# Additional Comments on Victorian Interim Emissions Targets

## Submission from Darebin Climate Action Now and 12 community climate groups.

The earth is already too hot and we are facing a climate emergency. The Victorian Government must provide leadership by clearly explaining the extent of the threat and the speed and scale of solutions required. Discussion of interim targets should reflect the need to to transition to zero emissions as fast as humanly possible (and well before 2050) and the need to rapidly ramp up measures to draw down the excess greenhouse gas emissions in the atmosphere. Our submission is in 8 sections:

1. Global warming poses a potentially catastrophic risk
2. Climate models understate the risk
3. The earth is already too hot
4. Adaptation will not be possible without emergency mitigation measures including rapid transition to zero emissions and large-scale drawdown
5. Overshoot must be limited in extent and duration
6. What goes up must come down
7. We need leadership and planning appropriate to existential risk
8. Conclusion and recommendations

Our submission draws heavily on the work of David Spratt and Ian Dunlop and some sections are paraphrased (with permission) from their publications: *Disaster Alley* [1] and *What lies beneath*[2].

## 1. Global warming poses a potentially catastrophic risk

The Paris Agreement voluntary emission reduction commitments, if implemented, would result in warming of 3.4°C by 2100, without taking into account 'long-term' carbon-cycle feedbacks, or around 5°C of warming if these feedbacks are included.[3]

The Global Challenges Foundation says that, despite scientific evidence that risks associated with tipping points "increase disproportionately as temperature increases from 1°C to 2°C, and become high above 3°C", political negotiations have consistently disregarded the high-end scenarios that could lead to abrupt or irreversible climate change.

In its Global Catastrophic Risks 2017 report, it concludes that "the world is currently completely unprepared to envisage, and even less deal with, the consequences of catastrophic climate change".[4]

[1] Dunlop, I. and D. Spratt (2017) *Disaster Alley: Climate change, conflict and risk.* Breakthrough, Melbourne. https://www.breakthroughonline.org.au/disasteralley
[2] Dunlop, I. and D. Spratt (2018) *What lies beneath*. Breakthrough, Melbourne. https://www.breakthroughonline.org.au/whatliesbeneath
[3] Reilly, J., S. Paltsev, E. Monier, H. Chen, A. Sokolov, J. Huang, Q. Ejaz, J, Scott , J. Morris and A. Schlosser (2015) *Energy and Climate Outlook: Perspectives from 2015*, MIT Program on the Science and Policy of Global Change, Cambridge MA
[4] Global Challenges Foundation CF 2017. Quoted in Dunlop & Spratt (2017) op.cit.

A 2007 study by two US national security think tanks concluded that 3°C of warming and a 0.5 metre sea-level rise would likely lead to "outright chaos" emphasising that "massive nonlinear events in the global environment give rise to massive nonlinear societal events".[5]

The Global Challenges Foundation explains what could happen:

*"If climate change was to reach 3°C, most of Bangladesh and Florida would drown, while major coastal cities — Shanghai, Lagos, Mumbai — would be swamped, likely creating large flows of climate refugees. Most regions in the world would see a significant drop in food production and increasing numbers of extreme weather events, whether heat waves, floods or storms. This likely scenario for a 3°C rise does not take into account the considerable risk that self-reinforcing feedback loops set in when a certain threshold is reached, leading to an ever increasing rise in temperature. Potential thresholds include the melting of the arctic permafrost releasing methane into the atmosphere, forest dieback releasing the carbon currently stored in the Amazon and boreal forests, or the melting of polar ice caps that would no longer reflect away light and heat from the sun."*[6]

In 2017, one of the first research papers to focus explicitly on existential climate risks proposed that "mitigation goals be set in terms of climate risk category instead of a temperature threshold", and described 3°C as a level of "catastrophic" warming. The authors focussed on the impacts on the world's poorest three billion people, on health and heat stress, and the impacts of climate extremes on such people with limited adaptation resources. The found that even 2°C of warming "would double the land area subject to deadly heat and expose 48% of the population [to deadly heat]."[7]

Climate change impacts on the essential requirements for human survival – water and food. When water resources diminish and food production is reduced or threatened, food prices escalate. Food riots can erupt. Add to this the threat of extreme weather events and its health impacts. Having one's survival under threat is a key trigger for anxiety, stress, and conflict, exacerbating social and political instability. Climate change is recognised by US military and policy makers as a threat to global security, as illustrated in the ABC *Four Corners* documentary *The Age of Consequences*.[8] Former officers in the Australian Defence Force have recently said that "climate change will emerge as the defining security threat this century".[9]

Sherri Goodman, a former US Deputy Undersecretary of Defence for Environmental Security, argues: *"the impact of climate change – rising seas, extreme weather, prolonged droughts – will be a 'threat multiplier' for security challenges, and could be the spark that ignites conflict and drives new waves of mass forced migration."*[10]

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[5] Campbell, K, Gulledge, J, McNeill, JR, Podesta, J, Ogden, P, Fuerth, L, Woolsley, J, Lennon, A, Smith, J, Weitz, R & Mix, D (2007) *The Age of Consequences: The foreign policy and national security implications of global climate change*, Centre for Strategic and International Studies & Centre for New American Security, Washington. A substantial portion of the following two pages is based on Dunlop & Spratt (2017) op.cit.

