



National Office: 26 Balmain Cr, Acton, ACT
GPO Box 1956, Canberra, ACT, 2601
(02) 6249 1788
info@socialsciences.org.au
www.socialsciences.org.au

27 November, 2020

House of Representatives Standing Committee on the Environment and Energy
Committee Secretariat
PO Box 6021
Parliament House ACT 2600

To the Committee Secretary,

Re: Submission to the Review of the Climate Change (National Framework for Adaptation and Mitigation) Bill 2020

Please find enclosed a submission from the Academy of the Social Sciences in Australia to the Committee's review of the *Climate Change (National Framework for Adaptation and Mitigation) Bill 2000*.

Also enclosed is a copy of the Academy's *Efficient, Effective and Fair* discussion paper on climate policy, published in June 2020.

The Academy represents an elected body of 720 leading Australian social science researchers, policy makers and commentators. The Academy was established in 1971 as an independent not for profit organisation and draws on the expertise of its Fellows to promote and advance the social sciences and to provide expert advice to governments, businesses and the community.

The Academy would be pleased to provide further information on this submission, or to arrange for Fellows with expertise on the matters raised to speak with the Committee as helpful. Contact details for the Academy's Policy Manager Ms Andrea Horsburgh are included in the submission for further consultation as required.

Yours sincerely,

A handwritten signature in black ink, which appears to read "Jane Hall". The signature is fluid and cursive.

Distinguished Professor Jane Hall FASSA FAHMS
President

Academy of the Social Sciences in Australia Submission to the Review of the *Climate Change (National Framework for Adaptation and Mitigation) Bill 2020*

The Academy of the Social Sciences in Australia (the Academy) is pleased to make a submission to the Committee's review of the abovementioned Bill.

The Academy strongly supports the intent and detail of this Bill and the associated *Climate Change (National Framework for Adaptation and Mitigation) (Consequential and Transitional Provisions) Bill 2020* as an effective means to reduce Australia's greenhouse gas emissions to net-zero by 2050, and in doing so to reduce the risk of direct and indirect social, environmental, economic and health-related risks and harms to Australians in the future.

This submission draws on and is supported by the content of the Academy's discussion paper, *Efficient, Effective and Fair Climate Policy* published in June 2020 and enclosed with this submission.

The need for action on climate change

The first object of the Act recognises that:

- a) *climate change is a serious challenge to Australia's prosperity and security that requires a planned transition towards a net-zero emissions economy and implementation of adaptation measures to protect livelihoods, businesses and the environment; and*
- b) *decisions under this Act should be consistent with limiting the increase in global warming to well below 2°C and pursuing efforts to limit it to 1.5°C above pre-industrial levels.*

The Academy **strongly supports this object**, noting that it is:

- consistent with international scientific consensus regarding the causes, risks and impacts of anthropogenic climate change
- consistent with Australia's national interest as a country and a society that is particularly vulnerable to the impacts of climate change
- consistent with Australia's commitments to limit damaging global warming as a signatory to the Paris Agreement

Australia is already experiencing the adverse impacts of climate change by way of increased severity and frequency of extreme weather events. Unless significant and urgent action is taken to mitigate and adapt to future climate change now, it is highly likely that such impacts and the associated costs and harms born by Australians will increase significantly in the future.

As spelt out in the Academy's *Efficient, Effective and Fair Climate Policy Discussion Paper*, there is also a compelling moral case for action based on:

- a) the fact that anthropogenic climate change imposes the greatest risks and harm to vulnerable people who have in general contributed the least to creating them. This is particularly true of future generations
- b) the principle that we as a nation have a moral responsibility to contribute fairly and equitably to global efforts to manage and mitigate climate-related risks and harm.

Principles for a national framework

The Act calls for establishment of a framework to address the challenge of climate change by:

- a) setting a target date for net zero emissions of December 2050, or earlier
- b) providing for a system of emissions budgeting;
- c) assessing the risk of, and preparing for, climate change impacts;
- d) assisting the national economy to adapt to climate change;
- e) establishing an independent body to ensure accountable and transparent plans to manage the climate challenge;
- f) aligning government and the private sector in the assessment of climate risks;
- g) providing policy certainty to assist the private sector in decision making;
- h) assisting and guiding the taking of action by government and the community to reduce emissions in order to meet Australia's obligations under a range of international agreements.

The Academy **strongly supports** the Bill's provisions for:

- a national framework to address climate change
- a firm target for achieving net-zero emissions by 2050 at latest
- providing for a system of emissions budgeting
- establishment of a transparent and accountable mechanism for independent oversight of climate action and assessment of risk
- policy certainty to allow businesses and households to invest with confidence and to reduce the economic harm associated with policy inertia and instability.

These provisions align directly with the principles for a first-best policy to reduce carbon-emissions outlined in the Academy's *Efficient, Effective and Fair Climate Policy Discussion Paper*. These are:

- 1) **Evidence-based:** Policies designed to address the economic, social and environmental costs of emissions should be **informed by the best available scientific evidence**
- 2) **Least cost adjustment using the market:** the transition to a low-emissions economy should be planned and implemented in a way that delivers the greatest benefit at the lowest cost to Australian businesses and taxpayers. Market-based mechanisms are the best way to support an efficient transition that encourages and rewards innovation and promotes investment
- 3) **Policy certainty** is required to enable businesses and consumers to invest with certainty. The costs of policy instability and inertia could potentially outweigh the costs of transition by a significant margin
- 4) **Fair adjustment:** policies must be implemented to support and ensure equity for Australian businesses and households
- 5) **Regionally flexible and contextualised:** allowing for place-based variations.

The mechanisms outlined in the *Climate Change (National Framework for Adaptation and Mitigation) Bill 2020* are consistent with these principles. Further, the Academy believes that they would allow the development of policy and regulatory frameworks that would enable Australian

businesses and households to make the timely, long-term decisions and investments that are required if Australia is to achieve net-zero emissions over the coming decades.

A system of emissions budgeting is a key step. It is critical to bring to an end the current situation whereby greenhouse gasses can be emitted without limit and without cost. An emissions budget, and glide path to net zero, is best supported by the issuing of long term tradeable permits to emit, within a carbon market supervised by an autonomous agency of the highest integrity and quality. A carefully thought out example of the nature and benefits of such a carbon market is set out in the Academy's *Efficient, Effective and Fair Climate Policy Discussion Paper*.

In particular, the Academy recommends that these provisions are adopted without delay: it is only with the certainty of an agreed, national framework that Australia will be able to commence an orderly and cost-effective economic transition and to benefit from the economic opportunities that are available to Australia in a global market. This is of particular importance to Australia given the likely reduction in importance of coal and gas exports as a component of our GDP.

In summary, the Academy commends the *Climate Change (National Framework for Adaptation and Mitigation) Bill 2020* to the Committee. The Academy would be pleased to provide further information on the points made in this submission or in the enclosed *Efficient, Effective and Fair Discussion Paper*, or to arrange meeting with economic and policy experts from within its Fellowship as helpful.

For further information please contact the Academy's Policy Manager Ms Andrea Horsburgh at: andrea.horsburgh@socialsciences.org.au or by phone: 0466 123 178.



Efficient, Effective and Fair Climate Policy: a Discussion Paper

June, 2020



CONTENTS

EXECUTIVE SUMMARY	04
PREFACE	06
ONE: THE NEED FOR ACTION	07
1.1 Global Problem.	08
1.2 Global Impacts	09
1.2 Global Responses	11
1.3 Impacts on Australia	12
1.4 Australia's Response	14
TWO: THE MORAL CASE FOR ACTION	16
2.1 Harm	16
2.2 Risk	17
2.3 Burden-Sharing	17
2.4 National Protection	18
2.5 National Prudence	18
THREE: USE THE MARKET	19
3.1 Least Cost Adjustment	19
3.2 Move Early	20
3.3 Limit and Trade Rights to Emit	20
3.4 The Power of Prices and Markets	21
FOUR: ONE WAY FORWARD: CALM	23
4.1 What CALM needs to account for	24
4.2 How CALM would work	24
REFERENCES	27

ACKNOWLEDGEMENTS

This paper was prepared in 2019 and 2020 by a working group comprising Fellows of the Academy of the Social Sciences in Australia: Sue Richardson (Chair), Sharon Friel, Quentin Grafton, Brian Head and Kevin McConkey for the Executive of the Academy of the Social Sciences in Australia. Lead authors for section one were Caitlyn Baljak and Quentin Grafton. The Lead author for section two was Garrett Cullity. The lead author for section 3 was Sue Richardson. As a possible way forward, the specific proposal for a Climate Asset and Liability Mechanism (section 4) was co-authored by Richard Holden, Warwick McKibbin, and Mike Young, who also contributed extensively to section 3. Earlier versions of parts of this document were kindly reviewed by: Frank Jotzo, Ken Henry, Mark Howden, Tom Kompas, Jonathan Pincus, Andrew Podger, John Quiggin, and Dennis Trewin.

The Academy has endorsed this discussion paper on mechanisms to support least cost and environmentally effective climate change mitigation in Australia and globally.





EXECUTIVE SUMMARY

The Academy of the Social Sciences in Australia considers the evidence on human induced climate change is clear, cannot be denied, and must be confronted. Earth's climatic systems are changing at a rate unprecedented in recorded human history, primarily because of the greenhouse gases produced by human activity. The impacts of climate change are causing significant damage to the natural world and to livelihoods, economic prosperity, health, food, water, and human security on international, national, and local scales. Almost no aspect of life, nature, business, and society are unaffected by climate change. The impacts of climate change are just beginning—they will get much worse.

For at least 15 years, Australia has been struggling to identify, to obtain wide support for and to implement policies to reduce emissions and to ensure a high-quality low emissions energy system. Many options have been developed, some have been implemented, fewer have been retained. At present we have a mix of national and state policies that do not add up to a strategy that is comprehensive, coherent and will induce the necessary fall in emissions in a way that minimises the costs to the economy and society.

We can do much better. We need to return to the basics of what constitutes a least-cost, fair and effective policy. We offer this discussion paper as a stimulus to the development of a truly first best policy to reduce Australia's greenhouse gas emissions.

