Hanna submission to **Climate Change National Framework for Adaptation & Mitigation Bill 2020**

House Standing Committee on the Environment & Energy

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House of Representatives

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RE: Climate Change (National Framework for Adaptation and Mitigation) Bill 2020

To the Standing Committee

Thank you for the opportunity to provide a submission to the

Climate Change (National Framework for Adaptation and Mitigation) Bill 2020.

I note this is **A Bill for an Act to establish a national climate change adaptation and mitigation framework, and to establish the Climate Change Commission, and for related purposes**

Outlined below a summary of the points within the bill addressed in this submission.

In essence, I emphatically support the Bill.

This submission provides comment on merits of the proposed Climate Change Bill ***through a health lens***.

My motivation to make this submission stems from a genuine concern I hold, as a health professional of many decades, that insufficient emphasis is being placed on the impact of climate change on the health and wellbeing of Australians and the global citizenry.

Climate change is disrupting the integrity of geophysical processes on a planetary scale, and we have strong evidence these affects are accelerating. Disruptions of the global climate, planetary hydrological cycles, ocean chemistry, indeed all systems directly interrupts ecosystems which in turn, directly, and more specifically NEGATIVELY impacts the health and welfare of human societies. We, of the health sector are left to mop up the human damage, and apply our skills and resources to restore health, wellbeing and mental stability. Success in our collective endeavours is not possible when human actions wilfully persist undertaking activities that solid science is warning is destructive to life on this planet. No health system, no matter how advanced and resourced, can protect us.

Hence, I am compelled to add my voice to the chorus from the health sector and other wise heads urging Australia to a) listen to and HEED the evidence and warnings of *climate science* and b) *urgently embark* on broad sweeping actions that can rapidly transition us away from otherwise impending doom. Whereas this may be characterised (derided) as 'alarmist' language, it is now abundantly clear that the situation IS SO DIRE that tepid-speak is no longer appropriate. Fire alarms are loud for a reason. Similarly, my language must also be loud and clear. Yet in this, my voice is one of many. U.N. Secretary-General Antonio *Guterres*

said in a speech to Columbia University Wednesday ".. *humanity* is *waging war* on *nature*. This is *suicidal*. *Nature always strikes back* and it is *already doing so* with *growing force* and *fury*, . . . "biodiversity is collapsing. One million species are at risk of extinction. Ecosystems are disappearing before our eyes" [1] . Sir David Attenborough has slammed Prime Minister Scott Morrison's support for new coal mines and lack of action on climate change, in his most damning assessment yet of Australia's environmental record.[2]

The necessity to extend the scan to include impacts on health, in its broadest sense, needs emphasising as current emission trajectories are careering towards a variety of tipping points beyond which catastrophic impacts will unfold, and many societies will not survive. The pathway to demise is a grim one, involving untold human suffering. It is unconscionable to ignore this very real and already apparent threat. We all have a moral duty to our fellow Australians, to the global citizenry alive today as well as those yet unborn, and to the ecosystems upon which human life depends, and which we have no right to *knowingly* and willingly destroy.

Although partially protected by the virtue of being a developed nation, the combination of Australia's high temperatures, highly erratic rainfall, vast climatic zone coverage, and our propensity to cluster around the coastlines make Australia highly vulnerable to climate change. This precarious state is exacerbated by the massive decline in climate research investment by conservative governments.

This submission begins with a very brief outline of my professional expertise – upon which this submission is based. I then outline some relevant recent climate events and address selected aspects of the Bill and Proposed Climate Act where my expertise intersect.

About the Author

Dr Elizabeth (Liz) Hanna.

My expertise encompasses health impacts of climate change, based on a foundation of an extensive clinical career in Intensive Care Unit Management then Hospital Administration, and followed by decades training public health workforce in physiology, exposures, epidemiology and policy development, primarily at the Universities of Sydney and La Trobe.

My third career at the Australian National University began in 2008. This involved directing research projects examining health impacts of climate change, assessing vulnerability and adaptation responses. Here I convened Australia's *National Climate Change Adaptation Network for Human Health*, as a hub of the National Climate Change Adaptation Research Facility (*NCCARF*), and edited the State of the Science and Policy series on Climate Change and Human Health published in the Asia-Pacific Journal of Public Health.

Throughout my career I have maintained a strong policy focus through the Public Health Association of Australia, convening their Environmental Health Special Interest Group and several terms on the PHAA Board. My environmental Health expertise led to committee membership to provide high level public

[1] See https://www.youtube.com/watch?v=8c6lKPqqTWU

[2] See https://www.abc.net.au/triplej/programs/hack/sir-david-attenborough-slams-scott-morrison-on-climate-record/11533566

/environmental health advice to the APVMA, NINCNAS, enHealth and Stockholm Convention, as well as several State Health Departments, and Consultancies here in Australia and across the Pacific.

