow tourism industry found a 95% likelihood that alpine area with at least 60 days of snow cover would shrink 18-60% by 2020. This would reduce the average ski season by 5 to 40 days[55]. Snow cover is set to shrink by 38-96% by 2050.

AGRICULTURE

"THE NFF BELIEVES [CLIMATE CHANGE] WILL POSSIBLY BE THE BIGGEST RISK FACING FARMERS IN THE COMING CENTURY".

— National Farmers' Federation 2006[56]

The agricultural sector faces significant challenges as climate change takes hold. Changes in rainfall patterns, evaporation,water availability and drought, and in the spread of pests and disease will affect many primary producers.

In 2006, CSIRO warned that *"changes in precipitation and subsequent water management are critical factors affecting the future productivity of the Australian landscape. The declines in precipitation projected over much of Australia will exacerbate existing challenges to water availability and quality for agriculture as well as for commercial and residential uses"*[57].

- 2005 was the warmest year on record across Australia, with the mean temperature 1.09°C above the 1961-1990 average[58].
- The rate of temperature increase has been faster in recent decades. Since 1976, temperatures have risen at the rate of 0.18°C per decade. In the 1990s, the rate was faster again, with the northern hemisphere warming by 0.38°C and the southern hemisphere by 0.23°C[59].
- The warming across Australia has been accompanied by declines in regional precipitation over the past 50 years, particularly along the east and south-west coasts[60].
- The CSIRO projects that most of Australia will see an annual average temperature increase of 0.4 to 2°C by 2030, and 1 to 6°C by 2070[61].
- CSIRO projects potential increases and decreases in drought frequency of south-east NSW. Most climate models show that rainfall will decrease over this region which could indicate

that drought frequency could increase from the current average of 3 drought years per decade to around 4 drought years per decade by 2030 (30% increase). By 2070 this could have increased to around 8 drought years per decade (around 160% increase) i.e. droughts in 8 out of every 10 years.

- In Victoria, decreases in average rainfall conditions may be associated with an increase in the frequency of the occurrence of dry years and decrease in frequency of wet years. Analysis shows a doubling of frequency of dry springs (defined as a one in ten year dry event for current climate) across most of the state and doubling of dry winters in the north of the State. Droughts would be extended beyond the season.
- CSIRO rainfall projections[62] for New South Wales and northern Victoria show changes in the seasonal distribution of rainfall with a much clearer tendency towards decreasing spring-time rainfall, and a tendency towards decreased winter rainfall. Summer and autumn seem to hold a greater possibility of rainfall increases, although these may be in the form of shorter, heavier rainfalls.
- The CSIRO projects a trend for less rain in the South East and more rain in the North West, and in other parts more unpredictable pattern changes.[63]

INSURANCE AND REINSURANCE

"AS GLOBAL WARMING CONTINUES, THE ANNUAL TOLL COULD REACH $150 BILLION IN THE NEXT 10 YEARS — AND $300 BILLION A YEAR BY 2050. FRENCH INSURANCE COMPANY AXA ESTIMATES THAT ABOUT 20 PERCENT OF GLOBAL GDP IS NOW AFFECTED BY CLIMATIC EVENTS, AND THAT "CLIMATIC RISK IN NUMEROUS BRANCHES OF INDUSTRY IS MORE IMPORTANT THAN THE RISK OF INTEREST RATES OR FOREIGN EXCHANGE RISK".

— Investor Network on Climate Risk 2004[64]

Global insured losses from weather-related natural catastrophes have been steadily increasing over the last few decades, and dominate the list of the largest insured losses.

Munich Re cautions risk carriers not to wait until science has provided answers to all the relevant questions about climate change because it will not be able to do so in the short term[65].

Pointing to a record typhoon season in Asia, Lloyd's warns insurers to be prepared for increased frequency of extreme storms not just in the Atlantic but around the world; *"With higher temperatures creating the right conditions for storm formation, we can also expect windstorm seasons to lengthen, causing the insurance industry to be "on risk" for longer each year. For example the recent tropical cyclone Monica which hit Australia was the most intense cyclone in southern hemisphere history and yet it occurred at a time when the season is usually all but over".*[66]

Munich Re reports that roughly half of all the loss events recorded in 2005 were windstorms, with costs to the world's economies exceeding US$185 billion[67]. In the Atlantic, 27 tropical storms and hurricanes broke all meteorological and monetary records, including the previous record year of 2004. These and other weather catastrophes, including floods in India, drought in

the Amazon, and the driest conditions in 100 years in Portugal and Spain, led Munich Re to observe that *"All loss records were broken in 2005, which finally led to the climate change debate taking on a new quality."*

The frequency of storm events is predicted to increase. The Insurance Australia Group's experience indicates that a wind speed increase of 25% leads to a 650% increase in building-related damage. IAG also points to the likelihood of increases in damage from floods, bushfires and hailstorms, which account for a higher proportion of Australian damages than occurs internationally. It further notes that 80% of Australia's population live within 50 km of the coast, where events such as flooding and storms are more common.

In terms of estimated insurance losses, Sydney's April 1999 hailstorm was Australia's most costly natural disaster since 1967. Insured losses in 2001 prices were estimated at almost $1.7 billion. More events like this will increase insurance premiums dramatically.

In 2006, Lloyd's chided industry for not taking changing catastrophe trends seriously enough, and warned insurers to face up to the challenge of climate change. Its report suggests that climate impacts — e.g., rising sea surface temperatures which will drive increased hurricane activity; and potential melting of ice sheets, which will increase the likelihood of storm surge damage — could have significant negative impacts on the industry.

Lloyd's urges insurers to move beyond traditional approaches to risk assessment based only on past trends. *"insurers must plan for a higher frequency of extreme events, over a longer storm season and over a wider geographical area…We foresee an increasing possibility of attributing weather losses to man-made factors, with courts seeking to assign liability and compensation for claims of damage."*[68]

The insurance giant sees effective partnership with business and government as crucial to managing risk. It boldly states that, if the insurance industry is to survive, it must start to actively adapt in response to greenhouse gas trends.

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