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INQUIRY INTO RECENT TRENDS IN AND PREPAREDNESS FOR EXTREME WEATHER EVENTS

Established in late 2005, The Climate Institute is a non-partisan, independent research organisation that works with community, business and government to catalyse and drive the change and innovation needed for a low pollution economy and culture.

Our vision is for a resilient Australia prospering in a zero carbon global economy, participating fully and fairly in international climate change solutions.

The Climate Institute (TCI) welcomes this opportunity to submit our views on extreme weather and climate change. The Climate Institute has investigated various aspects of these related issues, and has produced the following research reports (attached):

+ *Coming Ready or Not: managing climate risks to Australia's infrastructure* (2012). This report synthesizes information on the physical impacts and consequences of climate change on major infrastructure. It analyses preparations for climate change impacts in Australia among owners and operators of major infrastructure assets, and recommends four-step action plans for Government and business.

+ *A Climate of Suffering: the real costs of living with inaction on climate change* (2011). This examines the likely consequences for mental health and community wellbeing in the wake of extreme weather and climate change.

+ *Bushfire Weather in Southeast Australia: Recent Trends and Projected Climate Change Impacts* (2007). This analyses the impact of climate change on bushfire risk and finds that fire risk increases exponentially as temperatures rise. It is our understanding that the projections contained in this document are still valid. Even so, we recommend the Committees consult with the authors and their scientific peers to obtain up-to-date thinking and research on the subject.

Below is a brief outline of key findings and recommendations from these reports. We would be pleased to provide the Committees with more information and appear as a witness if called upon.

Key findings

1. Climate change is likely to increase the frequency and/or intensity of various types of extreme weather events. This has the potential to impose significant and potentially unmanageable costs on Australia's infrastructure, economy and society.

2. It is important to recognise not only the physical impacts of extreme weather events, but also the less immediate, less visible costs imposed on societal structures and individuals. The toll of such events on mental health and community well-being is significant, but remains under-recognised.

3. Australia is inadequately prepared for the physical impacts of climate change. Relevant government policy is fragmented and the business response is uneven. Australia still lacks a nationally coordinated approach to managing climate risks to major infrastructure. In the marketplace, laggards face no or little penalty, while early movers are hampered by fragmented information, and inappropriate and inconsistent regulation.

4. The implications of climate impacts for interdependent systems and communities have barely been explored and may be significantly underestimated.

Summary of an Action Plan for Government

1. Refresh the National Climate Change Adaptation Framework to improve inter-jurisdictional coordination in responding to and preparing for increasing climate risk across the economy and society.

2. Expand analysis of cross-sectoral interdependencies vulnerable to climate risk to identify cascading economic and societal consequences.

3. Develop a national adaptation scorecard to measure the degree to which Australia is adapting effectively and report on progress against agreed targets.

4. Deliver leadership through multi-sector collaboration.

1.1 Extreme weather in the context of climate change

A changing climate drives not just warmer but wilder weather. Past weather patterns are no longer a good guide to future risk. As new data has come to hand, and the scientific models have been recalibrated, projections of future climate risk have tended to increase.

The average global temperature is now almost 0.8°C higher than it was at the start of the 20th century. Record hot days now exceed record cold days by almost three to one for daytime temperatures, and five to one for nights. The 2000s is the hottest decade on record, with every decade since 1970 being hotter than the last.

The average temperature for the continent as whole recently ran above 39°C for seven days straight for the first time on record.[1] Australia experienced unusually and extensively hot conditions, with day and night-time temperatures breaking records in many parts of the country. The Bureau of Meteorology recently added new colours—purple and pink—to its weather map to denote temperatures once considered off the scale: 50–52°C and 52–54°C respectively.

[1] BOM, 'Extreme January Heat', *Special Climate Statement 43—Interim*, 14 Jan. 2013.

Heatwaves are part of the Australian experience, but the events of January 2013 are not normal. It is very unusual for extremely hot conditions to persist for so long and cover such a large part of the continent.

Global warming is also changing precipitation patterns across Australia. The south of the continent—where most of us live—has seen a significant decline in average annual rainfall.[2] At the same time, increased water vapour into the air increases the risk of more intense and widespread torrential downpours, particularly in Australia's north.[3] For Queensland, this is likely to spell storms and floods of increasing ferocity over a greater part of the state.[4]

Although not every event can be linked directly to humans' impact on the global climate, the human influence on broad weather patterns is becoming clearer. A recent study by the US National Oceanic and Atmospheric Administration concludes that La Niña-related heatwaves, like the one that struck Texas in 2011, are 20 times more likely than they were 50 years ago. In Britain, extremely cold Decembers are now half as likely, while very warm Novembers (like that of 2011) are now 62 times as likely.[5] In other words, the dice are now clearly loaded in favour of more such events.