Although Australia's total emissions are not high on a global scale, it is one of the highest per capita greenhouse gas emitters in the world. While Australia has made some moves towards climate change mitigation and adaptation, transformational change that is focused and effective over the long term is still required and urgent.

Australia must play a stronger role in limiting global warming to below 2°C. Not only because of the opportunity and responsibility for Australia to do so, but also because the costs of emissions reductions would be only a fraction of the costs that would be borne by Australia if temperatures were to increase by 2°C or more. In other words, it is in Australia's national and economic interests to do its part, as well as to actively encourage and support effective global mitigation, to avoid catastrophic climate change.

The Academy of the Social Sciences in Australia considers that there is a strong moral case for

action supported by five major and independent moral arguments; these concern harm, risk, burden-sharing, national protection, and national prudence. These arguments are compelling because climate change imposes risk and causes harm to vulnerable people and the environment; the institutions of society have a responsibility to minimise such risk and harm, consistent with their responsibility to balance the gains against the costs, recognising that the risks and harm will be ongoing unless addressed.

Although the effects are apparent now, without focused action even further impacts will occur to future generations, who have played no role in producing them; all individuals and all societal institutions should work to leave positive, rather than negative legacies for future generations. As part of the global community, our country has a responsibility to contribute at least an equitable share of the collective global effort to manage and mitigate risks and harm; ideally, Australia could also take a leadership role in effective management and mitigation across the world because that is also in our self-interest. Overall, the moral conclusion is that Australia needs to be taking greater and more concerted action to further reduce its contribution to climate change.

To drive such action, there is a need for an efficient, effective, and fair climate policy. In Australia, as well as in other countries, there have been various proposals for policy mechanisms to reduce carbon or greenhouse gas emissions, where these mechanisms use the powerful efficiency properties of property rights, prices and markets. The most efficient and effective policies will be the ones that give us the lowest costs of adjustment and the greatest chance of prospering during the transition.

A key part of such policies must be that they are based on a set of principles, including:

1. addressing economic, social and environmental costs of emissions based on scientific evidence;
2. utilising market-based mechanisms that minimise cost, encourage and reward innovation, and promote investment;
3. enabling businesses and consumers to invest with confidence, through policy certainty;

4. supporting an adjustment process that is fair to households; and
5. being mindful of regional impacts and allowing for place-based variations.

To make these principles concrete, and as the basis for discussion on policy design, this discussion paper provides an example of a way forward. This example, termed the *Climate Asset and Liability Mechanism* (CALM) proposes the establishment of an independent Australian Climate Bank to administer the system in a manner that locks Australia into a predictable policy process and gives it integrity and authority. It would require major emitters to have a permit issued by the Climate Bank to do so, and would enable businesses to invest with confidence via the introduction of climate bonds or other similar long-term assets that create a strong constituency for the retention of the system. It would also couple a day-to-day emission accounting mechanism with a tradeable certificate accounting system so that all Australians would be encouraged to reduce the impact that they are having on the climate. Finally, it proposes a fair adjustment process comprising a suite of parallel initiatives to assist regions, businesses and households.

Such a way forward would provide opportunities and incentives for business, government, communities and for leaders across society to take actions that will reduce greenhouse gases with minimum costs and disruption to the economy and the society. In the view of the Academy, Australia must act to reduce its emissions, and with smart policy design, it can do so in a way that minimises the costs and maximises the opportunities that arise in the transition to a low emissions economy.

Australia needs a first best policy, and such a policy will include putting a price on emissions and enabling trade in the rights to emit. By adopting an approach based on exemplary policy and clear political insight, Australia will be acting in its national interest and displaying its knowledge, skills, and capacity to innovate, to adapt, and to move the country and its people into an improved future.

PREFACE

The Academy of the Social Sciences in Australia is pleased to publish this discussion paper, the first in a series that reflects our commitment to develop and advance robust solutions to nationally important issues. These papers are intended to make the results of the current leading research within the Academy available to interested parties. Their aim is to present research related to policy so as to encourage discussion and comment.

Efficient, Effective and Fair Climate Policy: a Discussion Paper invites individuals, organisations, and institutions to consider and comment on key issues and possible action. The content of this discussion paper has drawn on relevant expertise within the *Academy of the Social Sciences* as well as from other bodies including the *Australian Academy of Science*, and has been based on peer-reviewed international publications relevant to the science and social science of climate change. The scientific information has been supported by comments on key aspects of the moral case for prioritising responsible action to tackle climate change. The paper addresses how to achieve any given target for greenhouse gas reduction in a way that causes least cost to the economy, promotes innovation and is fair. It makes the case that the efficiency properties of market mechanisms have an important role to play.

This paper addresses mitigation policies. In the future, attention will be given to other dimensions of climate change, including the important question of how Australia may best adapt.

The Academy's aim for this discussion paper is that it encourages engagement in the development of a way forward. The process of engagement will happen over the coming months in 2020, despite the communication challenges of the COVID-19 situation. There will be opportunities for many individuals, organisations, and institutions to bring their expertise to bear through discussion, written commentary, and interactive workshops.

The Academy hopes that *Efficient, Effective and Fair Climate Policy: a Discussion Paper* will provide an opportunity for authentic interaction with a view to the development of a position that will allow strong progress to be made on mitigation of global warming, within the context of the continuing social and economic development of Australia.



DISTINGUISHED PROFESSOR JANE HALL FASSA FAHMS
PRESIDENT



ONE: THE NEED FOR ACTION

MUCH STRONGER ACTION IS REQUIRED BY AUSTRALIA AND OTHER COUNTRIES TO PREVENT CATASTROPHIC CLIMATE CHANGE

“WE STAND AT A CRITICAL JUNCTURE IN OUR COLLECTIVE EFFORTS TO LIMIT DANGEROUS GLOBAL HEATING. BY THE END OF THE COMING DECADE WE WILL BE ON ONE OF TWO PATHS.

ONE IS THE PATH OF SURRENDER, WHERE WE HAVE SLEEPWALKED PAST THE POINT OF NO RETURN, JEOPARDIZING THE HEALTH AND SAFETY OF EVERYONE ON THIS PLANET. DO WE REALLY WANT TO BE REMEMBERED AS THE GENERATION THAT BURIED ITS HEAD IN THE SAND, THAT FIDDLER WHILE THE PLANET BURNED? THE OTHER OPTION IS THE PATH OF HOPE. A PATH OF RESOLVE, OF SUSTAINABLE SOLUTIONS.”

ANTÓNIO GUTERRES, UN SECRETARY GENERAL, 2 DECEMBER 2019

KEY POINTS

- Large negative impacts from climate change are already being experienced globally, including in Australia.
- It is in Australia’s national interest, because of its vulnerability to climate change, to use all its abilities, underpinned by exemplary policy, to stimulate global action on mitigation and adaptation.
- To avoid catastrophic climate change, Australia and other countries must do much more than simply meet the nationally determined targets agreed to in the 2015 Paris Accord.

1.1 GLOBAL PROBLEM

The planet's climactic systems are changing at a rate that is unprecedented in recorded human history; levels of CO₂ are now both higher and increasing more rapidly than anytime during the existence of Homosapiens, and the greenhouse gases produced by human activity are the overwhelmingly likely cause and driver.

Climate change presents dangers for every aspect of our economy, society, and the environment. In 2015, *The Australian Academy of Science* summarised the compelling evidence of the extent of climate change and the great harm that this will do, and is doing, to the Australian people and nature, as well as to those across the globe.¹ We leverage off the expertise of the *Australian Academy of Science*, and also offer an overview of the latest (at time of writing: April 2020) facts and understandings about the nature, extent and impact of climate change, both globally and for Australia.

GREENHOUSE GASES

Human-caused climate change results from greenhouse gases such as carbon dioxide (CO₂, methane (CH₄) and nitrous oxide (N₂O) accumulating in the Earth's atmosphere, trapping heat energy and preventing it from radiating back into space. Their impact is cumulative, with some lingering for centuries. This means that every tonne emitted today will continue to have impacts long-term. Figure 1 shows that CO₂ levels were quite steady over the past thousand years, with a maximum of 283 ppm until about 1800 (the beginning of the Industrial Revolution). Since then, they have risen dramatically and fast, to their current level of 413 ppm. The most recent five-year period (2015-2019) has seen a growth rate in global greenhouse gas emissions of 20% compared with the previous five-year period (2011-2015).² The most recent period is estimated to have increased emissions by 7 giga-tonnes of CO₂ compared with the 2011-2015 period. At these rates of growth, the world could use up the carbon dioxide 'budget' consistent with staying below 2°C of warming by 2040.³ The CO₂ 'budget' consistent with 1.5°C warming is very nearly exhausted.