[6] Global Challenges Foundation (2017) "Global Catastrophic Risks 2017", Global Challenges Foundation, Stockholm.

[7] Xu, Y & Ramanathan, V 2017, "Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes" *Proc. Nat. Acad. Sci.,* vol. 114, pp. 10315-10323.

[8] http://www.abc.net.au/4corners/stories/2017/03/20/4637278.htm

[9] *The Age*, 15 June 2017, p8

[10] Goodman, S "'Disaster alley': Australia could be set to receive new wave of climate refugees." *The Guardian,* April 5, 2017.

Poor and underdeveloped areas are likely to have fewer resources and less stamina to deal with climate change — in even its early and very modest manifestations.[11] Kurt Campbell, the lead author of the US study, *The Age of Consequences,* states bluntly that mass migration as a result of climate change will be unprecedented in scale and impact unless we take strong action soon. He says:

*"Perhaps the most worrisome problems associated with rising temperatures and sea levels are from large-scale migrations of people — both inside nations and across existing national borders… potentially involving hundreds of millions of people. These dramatic movements of people and the possible disruptions involved could easily trigger major security concerns and spike regional tensions. In some scenarios, the number of people forced to move in the coming decades could dwarf previous historical migrations. The more severe scenarios suggest the prospect of perhaps billions of people over the medium or longer term being forced to relocate. The possibility of such a significant portion of humanity on the move, forced to relocate, poses an enormous challenge even if played out over the course of decades."*[12]

## RISKS AT FOUR DEGREES OF WARMING

The business-as-usual present path of greenhouse gases commits us to a 4°C to 5°C temperature increase relative to pre-industrial levels[13]. A recent study by the European Commission's Joint Research Centre found that if global temperatures rise 4°C, then extreme heat waves, with 'apparent temperatures' (a measure that quantifies the combined effect of heat and humidity) peaking at over 55°C, will begin to regularly affect many densely populated parts of the world, forcing much activity in the modern industrial world to stop.[14] Another study found that "a 4°C warming by 2100 would subject 47% of the land area and almost 74% of the world population to deadly heat, which could pose existential risks to humans and mammals alike unless massive adaptation measures are implemented."[15]

The World Bank says that "there is no certainty that adaptation to a 4°C world is possible".[16] Asked about the difference between a 2°C world and a 4°C world, Professor Hans Schellnhuber replied in two words: "Human civilisation". Professor of Energy and Climate Change at Manchester University, Kevin Anderson, considers that a 4°C future "is incompatible with an organized global community, is likely to be beyond 'adaptation', is devastating to the majority of ecosystems, and has a high probability of not being stable."[17] He also says: "If you have got a population of nine billion by 2050 and you hit 4°C, 5°C or 6°C you might have half a billion people surviving."[18]

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[11] Campbell et al , op.cit., p 7

[12] Campbell et al op.cit. p 10

[13] Dunlop & Spratt (2017) op.cit.

[14] Ayre, J (2017) "Extreme heatwaves with 'apparent temperatures' as high as 55° celsius to regularly affect much of world", 11 August 2017, https://cleantechnica.com/2017/08/11/extreme-heatwaves-apparent-temperatures-high-55-celsius-regularly-affect-much-world-4-celsius-warming-pre-industrial-levels/. 'Apparent temperature' refers to the Heat Index, which quantifies the combined effect of heat and humidity to provide people with a means of avoiding dangerous conditions.

[15] Xu, Y & Ramanathan, V 2017, "Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes" *Proc. Nat. Acad. Sci.,* vol. 114, pp. 10315-10323.

[16] World Bank 2012, *Turn Down the Heat: Why a 4°C warmer world must be avoided*, World Bank, New York.