According Dr Kevin Trenberth, Senior Scientist, Climate Analysis, with the US National Center for Atmospheric Research, "The answer to the oft-asked question of whether an event is caused by climate change is that it is the wrong question. All weather events are affected by climate change because the environment in which they occur is warmer and moister than it used to be."[6]

Moreover, the risks associated with environmental change are often nonlinear. For example, extreme storm surges that occur, on average, once a century today are likely occur several times a year with only a 10 centimetre sea-level rise. A 50 cm sea-level rise could raise that to 10–1000 times a year, depending on the location.[7] Similarly, bushfire risk in south-eastern Australia increases by 5 per cent with a 1.5°C rise in global temperatures above pre-industrial levels, but by 20 per cent with a 3.4°C increase.[8]

While the extent to which Australia's climate changes this century depends largely on the success of efforts to reduce greenhouse gas emissions, some global warming is already locked in. On present trends, we will emit enough carbon pollution into the air to push the world's temperature up by about 4–6°C above the pre-industrial average by 2100.[9] And if promises countries have already made are not kept, the world could hit the four-degree-mark decades earlier.

To give the world a reasonable chance of staying well below 2°C warming—a goal 167 countries have now signed up to—emissions must peak before 2020 and fall steadily thereafter. Even the path to a 2-degree world is likely to be one plagued by extreme weather events of increasing intensity and frequency. The task now is two-fold: we must manage the unavoidable and avoid the unmanageable.

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[2] CSIRO and BOM, *State of the Climate 2012* (2012), http://www.csiro.au/Outcomes/Climate/Understanding/State-of-the-Climate-2012.aspx.

[3] National Academy of Sciences, *Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia*, Committee on Stabilization Targets for Atmospheric Greenhouse Gas Concentrations, National Academy of Sciences, National Academies Press (Washington, DC: 2010); CSIRO, BOM and DCCEE, 'Climate Change in Australia', website, http://www.climatechangeinaustralia.gov.au/index.php; IPCC, *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, (2007), http://www.ipcc.ch/ipccreports/ar4-wg1.htm.

[4] *Increasing Queensland's resilience to inland flooding in a changing climate: Final Scientific Advisory Group (SAG) Report*, Office of Climate Change, http://www.climatechange.qld.gov.au/whatsbeingdone/queensland/inlandfloodingstudy.html, accessed 11 January 2011.

[5] National Oceanic and Atmospheric Administration, *State of the Climate 2011*, http://www.ncdc.noaa.gov/sotc/national/2011/13

[6] K. Trenberth, 'Framing the way to relate climate extremes to climate change', *Climatic Change*, 115/2 (2012), 283–290.

[7] Geoscience Australia, 'Frequently Asked Questions', *OzCoasts* (2012), http://www.ozcoasts.gov.au/climate/sd_fqa. jsp#impact, accessed 15 September 2012.

[8] Lucas et al., *Bushfire Weather in Southeast Australia: Recent Trends and Projected Climate Change Impacts*, Consultancy report for The Climate Institute (2007).

[9] Potsdam Institute for Climate Impact Research & Climate Analytics**,** *Turn Down the Heat: Why a 4°C World Must be Avoided* (The World Bank: 2012).

2. Climate change imposes significant costs across Australia's economy and society

The discussion below focuses on two very different but ultimately interrelated areas where Australia is highly exposed to the damaging impacts of increasingly extreme weather. Damage to major infrastructure is generally immediate, widely recognised and very costly; however, repair and reconstruction is generally accepted as a high priority. In contrast, damage to human mental health may be immediate but can also grow and linger for long periods of time, often exacerbated by second- and third-order consequences of the original event. The costs of post-traumatic stress, grief, anxiety and depression are severe, but are not addressed.