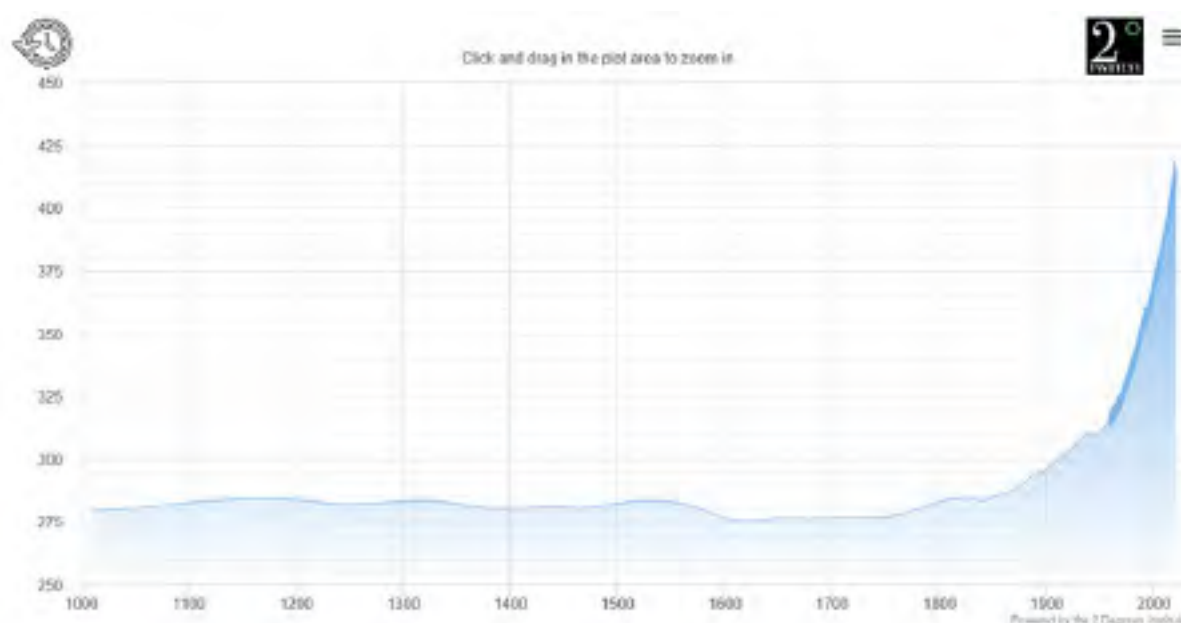


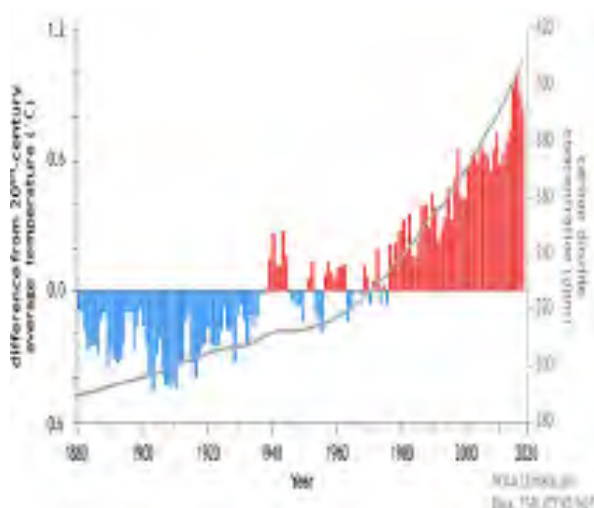
Figure 1: Global CO₂ levels, CO₂@ ppm, over the past 1000 years
<https://www.CO2.earth/CO2-ice-core-data>

Current commitments under the Paris Accord are well short of what is required to keep warming to 2°C, compared to the pre-industrial period (1850-1900). Even a 2°C temperature increase would result in a large disruption to economic, social and environmental systems on a global scale.

TEMPERATURE

There is a strong positive relationship between atmospheric CO₂ levels and the planet's temperature (see Figure 2). It is highly likely that human activities have already caused approximately 1°C of global warming above pre-industrial levels, currently increasing by 0.2°C every decade.⁴ 1.5°C of warming will likely occur between 2030 and 2052 if we continue our current emissions trajectory,⁵ but may occur earlier. Globally, the past four years have been the warmest on record. Oceans appear to have taken up more than 90% of the excess heat in the climate system and extensive bleaching of the Great Barrier Reef is one result. 2019 experienced the warmest ocean temperatures on record, followed by 2018, 2017 and 2015.⁶

FIGURE 2: Atmospheric CO₂ and Earth's surface temperature (1880-2018)



POLAR

The Arctic, Antarctic, and other snow-covered regions of the planet are experiencing the most severe planetary warming.⁷ Sea ice helps with the planet's thermal regulation because it reflects solar radiation back into space. This has a cooling effect. As sea ice melts, more heat-absorbing ocean water is exposed to soak up the sun's heat, creating a positive feedback loop for planetary warming. The extent of Arctic sea ice was at a record low in July 2019, and summer sea ice in Antarctica has been at its lowest ever recorded in 2017 and 2018.⁸

SEA LEVEL RISE & ACIDIFICATION

As the planet warms, sea levels rise due to the thermal expansion of water and the melting of land-based ice. Glaciers are experiencing significant losses worldwide. The Greenland and Antarctic ice sheets are melting at rates unprecedented in human history, with these ice sheets contributing to sea level rise at a rate seven times greater than that during the 1992-2001 period.⁹ This rise is taking place at a rate of 3.6mm per year and continues to accelerate.¹⁰

EXTREME WEATHER

Climate change increases the frequency, duration, and intensity, and therefore the damage done by extreme weather events, including heatwaves, droughts and storm surges, bushfires, and heavy rainfall leading to flooding. The impacts resulting from extreme weather pose the most immediate threats to human life from climate change and lead to significant human, environmental and economic costs—as recently experienced in Australia from the extended drought and unprecedented bushfires. As a measure of the global economic costs, across the world, insurers lost US\$135 billion because of natural disasters in 2017, which is 3.9 times the 30-year average and the largest loss ever recorded.¹¹

The insurance industry will face a dramatic shift in accounting for an increase in extreme weather events, sea level rise, and from insuring potentially stranded assets that result from climate change and responses to it. The CEO of one of the world's leading insurance groups has stated that, 'a +4°C world is not insurable,' due to the extent of the damage that will be caused by climate change.¹²

1.2 GLOBAL IMPACTS

The impacts of climate change are already causing significant damage to livelihoods, economic growth, health systems, food, water, and human security on international, national, and local scales. Almost no aspect of individual lives, business organisations, and societal institutions and structures will be unaffected by climate change. An effective response requires global co-operation.

ECOLOGICAL IMPACTS

The biosphere will be acutely affected by climate change. It is already contributing to the sixth mass-extinction event experienced by life on Earth, with species loss and extinction occurring in terrestrial, freshwater, and coastal ecosystems.¹³ Plants and animals have experienced changes in their ranges and abundances along with shifts in their seasonal activities. Polar zones and coral reef ecosystems will continue to be the most severely impacted, with 90% of the world's coral reefs at risk of bleaching with as little as 1.5°C of warming.¹⁴ Australia's Black Summer bushfires have increased the risk of extinction to many threatened species. Ecosystem services provide an unquantifiable but crucial benefit to communities globally, and their disruption would result in large economic and social losses.

HEALTH IMPACTS

Climate change threatens our health, with an increase in heat and severe weather-related deaths and illness, the spread of vector-borne diseases, water and food insecurity, and anxiety.¹⁵ Some of the health effects will be direct and immediate, while others typically will occur via more complex and indirect pathways. Across the globe, adverse health outcomes will be greatest

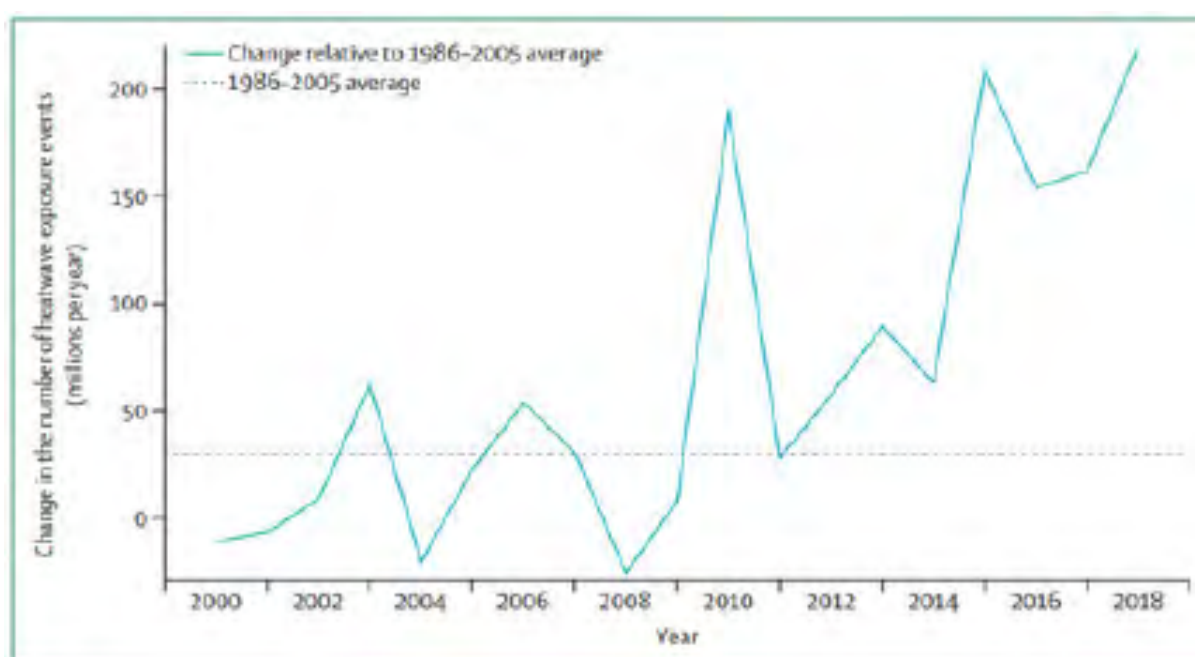
among poor people living and working in urban and coastal areas, elderly people, children, traditional societies, and subsistence farmers, who have the least capacity and resources to adapt to climate change or to mitigate its effects.¹⁶

Many health associations globally, including the *Australian Medical Association* and the *Australian Psychological Society*, have declared climate change a 'health emergency'.^{17,18}

A child born today will face significantly greater health risks at every stage of life as a result of climate change occurring now, and in the future.¹⁹ In many regions, climate change is creating weather conditions which are dangerous for the human body's thermoregulatory abilities: Already 30% of the world is exposed to at least 20 days per year in which the air temperature and relative humidity are dangerous to human health and this percentage will rise with further increases in global temperatures.²⁰ Globally, there were over 220 million additional heatwave exposures in 2018 for people over 65 compared to the average between 1986 and 2005 (see Figure 3).

There are many individual behavioural and psychological impacts associated with climate change, both to those experiencing the direct impacts of climate change—through exposure to

FIGURE 3: Change in number of heatwave exposure events in people aged 65 years and older, compared with the historical 1986-2005 average number of events (Source: Watts et al., 2019)



extreme weather, bushfires and floods, or forced migration—and to those experiencing anxiety about the planet’s future health.