[17] Anderson, K (2011) "Going beyond dangerous climate change. Exploring the void between rhetoric and reality in reducing carbon emissions." LSE presentation, 11July 2011. http://www.slideshare.net

[18] Fyall, J 2009, 'Warming will 'wipe out billions', *The Scotsman*, 29 November 2009, http://www.webcitation.org/5ul6K9Jmt?url=http://news.scotsman.com/latestnews/Warming-will-39wipe-out-billions39.5867379.j

## 2. Climate models under state the risks

There are many factors contributing to the underestimation of climate risks. In 2007, climate scientist, James Hansen coined the term 'scientific reticence' to describe one aspect of this problem:

*"Papers are accepted for publication more readily if they do not push too far and are larded with caveats. Caveats are essential to science, being born in skepticism, which is essential to the process of investigation and verification. ... [However,] a tendency for 'gradualism' as new evidence comes to light may be ill-suited for communication, when an issue with a short time fuse is concerned."*[19]

Even amongst climate scientists and world leaders, the personal impact of confronting the enormity of the challenges we face may be overwhelming. At a political level, those who tell unpalatable truths risk being labelled 'alarmist' and denied funding and access to those with the power to make decisions.

Professor Hans Joachim Schellnhuber, the director of the Potsdam Institute for Climate Impact Research in Germany, and advisor to German Chancellor Angela Merkel, told a conference of scientists in Copenhagen, prior to the 2009 climate negotiations, that if global temperatures increased to four degrees Celsius above pre-industrial times, then the carrying capacity of the earth would be just one billion people. He mentioned that this was something he had not told Chancellor Merkel.[20] At the *Four Degrees* conference in Melbourne in 2011 an audience member asked Professor Schellnhuber why he had not told the German Chancellor this crucial piece of information. "Some truths are too hard to tell" he replied.

A further problem is that the models used by the IPCC include those processes that can be relatively accurately modelled, but leave out others that are difficult to model, even though their contribution is may be substantial. Those omitted include carbon cycle feedbacks (such as melting permafrost and the declining efficiency of forests carbon sinks), and increasing methane emissions from wetlands. These excluded factors could together add another 1°C to warming by 2100.

The US Government Fourth National Climate Assessment states:
*"While climate models incorporate important climate processes that can be well quantified, they do not include all of the processes that can contribute to feedbacks, compound extreme events, and abrupt and/or irreversible changes. For this reason, future changes outside the range projected by climate models cannot be ruled out. Moreover, the systematic tendency of climate models to underestimate temperature change during warm paleoclimates suggests that climate models are more likely to underestimate than to overestimate the amount of long-term future change."*[21]

Several papers[22] suggest that 3.1°C, the median figure used by the IPCC as an estimate of for equilibrium climate sensitivity (how much the planet will warm for a doubling in the level of greenhouse gases), is too low:

- Fasullo and Trenberth found that the climate models that most accurately capture observed relative humidity in the tropics and subtropics and associated clouds were among those with a sensitivity of around 4°C[23]

[19] https://larxiv.org/abs/physics/0703220

[20] https://dotearth.blogs.nytimes.com/2009/03/13/scientist-warming-could-cut-population-to-1-billion/

[21] US Government 2017 Fourth National Climate Assessment 2017https://science2017.globalchange.gov/chapter/15/

[22] This section is based on page 5 of Dunlop & Spratt (2018) op.cit.

[23] http://science.sciencemag.org/content/338/6108/792

- Zhai et al. found that the seven models that are consistent with the observed seasonal variation of low-altitude marine clouds yield an ensemble-mean equilibrium climate sensitivity of 3.9°C.[24]
- Xu and Ramanathan found that when the 'fat tail' risks of future emission scenarios (low-probability, high-impact consequences) are taken into account the equilibrium climate sensitivity is more than 40% higher than the IPCC mid-figure, at 4.5-4.7°C. [25]
- Based on a study of glacial cycles and temperatures over the last 800,000 years, Friedrich et al. found that climate sensitivity is lower in colder, glacial periods and higher (around 4.88°C) in warmer, interglacial periods (such as the present).[26]

These are substantial underestimates and it is therefore important that the Victorian government adopt considerably more stringent emissions reductions pathways and carbon budgets than those suggested by IPCC models.

## 3. The earth is already too hot

In view of the various factors leading the underestimation of climate risks, it is perhaps not surprising that we are already experiencing impacts not predicted to occur for decades, or even until the end of the century. Some decades ago, a 2°C limit on warming was said to be likely to keep us safe from major climate tipping points. However major tipping points have already been triggered and others are close to being triggered at only 1°C of warming.

### Temperature shocks

Climate change is rewriting history books. In February 2016, an El Nino fueled warming spike brought us at least 1.6℃ above pre-industrial global average temperatures. This means that, for the first time, we had briefly passed the 1.5℃ international aspirational goal agreed in Paris.[27] As of March 2018 we have experienced a whopping 639 months in a row of warmer than normal temperatures. In 2009, 173 people died in the Black Saturday bushfires in the state of Victoria, but more than twice as many lost their lives in a heatwave that preceded the fires.[28] In 2003, a heatwave killed over 70,000 people in Europe.[29] Imagine the outrage if terrorists killed 70,000.