2.1 Infrastructure

Major infrastructure is exposed to the impacts extreme weather and climate change over multiple decades. As a critical enabler for activity across all sectors of the economy, this exposure may put other parts of society at risk. Infrastructure sectors are interdependent; when one is damaged others may be impaired. These impacts cascade through the economy and are felt broadly throughout the community. Modelling for the 2008 Garnaut Review conservatively estimated that the annual costs of unmitigated climate change on Australia's infrastructure would reach 0.5 per cent of GDP (about $9 billion) in 2020 and 1.2 per cent of GDP ($40 billion) in 2050.[10] Globally, climate change is already costing an estimated $US1.6 trillion per year, rising to over $US4 trillion by 2030.[11] Infrastructure damage is the largest single cost incurred.[12]

Organisations—public and private—that adapt better to climate change are more likely to provide resilient infrastructure and services, while those that do not manage their climate risks will face higher costs. These include the costs of impacts on staff and stakeholders, physical damage and repair, interruptions to supply chains and operations, and insurance and reputational damage.

Preventing dangerous climate change is crucial. As global emissions and temperatures rise, so do the costs of adaptation, and the risks of getting it wrong. For a global temperature rise of less than 2°C, climate impacts must at least be integrated to infrastructure design, construction, maintenance, operations and regulations as a matter of routine. For a world where global warming is greater, we need this and much more: radical realignment of exposed infrastructure, alternative pathways for essential services and dramatic transformation of how and where we live and work.

2.2 Mental health and community wellbeing

Following a severe weather event, a significant part of the community will suffer the debilitating effects of extreme stress, emotional injury and despair. A more hostile climate will likely raise substantially the incidence of post-traumatic stress, anxiety and depression.

The emotional and psychological toll of disasters can linger for months and years, affecting whole families, the capacity for people to work, and the wellbeing of the community. Higher rates of drug and alcohol misuse, violence, family dissolution, and suicide are more likely to follow more extreme weather events. Children and adolescents are particularly vulnerable to pre-disaster anxiety and post-traumatic stress.

Mental illness is already the second largest contributor to the disease burden in Australia, potentially making millions of people more vulnerable to mental ill health in an increasingly hostile climate. The

[10] Ross Garnaut, The Garnaut Climate Change Review, Final Report and Technical Appendices, (Canberra: The Garnaut Climate Change Review, 2008).
[11] DARA and Climate Vulnerable Forum, Climate Vulnerability Monitor: A Guide to the Cold Calculus of a Hot Planet, (2nd edn, 2012) http://daraint.org/climate-vulnerability-monitor/climatevulnerability-monitor-2012/
[12] Mercer, Climate Change Scenarios – Implications for Strategic Asset Allocation (2011), http://www.mercer.com/climatechange.

treatment and management of mental health problems costs taxpayers over $5 billion per year[13], while the cost in lost productivity is estimated at another $2.7 billion—costs set to rise in a changing climate.[14]

Mental health problems also tend to coalesce with economic and social ones, meaning that the overall toll is likely to be larger still. During last decade's prolonged drought, for example, 2004 figures indicate that around one in four rural workers had lost their job—about 100,000 agricultural workers, contractors and those employed in allied businesses.[15] By 2007, dry conditions had eroded Australians' quality of life, in dollar terms, to the tune of approximately $5.4 billion.[16]

Rural, regional, remote, Indigenous and peri-urban communities are particularly exposed in a deteriorating climate. Climate change compounds the chronic difficulties and inequities that already face many of these communities. Climate change will almost certainly increase the demand for social support and mental health services and, at the same time, make it harder to sustain them in affected areas.

3. Australia's readiness for climate change is at best patchy.

Our research into the management of climate risk to Australian infrastructure found the following:

- Government policy is fragmented. Australia still lacks a nationally coordinated approach to managing climate risks to major infrastructure, with much of the burden of policy implementation left to local councils – the least- resourced and most decentralized level of government. Information on Australia's preparedness for likely climate impacts is fragmentary and dispersed.

- The business response is uneven. Some organizations are moving to better understand and manage their exposure to climate risks. However, most infrastructure owners and operators are focused on maintaining their assets to standards based on historic, not future, climate. Laggards face no or little penalty, while early movers are hampered by fragmented information, and inappropriate and inconsistent regulation.

- Infrastructure is highly interdependent, but action on adaptation is isolated at the organizational level. Despite some examples of collaboration, preparation for climate change tends to focus on organization-level risk management. The implications of climate impacts for interdependent systems and communities remain underexplored.

- Concern about climate change has fallen among those sectors most exposed. There is also emerging resistance to adaptive decisions at the community level. This is particularly the case when local planning decisions are inconsistent and poorly communicated and implemented.