SOCIAL IMPACTS

The social impacts of climate change will be unevenly distributed, with those in developing countries, who have contributed least to greenhouse gas emissions, experiencing the worst impacts because they are the least able to adapt. Some 680 million people, nearly 10% of the 2010 global population, live in low-lying areas, many of whom are at risk from sea level rise and storm surges.²¹ Seas will rise by an extra 10 cm this century at 2°C compared with 1.5°C, putting a further 10–30 million people at risk from rising water levels.^{22,23}

Displacement of peoples and changes in their individual and collective behaviour due to sea level rise, more extreme weather events, and more severe drought conditions contribute to food insecurity. Climate change induced migration could create one of the greatest people displacement events in history.

Within Australia, it is likely that the people with the lowest income and wealth will be the least able to protect themselves from extreme heat, floods, bushfires, drought, and cyclones. This will have significant flow-on effects for everyone in Australia, not only in the short-term, but also long-term as harms to physical and mental health grow.

ECONOMIC IMPACTS

While difficult to quantify precisely, the global economy is set to lose trillions of dollars from the impacts of climate change. It is estimated that the future average global GDP per capita could be 8% lower with 1.5°C of warming and 13% lower with 2°C of warming by 2100.²⁴ The cumulative savings or avoided damages from complying with the Paris Accord, from now until 2100, exceed US\$420 trillion.²⁵

Although all economic sectors will be affected by climate change, there are several that are especially sensitive. Agriculture is one of the largest contributors to climate change,

representing about one quarter of greenhouse gas emissions globally from 2007–2016, and one of the sectors most vulnerable to its impacts.²⁶ For many regions, climate change exacerbates yield variability, reduces yield growth, and contributes to land degradation, heatwaves, floods, bushfires, and, thus, food insecurity and water scarcity. Climate change presents long term risks to agriculture that need to be managed.

1.3 GLOBAL RESPONSES

Scientists from multiple disciplines have been seriously examining climate change and its effects for many decades. The international political response to climate change can be tracked from the establishment of the *United Nations Framework Convention on Climate Change* in 1992. Since its establishment, there has been the adoption of major international agreements addressing climate change, significant investment in climate change mitigation and adaptation projects, reporting of climate change impacts, technology transfer, and research and development—as well as national, regional and local government and community responses.

PARIS AGREEMENT

Building from the *Kyoto Protocol* (1997), the *Paris Agreement* (2015) is an international agreement which aims to hold the increase in global average temperatures to “well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels”.²⁷ Although there is no ‘safe’ level of warming, the impacts of 1.5°C of warming will be significantly less than at 2°C.²⁸ As of 2018 the agreement had been signed by 197 nations and ratified by 185, including Australia. The world’s second largest current emitter, the United States, has announced its intention to withdraw from the agreement, effective 4 November 2020. The agreement commits countries to submit and update national emissions actions and targets which are not legally binding, known as ‘Nationally Determined Contributions’ (NDCs) from 2020 and to review targets every five years.

GOVERNMENT RESPONSES

Responses to climate change have not only occurred on an international level but also at national and local levels. State and local governments can contribute significantly to climate solutions through targeted local action. Several sub-national governments and cities have action plans to achieve carbon neutrality either by, or before 2050.²⁹ Urban strategies include electrification of vehicles, improving public transport, supplying the energy grid with renewable electricity, waste management practices, and sequestration via expanding green spaces.

THE GAP

Much stronger action is needed to achieve the goals outlined in the Paris Agreement. According to the *United Nations Environment Programme* (2019), current unconditional NDCs are expected to result in global average temperature rise by around 3°C above pre-industrial levels.³⁰ Existing global emission-reduction pledges would need to strive to a higher level to stay within 2°C warming and will almost certainly require negative emissions in the future.

1.4 IMPACTS ON AUSTRALIA

Australia is directly experiencing the extremely damaging effects of climate change. These manifest in the increases in the frequency, duration and intensity of heatwaves, prolonged droughts in southern Australia, more frequent and more severe fire weather over a longer fire season,³¹ more frequent and severe coastal storm surges, marine heatwaves that are seriously damaging the Great Barrier Reef and Tasmanian marine ecologies, and increases in extreme rainfall intensity. All these factors will

worsen with further climate change, and this will impact every aspect of Australian society.

LAND TEMPERATURE

Average surface air temperature over Australia has warmed by 1°C since 1910. Daytime maximum temperatures have warmed by 0.8°C, while overnight minimum temperatures have warmed by 1.1°C.³² Seven of the ten warmest years on record have occurred since 1998. The 2018–19 summer was the hottest on record for Australia by a margin of 0.86°C³³ while 2019 was the hottest ever recorded for area-average mean surface air temperature in Australia, exceeding the previous record by 0.5°C. January 2019 was the hottest month ever recorded by a margin of almost a degree. This followed on from the previous hottest summer on record in 2012–13, where the Bureau of Meteorology added two new colour categories to Australia's temperature prediction maps because of the extreme conditions.³⁴

Higher temperatures and lower rainfall contributed to a longer bushfire season and the unprecedented 2019–20 Black Summer that resulted in the death of 34 people and hundreds of millions of animals, the destruction of about 2,400 homes and over 8 million hectares of burnt land. In New South Wales alone, more than about 3.8 million hectares have been burned.³⁵ Millions of Australians have been exposed to unhealthy or hazardous air quality over many weeks with Canberra at times recording the worst air quality in the world during the 2019/20 summer bushfire disaster. This exposure will result in premature deaths,³⁶ possibly of hundreds, or more Australians. The latest climate change research indicates that climate change is already contributing to longer and more severe droughts in Australia.³⁷

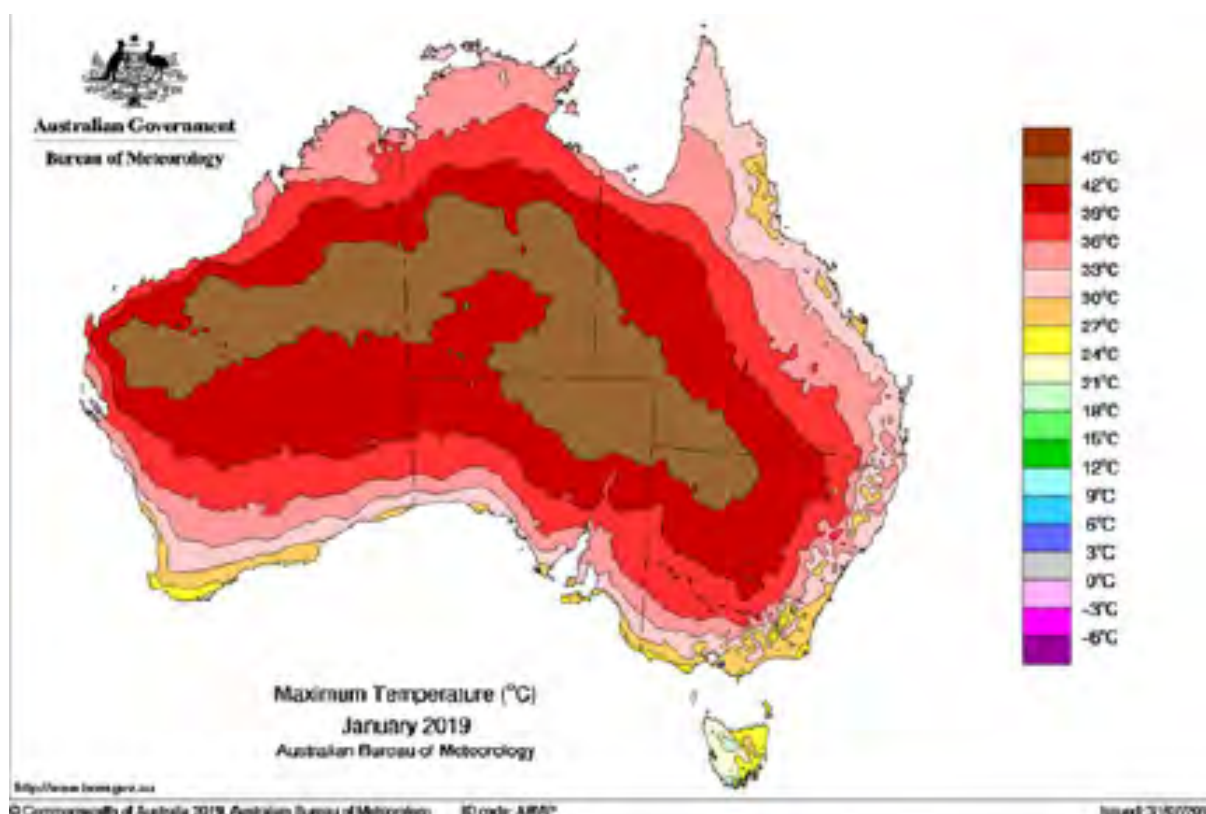


FIGURE 5: Mean Daily Maximum Temperature (January 2019)

RAINFALL

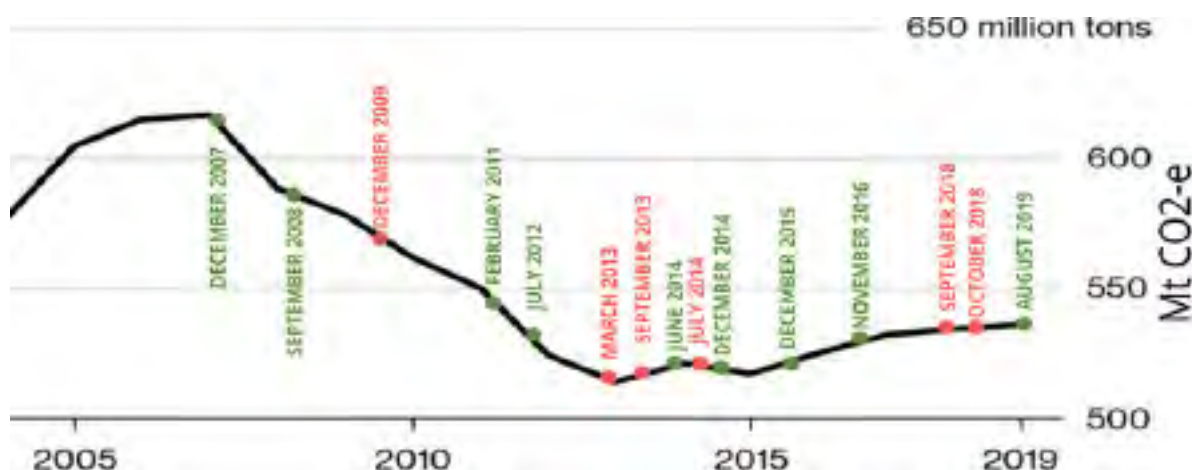
The high levels of natural rainfall variability are being influenced by warming of the land and seas around Australia. South-eastern and south-western Australia are becoming drier, with May to July rainfall in south-eastern Australia seeing the largest decrease, by around 20% since 1970, and an 11% decrease in April to October rainfall since the late 1990's.³⁸ North-western Australia is becoming wetter, with increasing sea temperatures likely causing greater evaporation, resulting in more intense rainfall events. Shifts in rainfall have implications for the growing period,

seasonal water availability, water quality, the health of ecosystems and severe weather events, such as flooding.