As a multi-award winning environmental health researcher and advocate, I Chair the Environmental Health Working Group of the World Federation of Public Health Associations and am a past President of the *Climate and Health Alliance*. My academic affiliation is with the *Australian National University Climate Change Institute* and *Fenner School for Environment and Society.*

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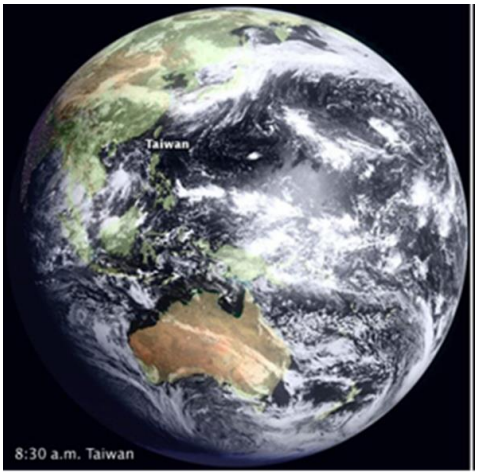
Initial statements:



NASA's satellite photos starkly remind us of the fragile globe upon which 7.8 billion people call home and must derive all our food, water and air that keeps us alive and healthy.

This clearly shows us the Earth's resources are limited, so in order to continue to supply our survival needs, they must be kept in a healthy (uncontaminated) state, and shared sustainably and equitably.

Environmental damage harms all of us.

The planet and all its natural ecosystems are **common goods**, such that the **Tragedy of the Commons** [1] has historically enabled individuals, industries, corporations and governments to reap the resources without constraints or consideration of the after effects of resource harvesting, and more critically, without impost or needing to pay the full cost.

In early times, when the Earth's population was low, land and water were abundant, such resource use was less problematic. However in the current era with a global population exceeding 7.8 Billion (United Nations estimates[3]), and the capacity to extract resources on industrial scales, such freedoms are no longer appropriate. Yet for too long they have been, and the result is that collectively, we have breached **Planetary Boundaries** [2][4]. Earth Overshoot Day was August 22 in 2020[5] . This day marks the date when humanity's demand for ecological resources and services within a given year exceeds what Earth can regenerate in that year. Every year it moves forward – earlier in the year as the global population consumes more than the Earth's regenerative capacity. Ultimately, we move into deficit, where people have too few resources to live a healthy and comfortable life, too little water and too little land to live in peace and produce the food they need to survive.

Australia cannot continue pretending that we are not culpable, or that we have a small or negligible role to play in reversing this pillaging of planetary life-giving resources. Per capita we consume more than our fair share, and more than most other developed countries, and per capita, our wastes pollute the environment also at a much higher amount. This includes greenhouse gas emissions. Earth Overshoot Day calculates that if everyone on Earth lived as Australians do, we would need 4.5 Earths to supply their environmental resources and absorb their wastes. We score marginally better than the USA at 5.0 Earths. But our consumptive patterns far exceed the global average of 1.7 Earths. Notably, the UK, EU and Japan consume the equivalent of only 2.7 or 2.8 Earths, and China's consumption is at 2.2. We can *and should* do better.