### Coral reef damage

The world has lost roughly half its coral reefs - the 'underwater rainforest' - in the last 30 years. Coral reefs support a quarter of all marine species, as well as half a billion people around the world.[30] The recent bleaching events which have killed around half of the Great Barrier Reef have also devastated other reefs in the Coral Triangle, affecting the livelihoods of millions of people in our region.

[24] http://onlinelibrary.wiley.com/doi/10.1002/2015GL065911/full

[25] http://www.pnas.org/content/early/2017/09/14/1618481114.short

[26] http://advances.sciencemag.org/content/2/11/e1501923.short

[27] https://theconversation.com/the-paris-climate-agreement-at-a-glance-50465

[28] http://www.bbc.com/news/world-australia-38805402

[29] Robine, Jean-Marie; Siu Lan K. Cheung; Sophie Le Roy; Herman Van Oyen; Clare Griffiths; Jean-Pierre Michel; François Richard Herrmann (2008). "Death toll exceeded 70,000 in Europe during the summer of 2003". *Comptes Rendus Biologies*. **331** (2): 171–178. doi:10.1016/j.crvi.2007.12.001. ISSN 1631-0691. PMID 18241810

[30] http://www.independent.co.uk/environment/environment-90-percent-coral-reefs-die-2050-climate-change-bleaching-pollution-a7626911.html

"Whether you're living in North America or Europe or Australia, you should be concerned," said biologist Ove Hoegh-Guldberg, director of the Global Change Institute at Australia's University of Queensland. "This is not just some distant dive destination, a holiday destination. This is the fabric of the ecosystem that supports us."[31]

### Sixth mass extinction

We are already in the midst of the sixth mass extinction. In their book *Dire Predictions*, Michael Mann and Lee Kump estimate that four degrees of warming would eliminate between 40 and 70 percent of the world's species. At 2.2 degrees, we would lose between 15 and 37 percent.[32]

### Destabilisation of large ice sheets and permafrost melt

In 2007, the IPCC predicted the disappearance of Arctic sea ice by 2100. However, this has proved to be a severe underestimate:
"*In reality Arctic sea ice has already lost 70% of summer volume compared to just thirty years ago, and expectations are of a sea-ice free summer within a decade or two*."[33]

Loss of Arctic sea ice has severe consequences for the future stability of permafrost and frozen carbon stores. As Joseph Romm writes:

*"The thawing tundra or permafrost may well be the single most important amplifying carbon-cycle feedback. Yet, none of the Intergovernmental Panel on Climate Change's climate models include carbon dioxide or methane emissions from warming tundra as a feedback. … A 2011 study by the U.S. National Oceanic and Atmospheric Administration and the National Snow and Ice Data Center found that thawing permafrost will turn the Arctic from a place that stores carbon (a sink) to a place that generates carbon (a source) in the 2020s—and release a hundred billion tons of carbon by 2100 … equivalent to half the amount of carbon that has been released into the atmosphere since the dawn of the industrial age."*[34]

One of the most significant research findings in 2014 was that the tipping point for the collapse of the West Antarctic Ice Sheet has already passed. Scientists found that:

*"the retreat of ice in the Amundsen Sea sector of West Antarctic Ice Sheet [is] unstoppable, with major consequences – it will mean that sea levels will rise 1 metre worldwide… Its disappearance will likely trigger the collapse of the rest of the West Antarctic Ice Sheet, which comes with a sea level rise of between 3–5 metres. Such an event will displace millions of people worldwide"*.[35]

Recent research indicates that East Antarctica – a 'sleeping giant' - is awakening unexpectedly. Researchers find it is vulnerable at much smaller atmospheric carbon dioxide levels than those

[31] ibid

[32] https://ncse.com/files/pub/evolution/excerpt--dire.pdf

[33] Dunlop & Spratt (2017) op.cit. p.6

[34] Joseph Romm. *Climate Change*, page 81. See also https://thinkprogress.org/global-warming-permafrost-thaw-97436404e353/

[35] Rignot, Mouginot et al (2014) "Widespread, rapid grounding line retreat of Pine Island, Thwaites, Smith, and Kohler glaciers, West Antarctica, from 1992 to 2011", Geophysical Research Letters 41:3502–3509.

previously predicted.[36] If it melted completely it would have ten times the impact on sea levels of losing the West Antarctic Ice Sheet.[37]

## Sea level risks

Associate Professor Malte Meinshausen, Director of the Australian-German Climate and Energy College at the University of Melbourne called the evidence of the retreat of ice in the Amundsen Sea "a game changer", and "a tipping point that none of us thought would pass so quickly"; noting that "now we are committed already to a change in coastlines that is unprecedented for us humans".[38] Estimates of sea level rise this century range from 1 to 1.5 metres,[39] with the US military preparing for 2.5 metres as a worst case scenario, as recommended by the National Oceanic and Atmospheric Administration:

*"In order to bound the set of GMSL [Global Mean Sea Level] rise scenarios for year 2100, we assessed the most up-to-date scientific literature on scientifically supported upper-end GMSL projections, including recent observational and modeling literature related to the potential for rapid ice melt in Greenland and Antarctica. The projections and results presented in several peer-reviewed publications provide evidence to support a physically plausible GMSL rise in the range of 2.0 meters (m) to 2.7 m, and recent results regarding Antarctic ice-sheet instability indicate that such outcomes may be more likely than previously thought. To ensure consistency with these recent updates to the peer-reviewed scientific literature, we recommend a revised 'extreme' upper-bound scenario for GMSL rise of 2.5 m by the year 2100, which is 0.5 m higher than the upper bound scenario from Parris et al. (2012) employed by the Third NCA (NCA3)."*[40]

Even the lower range of sea level rise projections would be a disaster for our neighbouring island states in the immediate future. In past climates, carbon dioxide ( $CO_2$ ) levels of around 400 ppm have been associated with sea levels around 25 metres above the present.[41]

Such long-term sea level rise would submerge parts of Australia on which 25-50% of the population lives. A 2 metre sea-level rise with a 1 metre storm surge would devastate Melbourne central and the bayside area.[42]

## Ocean current risks

The Gulf Stream (also known as the Atlantic Meridional Overturning Circulation or Amoc) has weakened by 15% since 1950 due to melting Greenland ice and ocean warming and the slowdown is accelerating. This represents a massive slowdown – equivalent to halting all the world's rivers three times over, or stopping the greatest river, the Amazon, 15 times[43].

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[36] https://phys.org/news/2016-03-antarctic-ice-sheet-giant.html

[37] http://www.nature.com/news/antarctica-s-sleeping-ice-giant-could-wake-soon-1.21808

[38] *A Climate Game Changer* https://vimeo.com/97926131

[39] Dunlop & Spratt (2017) op.cit. p9

[40] *NOAA Technical Report* NOS CO-OPS 083

[41] http://www.eurekalert.org/pub_releases/2013-01/nocs-nsd010213.php

[42] Spratt, D (2016) *Climate Reality Check*, Third Edition. http:breakthroughonline.org.au p12

[43]https://www.theguardian.com/environment/2018/apr/13/avoid-at-all-costs-gulf-streams-record-weakening-prompts-warnings-global-warming

"From the study of past climate, we know changes in the Amoc have been some of the most abrupt and impactful events in the history of climate," said Prof Stefan Rahmstorf, at the Potsdam Institute for Climate Impact Research in Germany and one of the world's leading oceanographers, who led some of the new research. During the last Ice Age, winter temperatures changed by up to 10°C within three years in some places.

*"We are dealing with a system that in some aspects is highly non-linear, so fiddling with it is very dangerous, because you may well trigger some surprises. I wish I knew where this critical tipping point is, but that is unfortunately just what we don't know. We should avoid disrupting the Amoc at all costs. It is one more reason why we should stop global warming as soon as possible."*[44]

A collapse in the Amoc would mean far less heat reaching western Europe and plunge the region into very severe winters, the kind of scenario depicted in an extreme fashion in the movie *The Day After Tomorrow*. A widespread collapse of deep-sea ecosystems has also been seen in the past.

Greenland's massive ice cap is melting at the fastest rate for at least 450 years. This influx will continue to weaken the Amoc into the future until human-caused climate change is halted, but scientists do not not know how fast the weakening will be or when it reaches the point of collapse.

### Forest carbon cycle risks

Some tropical forests — in the Congo, the Amazon, and in Southeast Asia — have already shifted to a net carbon source,[45] and recent work on a soil carbon feedback in a 26-year soil-warming experiment in a mid-latitude hardwood forest, in which warming resulted in a complex pattern of net carbon loss from the soil, supporting projections of a long-term, positive carbon feedback from similar ecosystems as the world warms.[46]

## 4. Adaptation will not be possible without emergency mitigation measures including rapid transition to zero emissions and large-scale drawdown

In 2015, most of the nations of the world pledged to "hold the increase in global average temperature to well below 2°C, and to pursue efforts to limit the temperature increase to 1.5°C". However, politicians and climate campaigners have been reluctant to spell out that honoring this commitment means an emergency transition to zero emissions and a massive and rapid roll-out of measures to draw down and sequester the excess heat-trapping gases already in the atmosphere.