OCEANS

Oceans around the Australia region have warmed by around 1°C since 1910, leading to an increase in the intensity and duration of marine heatwaves.³⁹ These heatwaves have been responsible for mass coral bleaching. For example, in 2016 and 2017, marine heatwaves were responsible for widespread coral mortality across the Great Barrier Reef.⁴⁰

FIGURE 6: Australia's Climate Change Policy vs Carbon Emissions Timeline



December 2007: Australia ratifies Kyoto Protocol and Dept. of Climate Change & Water is established (becomes CC & Energy), **September 2008:** Final Garnaut climate change report is released, **December 2009:** Carbon Pollution Reduction Scheme loses bipartisan support, **February 2011:** Government launches Climate Commission, **July 2012:** Price on carbon comes into effect, **March 2013:** Dept. of Climate Change disbanded, **September 2013:** Climate Council disbanded, **June 2014:** Government introduces first direct action legislation (establishes Emissions Reduction Fund), **July 2014:** Price on carbon is repealed, **December 2014:** Australia commits AUD 200 million to GCF, **December 2015:** National Energy Productivity Plan released, **November 2016:** Australia ratifies the Paris Agreement, **September 2018:** National Energy Guarantee is abandoned, **October 2018:** Australia states it will not replenish GCF, **August 2019:** Australia increases Pacific climate change finance to AUD 500 million.

1.5 AUSTRALIA'S RESPONSE

Australia is one of the highest per capita greenhouse gas emitters in the world. Eight sectors are responsible for most of Australia's emissions: Electricity, transport, stationary energy, agriculture, fugitive emissions, industrial processes, waste, and land use.⁴¹ Australia has taken some action towards climate change mitigation and adaptation, as shown in Figure 6 above. But transformational change that is focused and effective over the long term is required for a commensurate contribution by Australia to a global outcome that would limit warming to well below 2°C.

NATIONAL

Australia has ratified the Paris Agreement and in 2016 submitted its first NDC, stating its unconditional commitment to reduce carbon emissions by 26-28% below 2005 levels by 2030.⁴²

The Australian Government's current approach to greenhouse gas emission reduction is principally through land-use changes, direct actions and renewable energy. *The Emissions*

Reduction Fund and the Climate Solutions Fund use A\$4.5 billion of public funds to support businesses and the community to reduce emissions through the application of new, low-emission practices and technologies.⁴³

The Australian Government is currently actively exploring ways to achieve emissions reductions through the development and adoption of new technologies, with a particular focus on hydrogen. They are also developing a national Technology Investment Roadmap to prioritise Australian investments in new and developing low emissions technologies.⁴⁴

STATE & LOCAL GOVERNMENT

At state and local levels, significant mitigation efforts are being made. All state and territory governments have committed to net zero emission targets by 2050. The Australian Capital Territory and New South Wales have 2030 as their net zero targets, achieved through a combination of local emissions reductions and offsetting. Climate adaptation plans or policy frameworks have been released by all state and territory governments.*

* With the full publication of Western Australia's imminent.

THE GAP

Although Australia has re-confirmed its commitment to the Paris Accord, it is not doing its part to further reduce greenhouse gas emissions if average temperatures are going to increase by less than the 2°C stipulated in the Paris Agreement. In particular, Australian emissions have not declined following the repeal of the Carbon Price in 2014, with a projected increase from 2005 emissions of 6% by 2020 and 8% by 2030 (excluding land use, land-use change, and forestry).⁴⁵

In 2019, the Australian Government announced that it will no longer provide funding to the Global Carbon Fund but continues to contribute to multilateral development banks that invest in climate action. Australia has also announced that it plans to ‘mainstream’ climate change action into its bilateral aid program.⁴⁶

POSSIBLE TRANSITION PATHWAYS

There is a view that because Australia contributes only a small amount to the global carbon budget and that its efforts to mitigate future climate change will have little effect. On the contrary, there is a chance for Australia to be

a global leader for a better future. Australia faces the opportunity to transition from a high-carbon economy to a low-carbon economy, which would not only bring the benefits of climate change mitigation and reduce the costs of adaptation, but also presents valuable economic opportunities to Australian communities, individuals and businesses.^{47,48} Moreover, the costs of Australian emissions reductions, as part of global emissions reduction agreements, are only a fraction of the economic costs to Australia, should there be temperature increase of 2°C or more.⁴⁹ In other words, it is in Australia’s national and economic interests to do its part and also to encourage and support effective global mitigation to avoid catastrophic climate change.

The science on climate change is clear. The effects of climate change on all aspects of human society are clear. The effects of climate change on ecosystems and the marine and terrestrial environment are clear. The views of the relevant scientific and professional bodies are clear. In sum, effective and timely action on climate change (emissions reduction and adaptation), by Australia and other countries, is clearly in the national interest.



TWO: THE MORAL CASE FOR ACTION

The global COVID-19 pandemic highlighted how fragile socio-economic systems can be to major shocks. The national and global responses to the COVID-19 crisis highlight: (1) the importance of global co-operation to effectively manage the responses to the pandemic; (2) the need for non-ideological and evidence-based, expert guidance to respond effectively and at least cost; and (3) global shocks create policy opportunities and new thinking, that may not have been previously possible.

As with COVID-19, we have to respond to climate change together, not only for our own benefit, but also for the benefit of those who will follow us in the world. We should all accept the responsibility to act now in the interests of the future. The government should take actions that are most likely to reduce the extent and adverse impact of climate change and that involve manageable, value-for-money adjustments in the short and medium-term.

Anthropogenic climate change is a moral issue for two main reasons:

1. It imposes risk and causes harm to vulnerable people and to the environment. Most of these negative impacts will be borne by those who have contributed the least to producing them, the most severe falling on future generations.
2. The principle of contributational fairness means we have a moral responsibility to contribute an equitable share of the collective global effort to manage and mitigate risks and harm.

There are five prominent moral arguments for national climate action by countries such as Australia. They are independent of each other, all of them support the conclusion that Australia ought, as a nation, to be taking concerted action to reduce its contribution to climate change, beyond what is currently being done.

2.1 HARM

Climate change increases the frequency and severity of causes of harm such as extreme weather events, tropical diseases and

malnutrition. Global health statisticians are already reporting these effects and with further rises in global average temperatures, they are expected to increase. These harms are primarily borne by the most vulnerable members of the global community. We should be morally concerned to reduce the amount of harm we do to them. Given the long timescale over which our current emissions are projected to remain in the atmosphere, our current actions are expected to continue producing these harmful effects long into the future.

2.2 Risk

The second argument makes a weaker assumption. It appeals only to the risk that our actions will cause serious harm in the future, not to the fact that they are doing so currently. Action that imposes serious risks on others can be morally wrong because it is negligent and reckless, independently of the harm that actually eventuates. As the scientific evidence accumulates, it becomes progressively less reasonable to doubt that our contributions to climate change carry such risks.

These two arguments have broad application. They give us moral duties of both mitigation and adaptation duties not only to reduce the further imposition we make through ongoing contributions to global warming, but to help vulnerable people to adapt to the now-unavoidable threats imposed by our past actions. They apply not just to national governments, but to any agent whose actions contribute to increasing atmospheric greenhouse gas concentrations – including state and local governments, cities, corporations, non-government associations and individuals. And they apply to each of these agents unilaterally. The moral duty not to engage in actions that harm or endanger others is not a duty that we are exempted from when someone else is not complying with it. The strength of the duty is proportional to the harm or risk imposed if the duty is not followed, and it may be related also to the capacity to influence others to comply with their duty.

A third moral argument comes not from considerations of harm or risk, but instead from contributory fairness. It assumes only, that

global collective climate action has become rationally compulsory. Human activity, through its enhancement of the greenhouse effect that contributes to global warming, is adding extra energy to the Earth's climate system in a way that is creating an imbalance and as a global population, we cannot rationally allow this to continue unchecked. Once we accept this, it gives rise to the following additional moral arguments.

2.3 BURDEN-SHARING

When a group needs to achieve something important by acting together and is doing so by sharing the overall burden amongst its members, the failure to contribute an equitable share of that burden can amount to unfair free-riding. Duties of fair contribution apply to cooperative actions undertaken by groups of any size. In their large-scale applications (for example, to tax evasion), the moral force of these duties does not rely on linking particular instances of non-contribution to demonstrable harms: Failing to contribute can be unfair, whether or not it is harmful. The largest-scale application of duties of fair contribution is to the global problem of climate change. Several different factors evidently bear on the share of the burden of climate action that should equitably be assigned to wealthy countries like Australia. These include the size of our contribution to causing the problem, the benefits we have derived from emissions-producing development, and our comparative capacity to take action. All point towards assigning a higher per-capita share of the burden of collective global climate action to Australia than to countries that have emitted less, are less developed, and have less capacity to act.

Duties of this third, contributory kind are not unilateral (unlike the first two). They are duties to cooperate with others to address a common problem. However, they exist in the absence of universal compliance. Duties of burden-sharing are not extinguished by the existence of some free-riders, though the strength of the duty may be related to the extent of agreement and the capacity to influence others to comply.