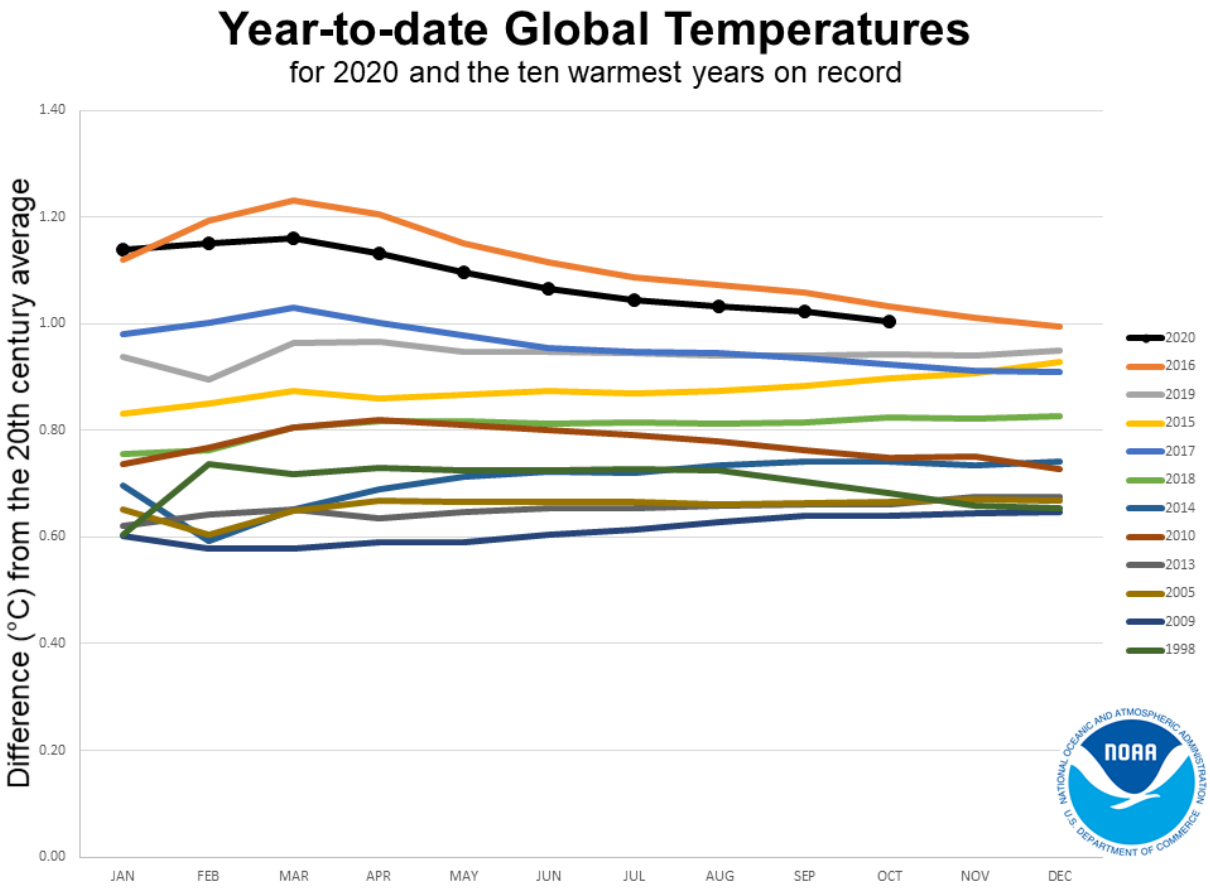
[3] See https://www.worldometers.info/world-population/
[4] The planetary boundaries, developed in 2009, are a set of non-negotiable global limits for factors such as temperature, water use, species extinctions and other environmental variables. These aim to quantify how far we can push the planet before threatening our very survival.
[5] See https://www.overshootday.org

Climate Change is one part of this equation. An important part. Willingly, and against scientific advice, allowing climate change to continue accelerating is the equivalent of lighting a match and tossing it into the volatile mix of environmental damages.

Climate change to date: global

The World Meteorological Organization (WMO) data reveals global warming is accelerating [3]. Heat records are being broken across the world [4].

2019 was the second warmest year in the instrumental record - after 2016, and 2020 is tracking surpass 2019, and possibly also pass 2016 to become the world's hottest year.



(Source: https://www.ncdc.noaa.gov/sotc/global/202010/supplemental/page-1)

2015-2019 are the five warmest years on record, and 2010-2019 the warmest decade on record. Since the 1980s, each successive decade has been warmer than any preceding decade since 1850 [5]. There is a growing chance of annual global mean near surface temperature temporarily exceeding 1.5 °C above the 1850–1900 pre-industrial level by 2024 [6].

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Our disruption of the climate system has far reaching effects, and they make frightening reading!
Sea levels are rising at an increasing pace, largely due to the thermal expansion (warming) of sea water as well as melting of the largest glaciers, like in Greenland and Antarctica. This is exposing coastal areas and islands to a greater risk of flooding and the submersion of low-lying areas,"

More than 93% of the excess energy accumulating in the climate system as a result of increased concentrations of greenhouse gases goes into the ocean [7]. In 2019, at least 84% of the world's ocean experienced at least one marine heatwave, and ocean heat content down to a depth of 2 kilometres exceeded the previous record highs set in 2018 [5].

Ocean warming has widespread impacts on the climate system and contributes more than 30% of sea level rise through thermal expansion of sea water. It is altering ocean currents and indirectly altering storm tracks and melting floating ice shelves.

Arctic, Greenland and Antarctic ice melt is increasing, at a rate of 0.72 million km^2 per decade [8], and in October 2020 was at its lowest level in the satellite record (42 years) [9]. The Arctic will soon be ice free, further contributing to Sea Level Rise (SLR). SLR is accelerating [10]. Sea level has risen throughout the satellite altimetry record (since 1993). Sea level rose 4.8 millimetres annually over the past five years, compared to 4.1 millimetres annually for the five years before that[11]. In 2019, the global mean sea level reached its highest value on the record [5].

Almost 2/3 of the world's cities are at risk of SLR [7].

As well as homes and agricultural land major infrastructure, hospitals, roads, ports, railways and airports are at risk of inundation [12]. Indonesia is relocating its capital Jakarta, a subsiding mega city (over 10 million people) to higher ground as SLR is exacerbating its flooding problems [13]. Relocation is extremely disruptive, expensive and enormously unpopular [14].