For a 90% chance of remaining below +2$^0$C we have zero carbon budget remaining, so it is clear that gradual reductions in emissions over decades cannot keep us under this limit with any real degree of confidence and it follows that the budget for a 90% chance of remaining below +1.5$^0$C is long since exhausted.[47] In fact, it is now predicted that global warming will pass the 1.5°C threshold in only a decade or so from now.[48]

Today's carbon dioxide($CO_2$) level, if maintained, will eventually produce a lot more warming than 1.5°C. In the early- to mid-Pliocene period 3 to 4.5 million years ago, $CO_2$ levels were similar today at

[44]https://www.theguardian.com/environment/2018/apr/13/avoid-at-all-costs-gulf-streams-record-weakening-prompts-warnings-global-warming

[45] https://grist.org/article/the-last-ditch-effort-to-save-the-worlds-forests-from-climate-change/

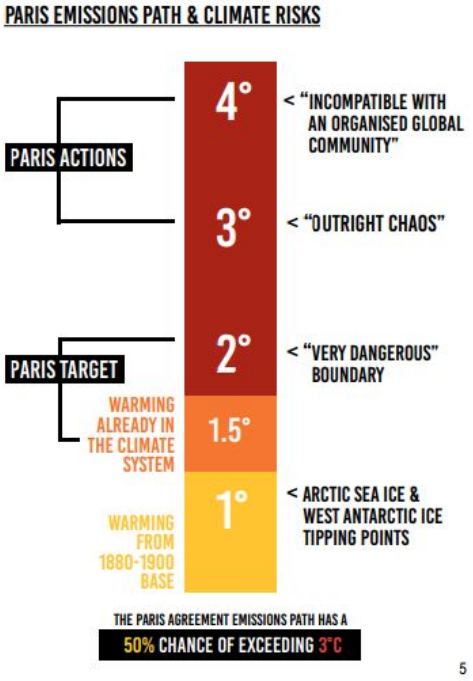
[46] http://science.sciencemag.org/content/358/6359/101

[47] http://onlinelibrary.wiley.com/doi/10.1002/2017GL075612/abstract.

[48] http://www.climatecodered.org/2018/04/15c-of-warming-is-closer-than-we.html

365–415 ppm but temperatures were 3°C to 4°C warmer than pre-industrial values and sea levels were 25 metres higher.[49]

On the present high emissions path, warming will hit the +2°C by the mid-2040s, and large reductions in $CO_2$ will not by themselves significantly delay this timing. This is because of the 'Faustian bargain' we have struck with fossil fuels.[50] Warming is being masked by aerosol emissions, mostly from fossil fuel extraction and use, producing a temporary cooling odf about 0.7°C[51]. We have no choice but to rapidly reduce our fossil fuel use but this will result in loss of the aerosol cooling.[52] When this is taken into account, the current level of greenhouse gases is likely to produce warming of more than +2°C, even in the short term.[53]




For most of human civilisation, during the last 11,000 years of the Holocene, $CO_2$ hovered around 280ppm, helping maintain the global climate in a relatively stable state conducive to agriculture and the growth of human populations and this is the level to which we must aim to return.[54] This will not be an easy task. As David Spratt points out:

*"Given the current state of the atmosphere, getting back to Holocene-like greenhouse conditions would require a rapid end to human-caused emissions, and the deployment at massive scale of efficacious biological and other drawdown measures to reduce the level of atmospheric greenhouse gases for many, many decades and perhaps a century or more."*[55]

## 5. Overshoot must be minimised in extent and duration

Overshoot scenarios, which are now becoming the norm in policy-making circles, hold great risks.[56] All of the IPCC 1.5°C scenarios involve overshooting the temperature target before cooling back to it by 2100, with the period of overshoot lasting at least several decades and possibly up to half a century. As James Hansen has pointed out,

*"the assumption that young people will somehow figure out a way to undo the deeds of their forebears, has crept into and spread like a cancer through UN climate scenarios."*[57]

[49] https://www.nature.com/articles/ngeo724

[50] http://www.climatecodered.org/2018/02/quantifying-our-faustian-bargain-with.html

[51] https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1002/2017GL076079

[52] https://theconversation.com/masking-and-unmasking-of-global-warming-by-aerosols-19990

[53] http://www.pnas.org/content/105/38/14245.short

[54] http://research.noaa.gov/News/NewsArchive/LatestNews/TabId/684/ArtMID/1768/ArticleID/11900/Carbon-dioxide-levels-race-past-troubling-milestone.aspx

[55] Spratt (2016) op.cit. p14

[56] https://www.youtube.com/watch?v=S7z61UZoppM&feature=youtu.be

[57] https://www.earth-syst-dynam.net/8/577/2017/esd-8-577-2017-discussion.html

In a period of rapid warming, most major tipping points once crossed are irreversible in human time frames, principally due to the great length of time that $CO_2$ stays in the atmosphere (a thousand years).[58] To overshoot past current temperatures to 1.5 or even 2°C of warming for over half a century could activate tipping points that cannot be reversed even with significant cooling.