Two further arguments focus on the responsibility that the government of a country

has for the welfare of its own future citizens. If governments of developed countries regard themselves as responsible only for protecting the interests of their current citizens, then the problem of climate change – a problem with a global cause and intergenerational effects – looks especially difficult to solve. For older citizens of wealthy countries like Australia, the costs of effective climate action are likely to be greater than the benefits that they can themselves expect to receive. However, if it is accepted that a national government has a duty to protect the interests of its future citizens, not just its current ones, two further moral arguments are important.

2.4 NATIONAL PROTECTION

Any resources that Australia spends on climate change mitigation cannot be targeted specifically towards its own population, whereas spending those resources on adaptation can be targeted locally. This may suggest that national self-interest is served by only doing the latter – ignoring global mitigation efforts and saving our resources for our own future compatriots to spend on adaptation. However, as climate science accumulates, it provides increasingly strong evidence that global climate inaction will

have impacts on future generations that are too large to be neutralised through adaptation measures, even in countries as relatively affluent as Australia. As this evidence becomes stronger, so does the duty we have to join the global efforts required to protect our future interests in addition to adaptation measures. Future inhabitants of a less habitable world will have moral grounds of complaint against current governments whose failure to contribute to global action has resulted in the problems they confront.

2.5 NATIONAL PRUDENCE

Given the reality of climate change, there will eventually have to be economic disruption to deal with it. This gives us a choice. The disruption could be delayed until it is forced on our future compatriots, producing sudden, unpredictable and unrecoverable costs on individuals, communities and businesses; or it can be introduced earlier, more incrementally, and in a way that is more easily absorbed. If we accept that we are now morally answerable to future Australians for the foreseeable impact on them of our current decisions, this grounds a moral duty to begin the process now.



THREE: USE THE MARKET

The scientific evidence is clear: Global climate warming means that we will face increasingly serious and potentially catastrophic impacts to our health, our environment and our economies. In what follows we set out two sets of arguments which are a starting point in resolving these issues. The first makes the case for using the power of property rights, prices and markets as a basic proposal to reducing greenhouse gases. The second provides an example of a policy approach that would do this, which we call the Climate Asset and Liability Mechanism (CALM).

3.1 LEAST COST ADJUSTMENT

The shift to a low emissions economy will require large scale structural change in the economy over the coming years. This will be disruptive and potentially costly. It seems beyond question that the policies to drive Australia's shift to a low emissions economy should be as efficient, effective and fair as it is possible to devise. The most efficient and effective policies will be the ones that give us the lowest costs of adjustment

and the greatest chance of prospering during the transition. A central part of these policies must be a price of some sort on the emission of greenhouse gases. Further gains are possible if there is a market in which the right to emit is traded. That policies also need to be fair hardly needs to be argued.

If market-like mechanisms and robust institutional arrangements are used to bring about this transition, then in the longer term there could be economy-wide benefits. The positive benefits realised could more than offset any future costs. Australia has abundant solar and wind resources; abundant endowments in nickel, copper and many of the other resources needed to produce, store and use renewable energy. We also have access to the unique combination of resources needed to produce 'green' commodities such as green steel and green aluminium. The private sector is much more likely to take up these opportunities if competing technologies are no longer permitted to emit greenhouse gases freely into the atmosphere but must pay a price to do so. Market-like mechanisms will deliver better

results than alternatives, including selective assistance to particular technologies.

3.2 MOVE EARLY

Australia is not fully in command of the circumstances in which it adjusts. It is clear from modelling done for Australia leading up to the Paris Accord,^{50,51} that climate actions by other countries have a larger impact on the Australian economy than Australia's own direct policy actions. As the rest of the world acts to reduce its carbon emissions, international demand for Australia's fossil fuel-intensive exports will fall. We can close our eyes to this risk, and scramble to adjust when it hits. Or we can initiate a strong and orderly shift to the new, low emissions world now.

Australia is not the only country to have some or all of the advantages noted above in a low carbon world. An early start down the path to a low emissions economy will give us more time to make the transition an orderly one, executed at minimum feasible cost. Rapid transitions are especially hard to adapt to, for businesses and for the workforce. It will also give Australia every chance of being early into the new world markets that will emerge for low emissions products, including green energy.

Australia has one of the highest levels of greenhouse gas emissions per person in the world. But despite this, because of our small population, we contribute less than 2% of global emissions. Australia alone cannot significantly change the course of climate change. This fact, combined with our high vulnerability to the damages caused by climate change, means that we must do all we can to support and stimulate global efforts to reduce emissions. We can do this by taking strong and effective actions ourselves. This requires that we make at least our proportionate contribution. Perhaps even more importantly, it would give us credibility in global negotiations. We can also provide a potentially powerful demonstration to major emitters that low-cost abatement is possible even in a fossil fuel intensive economy. Australia has a notable history of influencing global negotiations by a combination of example and skillful persuasion. One example is the international rules on farm subsidies and agricultural trade, where Australia provided

pivotal intellectual strength and leadership in coalition building.⁵²

3.2 LIMIT AND TRADE RIGHTS TO EMIT

Many countries, including Australia, will be better off if the approach taken to reduce greenhouse gas emissions is as efficient as possible. The atmosphere that determines the climate is not owned by any person or country. Unless there are specific country rules, any person or entity can emit into the atmosphere whatever they like, without seeking permission or paying a price, as do, for example, coal fired power stations and those who drive cars. The atmosphere is thus, exposed to the 'tragedy of the commons', whereby an atmosphere that supports a safe climate is damaged by the self-interested actions of individuals, businesses and government; actions that collectively do serious harm.

In consequence, a first step in an efficient and effective policy to meet Australia's emissions reduction targets is to create a property right to emit greenhouse gases. Only a government has the power to do this. Government must end the practice of free and unlimited emissions. There are two efficient ways to do this. It can put a tax on emissions, or it can create a right to emit, allocate these rights in some way across the economy and require that those who generate emissions have the right to do so. Let us call the right to emit an 'emissions certificate'. To be effective, the total of the rights created, the emissions certificates, must be less than the amount of emissions that are occurring without this constraint.

Each approach has its own advantages. A tax is simple to understand and to administer and raises revenue each year that can be used to assist the adjustment, but it has an uncertain impact on the quantity of emissions. A scheme of tradeable rights to emit can fix the quantity of emissions and encourages the reductions in emissions to occur in the sectors of the economy that can achieve this at lowest cost. Here, we focus on the benefits of using tradeable permits.

Once the emissions certificates exist, and have been allocated in some way, then a market in these certificates can be created. This market allows the certificates to be bought and sold by anyone who places a value on them. This would include producers who generate emissions in their production processes, such as cement factories and coal or gas fired power stations.

It could also include community groups or individuals who wanted to accelerate the reduction in greenhouse gas emissions; they could buy the certificates and not use them.

3.4 THE POWER OF PRICES AND MARKETS

The price of emissions certificates would be determined by the interaction of the numbers of certificates supplied by the government and the number demanded by producers and other groups. The price contains a great deal of information that is of value to producers and policy makers. It signals how easy or difficult it is to go on producing particular products when the emissions that are caused by the production have to be paid for. This economy-wide price signal will lead everyone to search for low cost ways to reduce their greenhouse gas emissions. This includes end-users, who will have an incentive to switch to less emissions-intensive products, new or old. Importantly, it will also allow adjustment between sectors, as sectors and production methods that can reduce emissions at low cost grow and sectors and production methods that find it particularly costly to reduce emissions shrink.

Market prices provide all the information necessary for consumers to make the appropriate trade-off between one (e.g. emissions intensive) purchase and another (e.g. with low emissions). Similarly, producers only need to understand their own production capabilities and the relative prices of inputs to production such as labour, emissions and raw materials and the price at which they can sell to decide what and how much to produce. This is one powerful aspect of the price mechanism—the power to aggregate disparately held information into one statistic—the market price—that helps guide decision-making.

The efficiency of this approach is enhanced because it influences all decisions associated with greenhouse gas emissions. The lowest total cost will be achieved when a large number of low-cost individual decisions are changed. The narrower the coverage of the policy, the larger the costs for those parts of the economy where the action is focused and also, the larger the economy-wide cost.

Perhaps most importantly, a market in emissions certificates creates new opportunities for innovation and profitable investment in technologies and processes that reduce greenhouse gas emissions. This is especially the case when the policy approach is expected to be stable because it locks in a framework that is politically difficult to change. There would be economy-wide opportunities to profit from reducing emissions by finding ways to reduce the need to buy certificates, or by selling certificates already held. This will cause enterprises to search continuously for new low emission technologies and new ways to apply existing technologies.

This stimulus to innovate does not require any formal coordination or government agency or funding. The profit motive would impel the search for, and adoption of, new ways to reduce greenhouse gas emissions. Anyone who can develop a more cost-efficient way of reducing emissions is rewarded by the market for doing so. Once a binding reform pathway is locked in, businesses are encouraged to innovate and when they think they have found a profitable way to reduce emissions, to invest.

We cannot predict with any precision what new opportunities will emerge in a world of changed incentives and institutional arrangements, but Australia is an innovative country with abundant access to renewable energy. We should expect to be surprised by a high degree of innovation, and of the adoption of that innovation, that occurs.

Well-designed market mechanisms with good regulation and clear policy give us the best chance of reducing emissions at the lowest cost and greatest benefit to society. Attention to detail, however, is critical. Badly designed policies implemented in poorly designed markets can lead to very expensive outcomes.

As a guiding rule, any adverse impacts on particular regions or households are more cost-effectively and more equitably dealt with using separate mechanisms designed for this purpose. When this approach is taken, the principal policy direction, to reduce greenhouse gas emissions, and the signals that lead us there, are clear.

The debate should not solely be about what emissions targets Australia should have. It should also have a keen focus on what is the most efficient and effective mechanism to adopt to achieve any given goal, and how to ensure that the goal is achieved.

Many organisations actively support the use of a carbon price as a key policy to reduce greenhouse gas emissions. Some examples are:

- BP states that it will adopt “more active advocacy for policies that support net zero [emissions by 2050], including carbon pricing”⁵³

- *The Business Council of Australia* states “We support the need for a market-based carbon price to drive the transition [to zero net emissions by 2050] and incentivise investment in low and no-emissions technology”⁵⁴
- The World Bank argues that a price on carbon ensures that “—the overall environmental goal is achieved in the most flexible and least-cost way to society. The carbon price also stimulates clean technology and market innovation, fuelling new, low-carbon drivers of economic growth”⁵⁵

Australia acting alone will not change the global climate in a meaningful way, but international climate action is inevitable, and it is profoundly in Australia’s national interest to be an energetic part of a cooperative global approach. To do this, we must first get our own house in order.