Drivers of outmigration are multifaceted, influenced by climatic and environmental hazards as well as political, demographic, economic and social factors embedded within policy incentives to encourage or obstruct migration. Evidence suggests that there are strong economic, social and cultural reasons for households to resist migrating away from areas that can no longer safely support their families, such as exposure to SLR until migration is the only remaining option [15].

As well as the oceans absorbing heat, they absorb CO_2. Around 23% of annual CO_2 emissions are absorbed into the oceans. This cushions the impacts of climate change but increases ocean acidity which reduces the ability of marine organisms such as mussels, crustacean and corals to calcify, affecting marine life, growth and reproduction.

Levels of dissolved oxygen in the oceans is declining in the open and coastal oceans, including estuaries and semi-enclosed seas. Since the middle of the last century, there has been an estimated 1%–2% decrease (77 billion–145 billion tons) in the global ocean oxygen inventory [5].

Disruption of marine ecosystems – via warming, acidification and deoxygenation - has catastrophic potential for global nutrition. Pollution through agricultural run-off, oil spills, plastics and urban waste further stress ocean health and marine ecosystems. Fish protein accounts for about 17 per cent of protein at the global

level and exceeds 50 % in many least-developed countries [7]. The nutrients found in fish are important for optimal neurodevelopment in children and for improving cardiovascular health.

Heat is killing people. In Japan, a major heat wave event in 2019 resulted in over 100 deaths and an additional 18,000 hospitalizations. In France over 20,000 emergency room were recorded for heat-related illnesses between June and mid-September and during two major summer heatwaves, there were a total of 1,462 excess deaths in the affected regions [5].

The months January to August in Russia for were 3.7 °C above average, a full 1.5 °C above the previous record set in 2007, and Siberia the year has been 5°C above normal [16]. In late June, Verkhoyansk reached 38.0 °C the highest known temperature anywhere north of the Arctic Circle. Antarctica also set new heat records, and Death Valley reached 54.4°C – the highest confirmed temperature on Earth for 80 years. Los Angles reached 49.4°C and the Middle East, Kuwait Airport and Baghdad reached 52.1 and 51.8°C respectively [16]. ***These temperatures are physiologically intolerable [17].***

The Lancet 2020 Countdown report analysed the global human health burden arising form and exposure to fossil fuels and resultant climate change [18]. Selected health harms from that report include:

- Vulnerable populations were exposed to an additional 475 million heatwave events globally in 2019, which delivered excess morbidity and mortality, such as a 53.7% increase in heat-related mortality in people older than 65 year over the past 20 years, and 296 000 deaths in 2018 alone [18].
- Human physical activity is restricted in the heat, so the increasing heat has reduced economic output, with 302 billion work hours lost in 2019.
- India and Indonesia lose labour capacity equivalent to 4–6% of their annual gross domestic product.
- In Europe in 2018, the monetised cost of heat-related mortality was equivalent to 1.2% of regional gross national income, or the average income of 11 million European citizens (indicator 4.1.2).
- Between 2015 and 2020, climate change fingerprints have been demonstrated in 76 floods, droughts, storms, and temperature anomalies.
- 67% of global cities surveyed expected climate change to seriously compromise their public health assets and infrastructure.
- The changing climate has downstream effects arising from interference with broader environmental systems threatened global food security as global yield of major crops declined by 1.8 – 5.6% between 1981 and 2019.

Changes in climatic conditions since 1950 are making it easier for the Aedes mosquito species to transmit dengue virus, increasing the risk of the occurrence of disease. In parallel, the global incidence of dengue has grown dramatically in recent decades, and about half of the world population is now at risk of infection [5].

Climate variability and extreme weather events are among the key drivers of the recent rise in global hunger and one of the leading causes of severe crises. After a decade of steady decline, hunger is on the rise again – over 820 million people suffered from hunger in 2018. Among 33 countries affected by food crises in 2018, climate variability and weather extremes a compounding driver together with economic shocks and conflict in 26 countries and the leading driver in 12 of the 26. In light of this, the global community faces an enormous challenge to meet the Zero Hunger target of the 2030 Agenda for Sustainable Development [5].

Tropical Cyclones (TCs) do not develop until the Sea Surface Temperatures (SST) reaches a threshold, roughly 26.7°C. But they also need a spatial temp gradient – rigorous statistical analysis and future projections are therefore complex. What is known is that above the SST threshold, more heat (ie energy) exists for the TCs that do evolve -making them more intense, and this has been observed. Latest figures show that 90 % of disasters classed as climate related—now cost the world economy US$520 billion per year and push 26 million people into poverty every year. [7]

Warming oceans increases are leading to fewer but more intense tropical cyclones globally. High intensity storms bring higher (more damaging) wind speeds and higher rainfall (flash flooding & erosion). The loss and damage bill is far greater. So the net effect is increased human health and economic losses. These will increase in a warming world [19].