At the COP23 in Bonn, Pam Pearson, founder and director of the International Cryosphere Climate Initiative, warned that the melting of the large ice-sheets is becoming "an irreversible driver of climate change". She said that most cryosphere thresholds are determined by the peak temperature, and the length of time spent at that peak, warning that:

*"Later, decreasing temperatures after the peak are largely irrelevant, especially with higher temperatures and longer duration peaks. … What keeps cryosphere scientists up at night are irreversible thresholds, particularly West Antarctica and Greenland. The consensus figure for the irreversible melting of Greenland is at 1.6°C."*

We must aim for the most rapid rate of emission reduction possible to reduce the potentially catastrophic risks that come with a long period outside the safe climate zone.

## 6. WHAT GOES UP MUST COME DOWN

The earth is already too hot. To reduce global temperatures back to relative safety, we must draw down enough of the greenhouse gases in the atmosphere to return from current levels of over 400 parts per million back to pre-industrial levels of around 280 parts per million. We certainly can't safely add any more greenhouse gases to the atmosphere, so this means that **from now on ever tonne of emissions must be matched by a tonne of drawdown of atmospheric carbon.**

How can we achieve this?

### WE CANNOT RELY ON BECCS

The IPCC models assume that large amounts of drawdown can be achieved during the second half of the century by means of Bio-Energy Carbon Capture and Storage (BECCS) - a technology unproven at scale. There is growing alarm amongst scientists about the BECCS political fix.[59] Oliver Geden, head of the EU Research Division at the German Institute for International and Security Affairs in Berlin, says:

*"Climate scientists and economists who counsel policy-makers are being pressured to extend their models and options for delivering mitigation later. This has introduced dubious concepts, such as repaying 'carbon debt' through 'negative emissions' to offset delayed mitigation — in theory… Climate researchers who advise policy-makers feel that they have two options: be pragmatic or be ignored… Many advisers are choosing pragmatism… Each year, mitigation scenarios that explore policy options for transforming the global economy are more optimistic — and less plausible."*[60]

James Hansen has pointed out the likely huge costs we are bequeathing our children:

[58] http://www.pnas.org/content/early/2009/01/28/0812721106.short

[59] https://www.nature.com/articles/nclimate2870; https://www.nature.com/articles/s41560-017-0055-2; https://www.tandfonline.com/doi/abs/10.1080/14693062.2017.1413322

[60] https://www.nature.com/news/policy-climate-advisers-must-maintain-integrity-1.17468

*"Proposed methods of extraction such as BECCS or air capture of CO2 imply minimal estimated costs of 104-570 trillion dollars this century, with large risks and uncertain feasibility."*[61]

### We need Victorian carbon drawdown budgets and targets

Since all emissions from now on must be matched by an equivalent amount of drawdown, **Victorian emissions targets should be complemented by a Victorian carbon drawdown budgets and targets.**

The adoption of a carbon drawdown budget would help to normalise for policymakers what is still too often constructed as a distant and theoretical task.

### Support research into safe and effective carbon drawdown methods

A recent paper by Kate Dooley at the University of Melbourne, looking at options for land-based negative emissions, found the most cost-effective large-scale drawdown action is the restoration of carbon-dense and biologically rich natural forests.[62]

There are also opportunities for increasing soil organic carbon. More research work needs to be done, but one estimate from the European Academies' Science Advisory Council estimates that increasing soil organic carbon could have the potential to absorb 2-3 GtC/year - around a quarter of the world's emissions.[63]

There are many other potentially relevant land-based drawdown methods listed as important solution by the researcher of the *Drawdown* project including:

- Silvopasture
- Regenerative agriculture
- Farmland restoration
- Managed grazing
- Conservation agriculture
- Biochar[64]

We must invest in research to determine their usefulness in Victoria.

## 7. We need planning and leadership appropriate to existential risk

Facts about the threat to humanity, the natural world, and the precious ecosystems on which we depend, are unpleasant and create fear and resistance, but downplaying the risks is not the answer. Leadership is required to help us face the truth, so that we can address the scale of the problem. If the severity of the problem is not understood, there is no chance of planning for effective action and of gathering public support. This is what we elect our political leaders to do, and once elected this is their responsibility — to take measures to provide security and wellbeing for their citizens, now and into the future. We expect them to take a long-term view, using all available resources, to create a sustainable future for the generations that follow. This begins with assessing the risk and taking all

[61] https://www.earth-syst-dynam.net/8/577/2017/esd-8-577-2017-discussion.html
[62] https://link.springer.com/article/10.1007/s10784-017-9382-9
[63] http://www.academie-sciences.fr/en/Reseaux-internationaux-dacademies/negative-emission-technologies-what-role-in-meeting-paris-agreement-targets-report-by-the-easac.html
[64] http://www.drawdown.org/solutions/food

measures necessary to identify how to best respond with risk-management techniques, skills and policy.