FOUR: *ONE WAY FORWARD*: CALM

Around the world, including in Australia, there are numerous proposals for specific policy mechanisms to reduce carbon or greenhouse gas emissions, which use the powerful efficiency properties of property rights, prices and markets. The World Bank reports on the latest developments in carbon pricing around the world. It concluded in its 2019 report that about 20% of world greenhouse gas emissions are now covered by some form of emissions pricing policy.

Key Principles that should be embedded in any policy are that it:

1. Addresses the economic, social and environmental costs of emissions based on scientific evidence
2. Utilises market-based mechanisms that minimise cost, encourage and reward innovation, and promote investment
3. Enables businesses and consumers to invest with confidence, through policy certainty
4. Supports an adjustment process that is fair to Australian households

5. Is mindful of regional impacts and considers place-based policies

There have been several Australian proposals for policies that meet these Principles including Australia's national carbon price and what was to be an emissions trading scheme that were discontinued in 2014. Some of these proposals include: from Rosalind Dixon and Richard Holden in 2019,⁵⁶ from Warwick McKibbin and Peter Wilcoxon in 2002;⁵⁷ further developed in 2008,⁵⁸ and from Mike Young in 2017.⁵⁹ These approaches share many common factors.

Drawing on the economic climate change expertise within the Academy, Academy Fellows Richard Holden, Warwick McKibbin and Mike Young put forward a unifying approach that they call CALM. CALM is a market-based approach that meets the key principles set out above. In making this proposal, the authors recognise that there are alternative policy designs that also draw on the efficiency properties of prices and markets. At this point, CALM is set out only in broad terms, with many details to be decided, should it or something like it gain policy traction.

4.1 WHAT CALM NEEDS TO ACCOUNT FOR

Under the CALM approach, there are two key goals. First, the emitting activities should incur the liabilities for their emissions (pay a price). Second, the allocation of the right to emit, and its price, should be set in a market framework, to achieve the emissions targets at a minimum economic cost.

There is no doubt that the introduction of a short-term emissions price would be a cost to the enterprises that currently emit for free and it would require costly adjustments for such enterprises. In contrast, long-term emissions prices provide opportunities for innovation and new enterprises that lead to potential benefits to the economy. These two time dimensions are frequently not distinguished, but there are large gains from doing so. The suite of policies and instruments chosen needs to ensure that long-term and short-term risks can be, and are, managed separately.

Moreover, if it becomes cheaper to reduce emissions because of technological breakthroughs, then the policy framework should make it possible to reduce emissions more quickly. Conversely, if fewer countries take action, or the cost of Australia's actions ends up being substantially higher than expected, then there needs to be an institutional arrangement that allows the proposed emission-reduction pathway to be varied in a manner that does not severely damage business confidence or the long-term emissions goals.

4.2 How CALM Would Work

The fundamental idea is to combine the best aspects of carbon pricing and emissions trading. This requires the creation of assets and liabilities related to the use of carbon in the Australian economy [we here use carbon as shorthand for greenhouse gas emissions]. Emissions cause a cost to the environment and in this scheme, become liabilities of whoever is emitting. The assets are the right to emit carbon. The concept that underlies all of the approaches cited above,

and CALM, is that all Australians should own the assets created by the policy. This is the foundation for ensuring that Principle 4, a fair adjustment for households, is met. The emitting activities should incur the liabilities.

The interplay between the owners of the assets and liabilities should be in a market framework to achieve the science-based emissions targets at a minimum economic cost. The design of the market is important because there are two goals of the policy framework. The first goal is to achieve the emissions targets in the longer term. This second goal is to achieve these targets at the lowest cost. Costs can be both short term and long term; however, over time, new opportunities could create positive benefits that more than offset any future costs. A market-based approach can be modified to eliminate unnecessary volatility in short-term costs.

Under CALM, the Australian Government would set the national emissions targets for each year until, say, they are net zero in 2050. These targets should meet the requirements of Principle 1, that is, be based on scientific evidence. It would then create an independent **Australian Climate Bank**.

The Climate Bank would:

- Issue annual emissions certificates (emissions assets) that give a right to emit a defined amount, for each year until, say, 2050. A declining number of emission certificates would be created for each year, to achieve zero net emissions at 2050
- Record the annual emission liabilities of all large emitters
- Require all large emitters to hold annual certificates equal to their liabilities from emissions in each year
- Bundle annual certificates into an emissions bond: this bond is a collection of annual certificates of different dates and different emissions
- Allocate all certificates in the form of emissions bonds at the start of the program
- Sell additional certificates, valid only for the current year, at a fixed price, to avoid excess volatility in the short-term market

The certificates could then be allocated to all Australian citizens. They could also be allocated to all companies that have assets on their balance sheets that are devalued by the imposition of the carbon constraint. Or there could be some combination of the two allocations. This combination of allocations represents a political choice about compensating households relative to producers.

Carbon bonds would be bought and sold in a market that is created and managed by the Climate Bank. The trading of these assets in a market will lead to a price in the current period and over every year into the future. These bonds will be valuable, and their prices will enable enterprises and households to discover the market's best estimate of the current and future cost of reducing carbon emissions at any point in time. This will inform current and future investment. It is important to appreciate that what matters for the development and adoption of low emissions forms of production is not the price of emissions today, but the price that people and firms expect over the life of any investment that they make.

There is an additional degree of regulation that is required to minimise short-term economic costs and avoid excess volatility in the short-term market. Carbon certificate prices can be made more stable by actions of the Australian Climate Bank. It would issue additional certificates at a fixed price (pre-announced) that can only be used to balance a carbon liability in the current year. The approach is similar to the way monetary policy is implemented in Australia. The long-term interest rate is determined by buyers and sellers trading of bonds in the long-term bond market, while the Reserve Bank of Australia fixes the short-term interest rate by intervening in the short-term market.

The number of carbon bonds that are issued should be at the low end of estimates of total allowable emissions. The reason for this is that they would normally be topped up by the annual certificates issued by the Climate Bank. As an alternative, or in addition, the Climate Bank could buy certificates, if there is a need or opportunity to accelerate the rate of emissions reduction.

In addition, if new information suggests that

emissions could or should be reduced more rapidly, then the face value of the allowable emissions per bond can be adjusted downwards, across the board. Emitters would then have to buy more bonds, to the extent that they could not reduce emissions by the required amount. This extra demand would raise the price of bonds, perhaps even fully offsetting the price impact of the fall in the quantity of emissions that they permitted.

Enterprises that find ways to draw down greenhouse gases from the atmosphere provide the same economic and environmental benefits as reducing emissions and should be recognised in a similar way. The Climate Bank could certify their negative emissions and then compensate them, using revenue from the sale of the annual certificates.

The Climate Bank and the market that it manages would be the means to achieve Principle 2: minimise cost, encourage, and reward innovation, and promote investment.

Ownership of the right to emit embedded in a financial asset creates a constituency throughout society which is financially driven to resist any government backsliding on future policy commitments and makes the policy more credible. It also enables those who reduce emissions to gain financially from doing so. This assists in meeting Principle 3, a climate of policy certainty.

The allocation of these new assets, which would increase the wealth of all households, should be more than sufficient to make most Australians better off even with the increased prices they would face from changing the carbon content of the Australian economy.

Australia's creation of a self-contained, market-based approach that is monitored and enforced by a highly credible national institution, would encourage other countries to cooperate by creating similar markets. If the annual price of carbon were equal in all countries, by negotiation, there would be no need to consider trading certificates across countries because trade only occurs when prices differ across markets. Thus, the result could be a cooperative global system run by national institutions rather than a centrally planned system run by global bureaucrats.

The incentives for countries to withdraw would be low, since domestic voters and corporations have a financial interest in the survival of the CALM assets on their balance sheets.

A global system with correct accounting of the assets and liabilities associated with carbon emissions would be efficient and lead to the lowest cost abatement globally. The CALM approach would reduce the cost to Australia of inevitable global climate action.

We invite careful consideration of a Climate Asset and Liability Mechanism that:

1. Establishes an **independent Australian Climate Bank** to administer the system in a manner that locks Australia into a predictable policy process and gives it integrity and authority
2. Enables businesses to invest with confidence via the **introduction of climate bonds**, or other similar long-term assets, that create a strong constituency for the retention of the system
3. Couples a **day-to-day emission accounting mechanism with a tradeable certificate**

accounting system so that all Australians are encouraged to reduce the impact they are having on the climate.

4. Includes a mechanism that supports an **adjustment process that is fair**
5. Relies on a suite of **parallel initiatives to assist regions, businesses and households** to adjust.

In concluding this section, we acknowledge that market-based mechanisms are not a complete solution. Direct regulations can have a cost-effective role to play in setting minimum standards and in expediting progress. But a cost for emitting and trading in the right to emit are an essential part of any low-cost strategy that maximises the role played by ingenuity, new technologies and a drive for efficiency.

Unless prices are consistent with the emissions reduction goal, there will be attempts to evade regulation and adopt cheaper, but more polluting methods.