More than 6.7 million new internal disaster displacements were recorded between January and June 2019, triggered by hydrometeorological events such as Cyclone Idai in Southeast Africa, Cyclone Fani in South Asia, Hurricane Dorian in the Caribbean, and flooding in Iran, the Philippines and Ethiopia. This number was forecast to reach close to 22 million in 2019, up from 17.2 million in 2018. Of all natural hazards, floods and storms contributed most to displacement [5].

We know that at least 11 to 15% of the population of Small Island Developing States live on land with an elevation of 5 meters or lower, and that a SLR of half a meter could displace 1.2 million people from low-lying islands in the Caribbean Sea and the Indian and Pacific Oceans; with that number almost doubling if the sea level rises by 2 metres. Our near neighbours in the Pacific will look to Australia as a) a culprit & b) and a land that owes them safe refuge. “Safe refuge” means a *true welcoming home*, not cramped conditions far from the sea without employment prospects – and certainly not a detention centre.

Since 2008, an annual average of 21.5 million people have been forcibly internally displaced by sudden weather-related hazards [7]. The numbers increase. Australia will not be immune to the problem of mass migration. People who lose their homes, food and water supplies WILL move to seek refuge to provide security for their families. The desire to survive is strong. These people are not guilty. They are not rorting any system. They only want to live …. as we all do.

Climate change to date: Australia

This committee will be well aware for the recent climatic events experienced across Australia, so this section will be brief.

Australia has already warmed 1.4°C [20]

The warming trend has persisted for over 60 years, whereby the Bureau of Meteorology (BoM) data show heatwave are increasing in peak temperatures and frequency, and they are also lasting longer in comparison to past conditions [21].. Very high monthly maximum temperatures that occurred nearly 2 per cent of the time in 1960–1989 and over 4 per cent of the time in 1990–2004, now occur over 12 per cent of the time (2005–2019). This is more than a sixfold increase over the sixty-year period [22].

This trend will continue, as heatwaves are projected to be 85% more frequent if global warming increases from 1.5 to 2.0 °C, and last up to a month if global warming increases from 1.5 to 3.0 °C [21] Recent modelling indicates that projections modelled under CMP5 underestimate future warming, with some models under the revised CMIP6 suite suggest Australia's warming of up to 6.5°C is possible by the end of this century, or 7°C warmer than pre-industrial levels if high emission scenarios persist [23].

We cannot allow this to happen!

Australia's hottest day on record was set in December 2019. The national area-averaged maximum temperature on the 18th was 41.9 °C, a whole degree higher than the value for the 17th (40.9 °C). Both days exceed the previous record of 40.30 °C set on 7 January 2013. 11 days during December had a national area-averaged maximum of 40 °C or above, seven of them consecutively from 23 to 29 December. Prior to this month, Australia had only recorded 11 such hot days since 1910 (seven of which occurred in the 2018–19 summer). Temperatures this high are indicative of the dangerous heat conditions that affected large parts of Australia [24].

The year 2019 was Australia's hottest and driest year in recorded history, which followed consecutive years of extreme drought [25].

Penrith, in Sydney's' western suburbs reached 48.9 °C on 4 January 2020. Canberra reached 44.0 °C, 1.2 °C above the previous record [25].

Yet with an average 2.11°C higher mean temperature than average, the summer of 2019-2020 was Australia's second hottest, coming 2nd to the 2018–19 summer [24].

As projected by the Bureau of Meteorology [26], and CSIRO Australia experienced the highest accumulated Forest Fire Danger Index (FFDI)[25].

Emergency Leaders for Climate Action (ELCA), a group of 33 former Australian fire and emergency service leaders, from every state and territory, warned of the unfolding conditions back in April 2019 and tried to meet with the Government. They predicted a catastrophic fire season, urged stronger action on climate change, an increase in emergency response capabilities, and more work to reduce bushfire risks. They reported "Sadly, those warnings fell on deaf ears and, as the world watched on in horror, those same warnings became a harsh reality " [27].

It is important to register that this ghastly summer of occurred with only 1.4°C of warming. Further intensification of these extremes and resultant catastrophic disasters is unimaginable. We must prevent this, and put a stop to such trajectories.

Evidence:

Burning of fossil fuels has emitted excessive amounts of greenhouse gases into the atmosphere. Global atmospheric CO_2 levels have historically oscillated between 180 and 280 parts per million (ppm) throughout the ice ages and inter-glacial warm periods. Levels peaked at over 417ppm in 2020, the highest they have been in human history, and probably the highest in 3 million years [28]. Renewable technology is now cheaper than fossil fuels and Australia has abundant supplies, such that employment prospects and export opportunities are available.

