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The Secretary
Senate Select Committee on Climate Policy
PO Box 6100
Parliament House
Canberra ACT 2600

Submission to Senate Select Committee on Climate Policy – CPRS

As physical scientists researching the dynamics of the earth's oceans and atmosphere, we commend the Australian government for its attempts to put in place a scheme to reduce greenhouse gas emissions. However, we are deeply concerned by the weakness of the proposed CPRS targets. In this submission we summarise the science that leads to our concern (item c in the terms of reference). Rather than discuss consequences for the end of the century (a timeframe so long that populations, cultures and technologies will likely change beyond our conception), we will frame our discussion by considering what many alive today will experience within their lifetime.

Global warming

The Committee will be aware of the predictions, from the IPCC's Fourth Assessment Report (AR4) [1], for future global surface temperature increase due to anthropogenic greenhouse gas emissions. Currently, atmospheric greenhouse gas concentrations are increasing by approximately 2ppm per year[2]. At this rate, CO_2 concentration is set to reach 470ppm by 2050 *even if* we take action sufficient to prevent the emission rate from continuing to increase, and provided that no positive feedbacks occur in the natural system. The concentration would then be 78% above pre-industrial CO_2 levels. Climate modelling predicts the consequent global mean surface temperature rise above pre-industrial levels to be 1.5-3°C by 2050 (with further temperature increase "in the pipeline" because the bulk of the ocean will continue to warm over a much longer period).

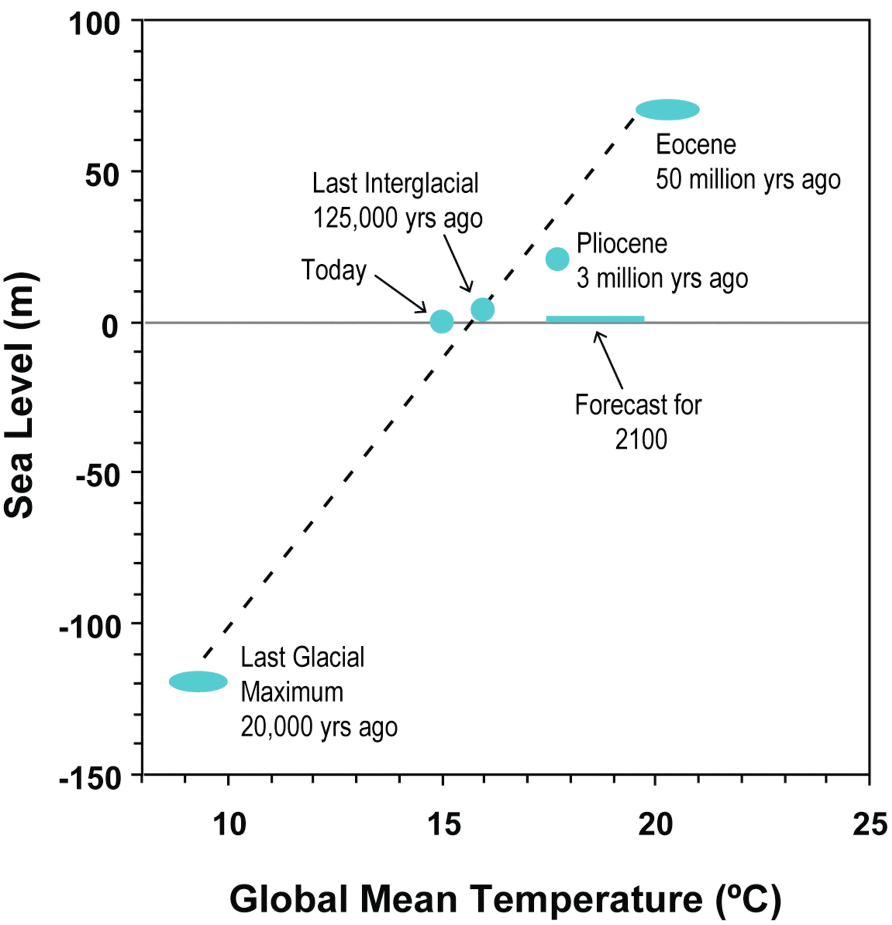
The Committee will no doubt receive some submissions arguing that the above predictions of warming rate are unfounded, and that society should therefore wait for more evidence before acting. Such arguments miss the obvious point. The simplicity of the physics behind global warming is inescapable and beyond question: more of the sun's energy is trapped in the atmosphere when greenhouse gas concentrations increase – therefore, the global atmosphere must heat up. The IPCC's AR4 showed unequivocally that warming occurred in the 20th century, and that computer climate models *only* recreate this warming trend when anthropogenic release of greenhouse gases is included in the models. Indeed, climate model predictions since the late 1980s have proven remarkably accurate in forecasting the rate of global warming over the last 2 decades[3]. Abundant palaeoclimate evidence further confirms that earth temperatures are higher when radiative forcing (ie. CO_2 concentration or solar insolation) is higher. Thus, human activities are certainly the cause of increasing greenhouse gas concentrations, which in turn is the only reasonable explanation for the observed increases in temperature since industrialisation.

Sea Level Rise

Global warming will have many impacts on society and civilisation. However, we focus on one impact that cuts across most nations and will have a profound effect: sea level rise. We do not discuss in this submission the many other important environmental consequences of predicted global warming (eg. temperatures, precipitation, ocean acidity and consequent ecological changes), because we believe that the certainty of large sea level rise and its unavoidable impact provides more than sufficient motivation to act decisively, and to act without further delay.