REFERENCES

1. Australian Academy of Science. (2015). The Science of Climate Change: Questions & Answers, viewed 15 March 2020. Available: <https://www.science.org.au/climatechange>
2. World Meteorological Organization. (2019). The Global Climate in 2015–2019. Geneva, Switzerland. Available: https://library.wmo.int/index.php?lvl=notice_display&id=21522#.XdGYqVcza70
3. IPCC. (2018). Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.
4. *ibid.*
5. *ibid.*
6. World Meteorological Organization. (2019). The Global Climate in 2015–2019. Geneva, Switzerland. Available: https://library.wmo.int/index.php?lvl=notice_display&id=21522#.XdGYqVcza70
7. IPCC. (2019a). Summary for Policymakers In: *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*. [H.- O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, M. Nicolai, A. Okem, J. Petzold, B. Rama, N. Weyer (eds.)]. In press.
8. World Meteorological Organization. (2019). The Global Climate in 2015–2019. Geneva, Switzerland. Available: https://library.wmo.int/index.php?lvl=notice_display&id=21522#.XdGYqVcza70
9. *ibid.*
10. Church, J.A., P.U. Clark, A. Cazenave, J.M. Gregory, S. Jevrejeva, A. Levermann, M.A. Merrifield, G.A. Milne, R.S. Nerem, P.D. Nunn, A.J. Payne, W.T. Pfeffer, D. Stammer and A.S. Unnikrishnan. (2013). Sea Level Change. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
11. Crawford, S., et al. (2018). Global insurance trends analysis 2018. EY Report. Available: [https://www.ey.com/Publication/vwLUAssets/ey-global-insurance-trends-analysis-2018/\\$File/ey-global-insurance-trends-analysis-2018.pdf](https://www.ey.com/Publication/vwLUAssets/ey-global-insurance-trends-analysis-2018/$File/ey-global-insurance-trends-analysis-2018.pdf)
12. Buberl, T. (2017). AXA accelerates its commitment to fight climate change [press-release], viewed 8 November 2019. Available: <https://www.axa.com/en/newsroom/press-releases/axa-accelerates-its-commitment-to-fight-climate-change>
13. Ceballos, G., Ehrlich, P.R., Barnosky, A.D., García, A., Pringle, R.M. and Palmer, T.M. (2015). Accelerated modern human-induced species losses: Entering the sixth mass extinction, *Science advances*, 1 (5), p.1400253.
14. Frieler, K., Meinshausen, M., Golly, A., Mengel, M., Lebek, K., Donner, S.D. and Hoegh-Guldberg, O. (2013). Limiting global warming to 2 C is unlikely to save most coral reefs. *Nature Climate Change*, 3 (2), p.165.
15. Costello, A. et al. (2009). Managing the health effects of climate change. *The Lancet*, 373 p.9676.
16. Friel, S. (2019). *Climate Change and the People's Health*. Oxford University Press.
17. Australian Medical Association. (2019). Climate change is a health emergency, viewed 15 November 2019. Available: <https://ama.com.au/media/climate-change-health-emergency>
18. World Health Organisation. (2015). WHO calls for urgent action to protect health from climate change – Sign the call, viewed 15 November 2019. Available: <https://www.who.int/globalchange/global-campaign/cop21/en/>
19. Watts, N., Amann, M., Arnell, N., Ayeb-Karlsson, S., Belesova, K., Bouley, T., Boykoff, et al. (2019). The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. *The Lancet*, 394 (10211), p.1836-1878.
20. Mora, C., Dousset, B., Caldwell, I. et al. (2017). Global risk of deadly heat. *Nature Climate Change*, 7, p. 501–506.
21. Brown, S., Nicholls, R.J., Goodwin, P., Haigh, I.D., Lincke, D., Vafeidis, A.T. and Hinkel, J. (2018). Quantifying land and people exposed to sea-level rise with no mitigation and 1.5 C and 2.0 C rise in global temperatures to year 2300. *Earth's Future*, 6 (3), p.583-600.
22. IPCC. (2018). Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T.

Waterfield (eds.)). In Press.

23. Kulp, S. & Strauss, B. (2019). New Elevation Data Triple Estimates of Global Vulnerability to Sea-Level Rise and Coastal Flooding. *Nature Communications*, 10 (4844), p.1-12.
24. Pretis, F., Schwarz, M., Tang, K., Haustein, K. and Allen, M.R. (2018). Uncertain impacts on economic growth when stabilizing global temperatures at 1.5 C or 2 C warming. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 376 (2119), p.20160460
25. Kompas, T., Pham, V. H., Che, T. N. (2018). The Effects of Climate Change on GDP by Country and the Global Economic Gains from Complying with the Paris Climate Accord. *Earth's Future*, 6 (18), p.1153-1173
26. IPCC. (2019b). Summary for Policymakers. In: IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse gas fluxes in Terrestrial Ecosystems. [Arneth, A., Barbosa, H., Benton, T., Calvin, K., (et al.)], In press.
27. United Nations. (2016). Paris Agreement. Paris: United Nations, p.1-27.
28. IPCC. (2018). Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.
29. CDP Worldwide. (2019). 43 cities score an A grade in new cities climate change ranking, viewed 15 November 2019. Available: <https://www.cdp.net/en/articles/media/43-cities-score-an-a-grade-in-new-cities-climate-change-ranking>
30. United Nations Environment Programme. (2019). Emissions Gap Report 2019. UNEP, Nairobi.
31. CSIRO. (2019). Climate Change Information for Australia. Available: <https://www.csiro.au/en/Research/OandA/Areas/Oceans-and-climate/Climate-change-information>
32. Bureau of Meteorology and CSIRO. (2018). State of the Climate 2018, viewed 8 November 2019. Available: <http://www.bom.gov.au/climate/current/annual/aus/>
33. Bureau of Meteorology. (2019). Special Climate Statement 68—widespread heatwaves during December 2018 and January 2019, viewed 8 November 2019. Available: <http://www.bom.gov.au/climate/current/statements/scs68.pdf>
34. Joelle Gergis. (2018). Sunburnt Country: The History and Future of Climate Change in Australia. Melbourne University Publishing.
35. 'L. Granwal. (2020). Bushfires in Australia- Statistics and Facts. Statista. Accessed: https://www.statista.com/topics/6125/bushfires-in-australia/#dossierSummary__chapter3
36. Shi, L., Zanobetti, A., Kloog, I., Colull, B.A., Kourakis, P., Melly, S.J., Schwartz, J.D. (2016). Low-Concentration PM2.5 and Mortality: Estimating Acute and Chronic Effects in a Population-Based Study. *Environment Health Perspectives*, 124 (1), p.46-52.
37. Abram, N.J., Wright, N.M., Ellis, B. et al. (2020). Coupling of Indo-Pacific climate variability over the last millennium. *Nature* 579, p. 385–392. <https://doi.org/10.1038/s41586-020-2084-4>
38. Bureau of Meteorology and CSIRO. (2018). State of the Climate 2018, viewed 8 November 2019. Available: <http://www.bom.gov.au/climate/current/annual/aus/>
39. *ibid.*
40. Bureau of Meteorology. (2017). 2017 marine heatwave on the Great Barrier Reef, viewed 15 November 2019. Available: <http://www.bom.gov.au/environment/doc/marine-heatwave.pdf>
41. Climate Council of Australia Ltd. (2018). Australia's Rising Greenhouse Gas Emissions. [Greg Bourne, G., Stock, A., Steffen, W., Stock, P. and Brailsford, L. (eds.)]. In Press.
42. Commonwealth of Australia. (2015). Australia's Intended Nationally Determined Contribution to a new Climate Change Agreement. Available: <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Australia%20First/Australias%20Intended%20Nationally%20Determined%20Contribution%20to%20a%20new%20Climate%20Change%20Agreement%20-%20August%202015.pdf>
43. Department of Environment and Energy. (2019). About the Climate Solutions Fund – Emissions Reduction Fund, viewed 2 December 2019. Available: <https://www.environment.gov.au/climate-change/government/emissions-reduction-fund/about>
44. Department of Industry (2020). Australia's Technology Investment Roadmap: A discussion paper. Accessed: <https://consult.industry.gov.au/climate-change/technology-investment-roadmap/>
45. Climate Council of Australia Ltd. (2018). Australia's Rising Greenhouse Gas Emissions. [Greg Bourne, G., Stock, A., Steffen, W., Stock, P. and Brailsford, L. (eds.)]. In Press.

46. Department of Foreign Affairs and Trade. (2019). Pacific Regional—climate change and resilience, viewed 15 November 2019. Available: <https://dfat.gov.au/geo/pacific/development-assistance/Pages/resilience-pacific-regional.aspx>
47. Denis, A., Jotzo, F., Ferraro, S., et al. (2014). Pathways to deep decarbonisation in 2050: How Australia can prosper in a low carbon world, *ClimateWorks*, Melbourne.
48. Garnaut, R. (2019). *Superpower: Australia's low-carbon opportunity*. Black Inc. Melbourne.
49. Kompas, T., Pham, V. H., Che, T. N. (2018). The Effects of Climate Change on GDP by Country and the Global Economic Gains from Complying with the Paris Climate Accord. *Earth's Future*, 6 (18), p. 1153-1173
50. McKibbin W. (2015a). Report 1: 2015 Economic Modelling of International Action Under a new Global Climate Change Agreement. Report to Department of Foreign Affairs and Trade.
51. McKibbin W. (2015b). Report 2: Economic Modelling of Australian Action Under a new Climate Agreement. Report to Department of Foreign Affairs and Trade.
52. Cooper, A. F., Richard A. Higgott and Kim Richard Nossal. (1993). Relocating Middle Powers: Australia and Canada in a Changing World Order. *Vancouver University of British Columbia Press*
53. Looney, B. (2020). Reimagining Energy, reinventing BP, speech, BP CEO, statement to investors 12 February 2020. Available: <https://www.bp.com/en/global/corporate/news-and-insights/speeches/reimagining-energy-reinventing-bp.html>
54. Business Council of Australia, Energy and Climate Change. Melbourne. Viewed 12 February 2020. Available: https://www.bca.com.au/energy_and_climate
55. The World Bank, Pricing Carbon. Washington. Viewed 13 February 2020. Available: <https://www.worldbank.org/en/programs/pricing-carbon>
56. Holden R. and R. Dixon (2019) "A Climate Dividend for Australians" University of New South Wales, Sydney. Available: https://www.grandchallenges.unsw.edu.au/sites/default/files/2019-03/Australian%20Climate%20Dividend%20Plan_0.pdf
57. McKibbin W. and P. Wilcoxon .(2002). The Role of Economics in Climate Change Policy. *Journal of Economic Perspectives*, 16 (2), p. 107-129
58. McKibbin W.J. and P. Wilcoxon. (2008). Building on Kyoto: Towards a Realistic Global Climate Change Agreement. *The Brookings Institution*.
59. Young M. (2017). Climate Sharing a Popular Option. *Droplets* 21. Centre for Global Food and Resources, The University of Adelaide.