The most recent *State of Greenhouse Gases in the Atmosphere* report published by the World Meteorological Organisation (WMO) provides incontrovertible evidence that human activities, such as Australia's coal and gas industries industry, are driving this rise in temperatures [29]. The WMO report explains that analysis can discriminate between fossil fuel combustion and natural sources of CO_2 by measuring the content of radiocarbon (14C) in atmospheric carbon dioxide (CO_2). The report also notes that instead of the trend reversing, atmospheric CO_2 emissions are *accelerating*, as the increase in CO_2 from 2018 to 2019 was larger than that observed from 2017 to 2018, and larger than the average annual growth rate over the last decade. CO_2 accounted for about 80% of the 45% increase in greenhouse gas warming from 1990 to 2019. The report predicts that the impact of the global Covid19 pandemic will be minimal as emissions will continue to increase - but at only a slightly reduced rate.

The WMO Report also clearly outlines WHY emission reductions are urgently needed.

> "*Only when net fossil fuel emissions of CO_2 approach zero will the net uptake by ecosystems and oceans start to reduce CO_2 levels in the atmosphere. Even then, most of the CO_2 already added to the atmosphere will remain there for several centuries, continuing to warm our climate. In addition, the Earth climate system has a lag time of several decades due to buffering of the excess heat by the oceans, so the sooner we reduce our emissions, the less likely we are to overshoot the warming threshold the world agreed to in the Paris Agreement."[29]*

Accepting the climate science:

Recognition of the precarious position of our continued flourishing amidst global environmental degradation is gaining momentum. A global wave of environmental awareness is surging from grassroots levels all the way through to boardrooms and the United Nations with Sustainable Development Goals (SDGs) adopted by all member states (including Australia) in 2015[6].

Criminalizing environmental damage:

On November 22 2020 France's Ecology Minister Barbara Pompili and Justice Minister Éric Dupond-Moretti announced the news that "Ecocide" will now become an "offence", rather than a "crime", punishable by fines of up to €4.5million and up to 10 years in jail [7]. A second offence will also be created, called "endangering the environment" which allows for sanctions even before the pollution has taken place, through deliberate violations of responsibility.

Stranded assets – Fossil fuel investment withdrawal:

Corporations and fund managers are turning away from coal. In early 2020, BlackRock, the world's largest investor, with a total of $US7 trillion in funds under its control announced it will put climate change at the centre of its investment strategy [8] .

[6] See https://www.undp.org/content/undp/en/home/sustainable-development-goals.html
[7] See https://www.connexionfrance.com/French-news/France-s-creates-new-ecocide-offence-with-4.5m-fine-and-up-to-10-years-in-jail

[8] See https://www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter

Insurers abandoning fossil fuels:

The number of insurers withdrawing cover for coal more than doubled in 2019 as the industry's retreat from the sector accelerates and spreads beyond Europe. Insurance companies have stopped covering roughly US$8.9 trillion of coal investments – more than one-third (37%) of the coal industry's global assets, and stopped offering reinsurance to 46% of them[9] .

Global governments acting to protect the climate:

Many other countries, including our major trading partners recognize the need to reduce emissions, and have enshrined the reduction into law. Sweden pledges to reach net zero by 2045, United Kingdom, France, Denmark, New Zealand, Hungary, South Korea, and Japan by 2050, and China by 2060 [30].

People (the voters) understand the risks and want climate action:

The scientific community agree [31]. The world's children agree. Professional health groups around the world agree [32] [33-38]. Indeed 1,840 jurisdictions and local governments across 32 countries, and covering 820 million citizens have declared climate change is an emergency [10]. In Australia, close to 100 jurisdictions representing 9 million people – over a third of the population – have declared a climate emergency, including the government of the Australian Capital Territory, based in the capital Canberra, and South Australia's Upper House. More than 100 of the candidates in the 18 May 2019 federal election signed the Climate Emergency Declaration petition.

The Australian Government's recent record:

Last week the Federal Government gave approval for the Narrabri gas project to go ahead. The approval allows Santos to drill 850 wells in grazing land and the Pilliga forest to extract up to 200 terajoules of gas a day for 20 years.

Yet on 10 November 2016, Australia ratified the Paris Agreement and the Doha Amendment to the Kyoto Protocol, indicating commitment to action on climate change by pledging to reduce carbon emissions by 26 - 28 % below 2005 levels by 2030. This is insufficient.

The *Australian Government's Action on Climate Change Factsheet* described the signing of the Paris Agreement as ***symbolic*** [39]. In supporting this Climate Bill, I urge the Australian Government to recognize that the gravity of Climate Change demands more than 'symbolism'. No less than the survival of the human species is at stake. Decisions made NOW, climate policies designed NOW, are critical to redirect the trajectory, away from its current path towards needless annihilation. The more ambitious our early mitigation, the easier and cheaper the available and feasible transformation options, and less need for the world to rely on socially and scientifically contested negative emissions technologies and high-cost emission reduction options in the future [40].