We need parliamentarians, corporate and community leaders to show courage. A recent report *Thinking the Unthinkable*[65] highlights the tremendous challenges for corporate and public service leaders, and sadly illustrates their shrinking away from responsibility to tackle unthinkable events — climate change capping them all. We need our leaders to manage this challenge with courage and wisdom.

The public appears to be more prepared for the conversation than are our leaders. Recent work by Melanie Randle and Richard Eckersley investigated the perceived probability of threats to humanity and different responses to them in the US, UK, Canada and Australia.

*"Overall, a majority (54%) rated the risk of our way of life ending within the next 100 years at 50% or greater, and a quarter (24%) rated the risk of humans being wiped out at 50% or greater. The responses were relatively uniform across countries, age groups, gender and education level. ... Almost 80% agreed "we need to transform our worldview and way of life if we are to create a better future for the world". About a half agreed that "the world's future looks grim so we have to focus on looking after ourselves and those we love" and over a third that "we are facing a final conflict between good and evil in the world."*[66]

This is the great irony: people have a reasonable intuitive sense of what might be coming, but our leaders appear to be incapable of engaging with the perceived and well documented climate emergency.

We must recognise we are in a global climate emergency that threatens human civilisation. Facing up to the truth about our predicament is of the essence. Victoria –and the rest of Australia - must contribute to building an international coordinated climate emergency response based on solid management appropriate to existential risk.[67] "We need a national leadership group outside conventional politics, drawn from across society, charged with implementing the national climate emergency program".[68] Victoria can take the lead.

## Conclusions and recommendations

Nothing short of emergency action can preserve a livable planet. The current Australian Government emission reduction targets and policies for 2020 and 2030 are clearly totally inadequate. Victorian and other states must do as much as possible to take up the slack. No time remains for incrementalism and half-measures. What is required is a massive reorganisation of society on a scale never before seen in peacetime. We must transition at emergency speed to a life sustaining future.

Leadership, honesty and courage are required. This emergency transition must be planned while we still have time. Waiting for further catastrophes to signal the need for change will bring disorder, instability and huge loss to individuals' and communities' well being - emotionally, socially and economically. We need plans that protect workers and communities as we retire fossil fuel industries; plans for communities to control energy systems to ensure price stability; plans for

[65] http://www.thinkunthinkable.org/report

[66] http://ro.uow.edu.au/buspapers/740/

[67] Dunlop & Spratt (2017) op.cit. p. 20

[68] ibid p. 23

protection and restoration of carbon sinks and our beloved natural places; protection of other species; protection for the most vulnerable in our community; respect for our Indigenous peoples and their knowledge and connection with the land; and assistance to our international neighbours who already bear the brunt of the climate consequences of our western consumptive culture and our denial of our dependency on the natural world.

With the highest per capita emissions in the developed world and a large historic climate debt we have a clear moral responsibility to act decisively with emergency action on climate change. We have a moral obligation to our young people and all future generations to show leadership by taking the strongest possible action to build a life sustaining future. Half measures are of no benefit at this point in history.

We recommend that:

- ❏ the Victorian emissions reduction target be revised to recognise the need to reduce emissions to zero as fast as humanly possible, and reaching zero well before 2050
- ❏ Victorian interim emissions reductions targets be set at levels consistent with the need to reduce emissions to zero at emergency speed - a 50% reduction on 2005 levels by 2025 and a 100% reduction (zero emissions) by 2030
- ❏ Victoria set a drawdown budget and targets commensurate with drawing down and sequestering the excess greenhouse gases already in the atmosphere, together with any that are emitted from now on, with a view to making a fair contribution to returning atmospheric carbon dioxide to pre-industrial levels as fast as possible
- ❏ the Victorian government investigate safe land-based methods of drawdown and inform the public about the options
- ❏ the Victorian government recognise its responsibility to accurately inform members of the public about the risks associated with the climate emergency and work with other levels of government to provide strong leadership

> "It always seems impossible until it's done." Nelson Mandela

## The groups supporting this submission

This submission and the responses to the questionnaire were written by Darebin Climate Action Now and are supported by the following 12 groups:

- ❏ Baby Boomers for Climate Action
- ❏ Climate Action Moreland
- ❏ Council Action in the Climate Emergency
- ❏ Dandenong Ranges Renewable Energy Association
- ❏ Eastern Action for the Environment
- ❏ Frack Free Geelong
- ❏ Geelong Sustainability
- ❏ Higgins ACF Climate Action Group
- ❏ Psychology for a Safe Climate
- ❏ The Sustainable Hour – 94.7 The Pulse
- ❏ Wodonga Albury Toward Climate Health
- ❏ Yarra Climate Action Now