The scientific projections of sea level rise have progressed substantially since AR4. AR4 predicted that sea level would increase by 0.2-0.6m during the 21st century (noting that additional uncertainties were highly skewed towards greater change because of the unconstrained potential for dynamic ice sheet collapse). More recent evidence indicates that this range is an underestimate by a factor of three[4] and, upon incorporation of ice sheet dynamics, points to a likely range of 0.8-2.0m[5]. However, the most compelling evidence comes from palaeoclimate data in the last interglacial period (120,000 years ago) when global temperatures were 2°C higher than today[6]. The accompanying sea levels were 4-6m higher[6] implying that one of the major polar ice caps (either the Greenland Ice Sheet or West Antarctic Ice Sheet) melted.

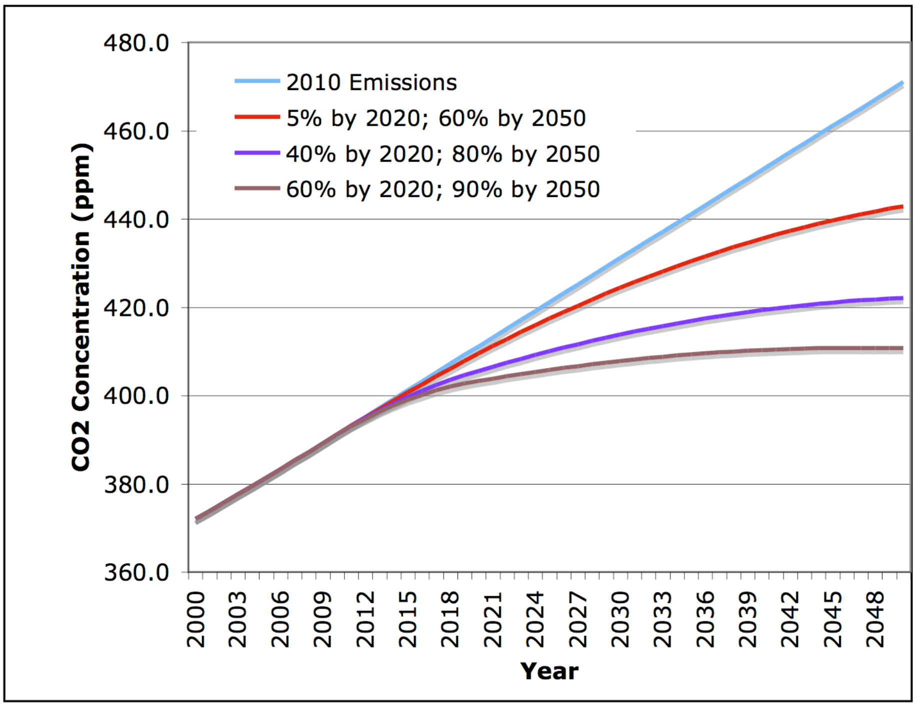
We can put this data in the context of earth history using the graph (adapted from Archer & Brivin, 2008[7]) on the left. Despite many inherent complexities in Earth's climate system (e.g. the shape and size of ice sheets affects their evolution), the graph demonstrates that a simple and strong relationship exists between the observed equilibrium sea level and global mean surface temperature. Using these examples from Earth's past, we would predict that a temperature rise of only 1°C can lead to an equilibrium sea level increase of 10-20m, an estimate much larger than the IPCC forecasts for 2100 indicated in the



graph (and consistent with that by others[4,7]). Examples from the past show rapid changes in sea level accompanying small changes in temperature—meaning that ice sheets are capable of contributing large pulses of meltwater to the oceans as they destabilize. The implication is that the larger the degree of warming we commit to, the larger the risk of sea level rise that is sudden and catastrophic in today's terms.

Where should we aim?

Avoiding sea level rises comparable with the last interglacial period (and thus a dangerous level of climate change) necessitates limiting global mean surface temperature to less than 2°C above current levels. Taking the accepted range of climate sensitivity (2-4.5°C increase for a doubling of CO_2 concentration[1]), then a limit of 400ppm is required to minimise the risk, while the best estimate of climate sensitivity (3°C) implies that 460ppm is the threshold at which dangerous climate change becomes the *most probable* outcome.



The graph on the right projects CO_2 concentration based on several different emissions strategies (under the assumption that natural CO_2 sinks do not saturate). Every case exceeds 400ppm by 2020. The proposed emission reduction target of 5% by 2020 will have negligible impact on the atmosphere composition and climate change by 2020; moreover, even allowing for cuts of 60% by 2050 we find CO_2 concentration approaching 450ppm, with a continuing upward trajectory. This strategy invites dangerous climate change. Only global emission reductions (relative to 2000) deeper than 40% by 2020 will avoid concentrations greater than 420ppm by 2050.

Should Australia take action?

Australians have the highest emissions per capita in the OECD, and 5th highest in the world[8]. Australia is also relatively affluent and the nation is currently without debt. Hence we are well placed to make deep cuts. We can and should lead the way. The proposed 5% cuts by 2020 undermine the credibility and influence Australia might otherwise have in international venues to push for the necessary cuts.

"Business as usual" is not an option. There is also a real and increasing risk that the cost of insufficient action globally will be beyond imagination - in both economic and human terms. Australia can best position itself at the leading edge of a global response, with strong actions that immediately make renewable energy competitive and stimulate a wide range of new 'sustainable' industries. In the longer term, our actions now may determine the extent to which humans are able to adapt to the new climatic conditions in Australia and continue to inhabit parts of this ravaged continent.

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