[9] See https://unfriendcoal.com/2019scorecard/
[10] See https://climateemergencydeclaration.org/climate-emergency-declarations-cover-15-million-citizens/

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The word has just witnessed an unprecedented level of warming. Analysis released in the climate science literature paints a highly disturbing picture of the near term future warming. I stress that this rate of warming is unsafe for humans and human society.

At this relatively small amount of warming, the world is already experiencing substantial impacts and damages, including for agriculture, water insecurity, conflict, storms and sea level rise, mass death events from heat extremes, widespread loss of human livelihoods and destruction of natural systems such as the Great Barrier Reef.

The magnitudes of hazard are showing an increasing trend – yet lack of ambition to redress the trend reveals widespread unjustified expectation that a) climatic disaster episodes will not reappear, and b) future events are unlikely to be as severe as recent extreme events. Whereas climate science is unequivocal that future climatic extreme events could be significantly worse – hence we should prepare to experience exceedance events much more frequently. Failure to adapt will inevitably lead to system disruption, widespread grief and loss, across personal, financial, ecological and infrastructure domains.

Coupled with the need to adapt is the imperative to mitigate, substantially, and urgently. Global carbon dioxide emissions are still rising, despite the Covid shutdowns. The world is not yet on a trajectory that allows for a transition to stringent low emissions development pathways consistent with the stated temperature goals [40].

The Paris INDC's, including Australia's commitment, fall well short, and unless greater ambition is shown, will fail the target of limiting global temperature rise to "well below 2 degrees Celsius" and endeavouring to keep average temperature rise below a more ambitious 1.5 degree limit. UNEP warns the Paris pledges will push the world to temperature rise of 2.9 to 3.4^{o}C this century [41]. Furthermore, the INDC's are non-binding guidelines, which further raises the likelihood that global nations, including Australia, will fail to meet their targets under full accounting.

All countries, must urgently commit to greater emissions cuts than countries have pledged. As one of the highest emitting countries per capita, and one of the wealthiest, Australia is morally obliged to embark on far greater cuts, and genuine commitment to translating ambition into action, in order to deliver the required emissions reductions.

Australia's climate can be described as: Hot and getting hotter. Heat exposure is Australia's greatest climate health threat, which also precipitates fires, and damages agricultural systems, crops, stock, wildlife and ecosystems. The rapidity of CO_2 emissions, and global warming is unprecedented in human history and will require significant adaptive changes to infrastructure, such as urban and housing design, and heat tolerance of bitumen and rail tracks (so they do not warp on hot days), and indeed all human systems.

Extreme heat is the leading cause of weather related deaths across the world [42]. Humans evolved in a cooler climate, and despite having a highly effective thermoregulatory system which maintains a stable core temperature of about 37^{o}C, we have an upper limit to our tolerance to exposure to extreme heat, and importantly, to have the capacity to exercise, work for any extended periods [17]. Australians are already dying in the increasingly hot summers, and increased fire regimes [43].

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The climate of northern Australia is already a difficult environment for human activity, where the average daily maximum temperatures range between 33°C and 39°C [44], tending to be higher inland and lower towards the northern and eastern coasts and on the Great Dividing Range. It is not uncommon for daily temperatures at individual inland locations to exceed 40°C on a regular basis during these months [44]. Much of rural Australia experiences extreme heat through summer, such as 54 consecutive days over 35°C in Moree in the summer of 2017, and Canberra experiencing 18 days over 35°C, a figure that is not projected to become customary until 2090 [45]. Canberra also had 3 days over 40°C, which is double the projection for 2090 under RCP 4.5 [46].

The Royal Commission into National Natural Disaster revealed salient warnings for Australia[47].

1. Net zero emissions by 2050

The Bill states:
"We need to limit global warming to as close to 1.5 degrees as possible. To do this, science tells us that we must reduce our emissions to 'Net Zero' by no later than 2050."

Given the gravity of ramifications of further world warming, it is clear that Net Zero by 2050 is too late. Australia has the capacity to move faster and become a world leader, not as we are regarded today – as a world laggard. If not for our global responsibilities, we must do this out of self-interest, to reduce the negative impacts here at home, in Australia, for Australians.

The Bill acknowledges:
"Net Zero does not mean no emissions. It means we need to balance the carbon we put into the atmosphere with what we draw down through tree planting and soils - just like balancing a budget."

The Science is available to achieve this. It promotes clean healthy jobs, and can attract investment and viable industries.