The Climate Institute considers the National Adaptation Framework 2007 provides an adequate foundation for government action to improve Australia's readiness for climate change. One of the most important aspects of the Framework is as a tool to drive better coordination of action across all levels of government. However, the lack of progress made in implementing the Framework is deeply concerning. Five years since the Framework was produced it is unacceptable that no further progress has been made on governance than a high level discussion of roles and responsibilities.

[13] Australian Institute of Health and Welfare, Mental health services in Australia 2007-08, Cat. No. HSE 88, (Canberra: AIHW, 2010).
[14] M. F. Hilton et al. 'Using the interaction of mental health symptoms and treatment status to estimate lost employee productivity', Australian and New Zealand Journal of Psychiatry, 44/2 (2010), 151–61.
[15] L. Lu & D. Hedley, 'The impact of the 2002-03 drought on the economy and agricultural employment' [web document] (Canberra: Australian Government Treasury, 2004), http://www.treasury.gov.au/documents/817/HTML/docshell.asp?URL=03_article_2.asp .
[16] N. Carroll, P. Fritjers & M. A. Shields, 'Quantifying the costs of drought: new evidence from life satisfaction data', *Journal of Population Economics*, 20/4 (2007).

4. Interaction and interdependence, and the limits to adaptation

Added to the direct impact of extreme weather events are the indirect or flow-on effects, still poorly understood and too often ignored. To date, thinking on adaptation—and hence such strategies, programmes and policies as there are—has focused on single-sector or single-region assessments, or both. The emphasis is usually on sectors or regions considered largely in isolation from others.

A recent report released by the World Bank, *Turn Down the Heat: Why a 4°C warmer world must be avoided*, notes that "projections of damage costs for climate change impacts typically assess the costs of directly damaged settlements, without taking surrounding infrastructure into account… A better understanding of the potential for such cascading effects, their extent, and potential responses is needed."[17]

Even in the most sophisticated modelling seldom analyses interactions between and within regions and sectors. Also absent from most studies is the interaction between adaptive and mitigatory responses and climate-change impacts; between the biophysical, and the social, the political and the economic.

TCI is unaware of any studies that look at climate change and extreme weather as they interact with key resource, social, environmental, and economic trends. These might include, for instance, aging and immigration, declining ecosystem health, and demand for freshwater. Ignorance of these elements grievously handicaps planning and policy-making. Studies and modelling that explores these interactions are urgently needed.

There is a risk that decision makers and society-at-large may be lulled by the idea that the global environment will change steadily and slowly. However, the science does not seem to suggest gradualism. Rather, climate change is likely to combine with climatic variability in tumultuous ways, in fits and starts.

We urge the Committee to consider possible synergies and the limits to adaptation in multiple, interconnected sectors and places.

An Action Plan for Government

1. Refresh the National Climate Change Adaptation Framework

+ Work across Federal, State and Local Government jurisdictions to develop agreed approaches and consistency of adaptation action. To truly improve resilience and preparedness, these must cover not only hard infrastructure and economic sectors but also social structures and support systems.

2*. Expand analysis of cross-sectoral interdependencies vulnerable to climate risk*

+ Expand the approach for 'critical' infrastructure taken by the Federal Critical Infrastructure Program for Modelling and Analysis to all other key infrastructure assets and industry sectors.

+ Develop and share analysis into the potential for cascading consequences over multiple sectors and multiple time periods, again recognising societal as well as economic costs.

3. Publish a National Resilience Report Card

+ Develop a national adaptation scorecard to measure the degree to which Australia is adapting effectively and report on progress against agreed targets.

[17] Potsdam Institute, *op. cit.*

+ Publish tools and resources for small business and the community to support effective adaptation at the local level.

4. Deliver leadership through collaboration

+ Collaborate with government, the private and community sectors to build skills and capacity around identifying and managing climate risk effectively.

+ Establish city-wide taskforces with multi-sector participation to better coordinate adaptation and climate risk management strategies for each of the major capital cities across Australia.

So far, the multi-agency response to the immediate dangers of this summer's heat and fire events has been impressive. However, arguably the more difficult tasks lie ahead: building on such first phase resilience responses to minimise financial, social and human costs that emerge during the after-effects of the extreme weather events, and preparing for future, likely to be more dangerous extreme weather events to come.

Strengthening Australia's resilience to extreme weather events is an urgent task in seeking to manage the unavoidable climate risks through accelerated adaptive responsiveness in public and private sectors. It is now as urgent a task as limiting carbon pollution and helping the global climate effort that seeks to avoid the unmanageable risks that will arise from unmitigated global warming.

Yours sincerely,

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