The proposed Climate Act is designed to:
" *help Australia by setting that target and helping us get there*" , by the following 5 elements:

1. Set Net Zero emissions by 2050 in law
2. Establish a process to review the Net Zero target every 5 years as things change
3. Require five-year emissions budgets to reduce emissions smoothly through to Net Zero
4. Require five-year emissions reduction plans to ensure that Australia meets those emissions budgets, and
5. Establish principles of fairness and equity to guide those budgets and plans.

It is now abundantly clear that only a future emission trajectory that effectively reduces atmospheric CO_2 concentration levels below today's levels would provide a reasonable chance to keep warming at or below

1.5 °C in the longer term [48]. And even such 1.5 °C of warming could come with multi-metre sea level rise by 2300.

This is a rapidly changing field. Not only will the effects of climate change continue to accelerate and deliver increasing health harm and economic damage, the opportunities to hasten the transition to a low/zero carbon economy will further develop. Hence establishing a process of regular reviewing of targets and best strategies is eminently sensible.

Legislating Net Zero and 5-year budgets offers the most effective way of ensuring this does not slip to the back burner. It provide stability and certainty necessary to attract investment, and offers clear guidelines for industry, community to factor in for their own activities and plans.

2. National risk assessments and adaptation plans

Climate change will cause impacts that pose challenges to the well-being of humans and nature[2]. The UNFCCC signed the Paris Agreement in 2015 to enhance mitigation of and adaptation to climate change. Efforts led by the United Nations and growing concerns in the port sector, reflected in initiatives such as the World Ports Climate Declaration and the World Ports Climate Initiative[3], have led to enhanced climate resilience through adaptation strategies, although these are still at the planning stage for most seaports[7]

Nations and industry sectors across the world are grappling with adaptation and resilience building. In the adaptation framework, a necessary first step is risk analysis that addresses the issue of 'adapting to what' [49]. Policy makers, Industry, community leaders, indeed ALL Australians need to be fully briefed on the science, Australian relevant science, and Australian based research to enable accurate assessment of risk and evaluation best adaptation options available.

Such assessments will provide information on the resilience of existing measures, but must also scan future needs for the coming decades, focusing on the major impacts of climate change that contribute to increased risk in terms of economic, social and environmental consequences. However despite progress made, the task of adaptation is never complete as climate change acceleration is delivering increasing scales of threats, and threat multipliers. The end point of resilience building and adaptation is therefore unlikely to ever be met or *finalised*. Hence comments and attitudes expressed by Coalition members of the Australian government that "Australia has sufficient climate research" is nonsensical at best, and dangerous at worse.

3. Technology assessments

These are clearly required, but lie outside my expertise.

4. An independent advisory commission

To follow a 1.5°C-consistent pathway, the world will need to decrease fossil fuel production by roughly 6% per year between 2020 and 2030. [50]. AS a higher than global average contributor to climate change, and as a privileged wealthy nation with abundant renewable resources, Australia should aim to exceed these levels of reduction. Canberra has shown that it is possible without harming the local economy, and engenders enormous local and political support.

This will require bi/ tri partisan support, along with support from the Independents.
An Independent advisory Commission – truly Independent, and with relevant expertise can help drive this through. I would caution tht appointments NOT be heavily weighted with fossil fuel executives, who have demonstrated that their solution to COVID-19 is a' Gas-led recovery". Such claims are in direct opposition to the betterment of the nation, the nation's health and the nation's future economic prospects.
Members should be include climate scientists, carbon policy experts, renewable technology experts, urban design and transport experts, and importantly, climate and health experts, as well as epidemiologists.

Concluding remarks

Climate change is already wreaking havoc up on the health of the global population. Australia is highly vulnerable to climate change, and recent events have taken a devastating toll on the health and wellbeing of Australians. This process will continue and accelerate as my initial comments have clearly demonstrated.

To quote the United Nations Secretary-General Antonio *Guterres*, it is tantamount to ***suicide*** to continue along a pathway to destruction. We know what our current fossil fuel industries and reliance upon them is doing to the future of humanity – and to ourselves. We have healthy and profitable alternatives. We must act, and we MUST act rapidly.

So the need for Australia to accelerate its emission reduction targets is unequivocal. The immediate health savings alone from phasing out coal and vehicular emissions provide sufficient reason to dramatically increase ambition.

A 2°C warming would see 50% of all tipping points crossed, whereas limiting to warming of 1.5°C reduces this to 20% [51].

Full accounting is required for energy policies, with all costs, and all benefits encapsulated, with sound estimations of forward costing, and costing to other sectors, such as health and social costs. Too often, policy decisions are determined that result in problems for the 'losers' who are unceremoniously called "collateral damage", and which translate into damaged environments [52], and health costs to the individual, and to the society through health bills, and loss of citizen capacity.

I applaud and fully support this Bill.

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