

## Answers to Questions taken on Notice in the Hearing of

### NSW Parliament Portfolio Committee No. 7 – Planning and Environment

regarding the

### Climate Change (Net Zero Future) Bill 2023

Professor Penny D Sackett

3 November 2023

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I was invited to meet with NSW Parliament Portfolio Committee No. 7 – Planning and Environment during the Committee's 30 October 2023 hearing of NSW Climate Change (Net Zero Future) Bill 2023,<sup>1</sup> which is now under inquiry by the Committee.

During my appearance, Committee members asked me two questions that I agreed to take on notice. The answers to those questions are set out below.

#### Question from Mr Ruddick

##### *Context taken from the transcript:*

**The Hon. JOHN RUDDICK:** You stated: Many coastal areas in Australia will experience what are now considered 'once-in-100-years extreme-sea-level events' *at least once a year* by 2100. We were told 30 or 40 years ago that we would imminently face rising oceans. I don't think that's happened. Other people have appeared before the Committee and claimed that it has. I am pleased to see that you're saying that it is something that will happen, but are you in agreement that we have not yet seen oceans rising as was predicted?

**PENNY SACKETT:** No, I don't agree with that point. Oceans have risen; the evidence is very clear on that. It's also clear—and this is rather recent science—that that rate of increase in the ocean is now accelerating. That is, it's rising faster and faster. So, the oceans have already risen, and they will definitely rise further. How much further lies currently under our control, partially, by how much we limit greenhouse gases.

**The Hon. JOHN RUDDICK:** How much have oceans risen in the past 100 years?

**PENNY SACKETT:** I'm talking now about an average, and I would like to take this on notice, if I could, so I can get you a precise answer.

**The Hon. JOHN RUDDICK:** Thank you.

**PENNY SACKETT:** If you'd allow me, I'd like to take that on notice, and I will return that answer very quickly to the Committee.

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<sup>1</sup> NSW Climate Change (Net Zero Future) Bill 2023, accessed on 21 October 2023 at: <https://www.parliament.nsw.gov.au/bills/Pages/bill-details.aspx?pk=18510>

**The Hon. JOHN RUDDICK:** It might have gone up a centimetre or two, but it's not having any impact. Demand for real estate on coastal properties continues to soar, so I don't think it's actually having any real-world impact. I mean, a one- or two-centimetre rise will be negligible for all communities.

**PENNY SACKETT:** It is more than that, and I would disagree that it's not having an impact. There are many companies, for example, that are already working, quite worried about the infrastructure that they have built next to coasts. There are already airports considering how this might affect their runways and so forth, so I would not agree that it has not had any impact. I'm not a real estate specialist, I admit.

## My response to Mr Ruddick

Sea levels have been rising at an accelerating rate since 1900. Global heating causes oceans to rise for two principal reasons: (1) warmer ocean water expands, and (2) increasing melt water of land ice can flow into the ocean. The second of these causes is increasing in importance. Due to differences in the topographical details of how coastal land areas are connected to their ocean shelves, sea level changes differ around the globe. For that reason, in order to discuss global changes, average (or mean) sea levels are usually used.

The summary of the sixth assessment report from Working Group I (AR6 WGI) of the Intergovernmental Panel on Climate Change (IPCC) states that “Global mean sea level has risen faster since 1900 than over any preceding century in at least the last 3000 years (*high confidence*).”<sup>2</sup> In other words, in terms of sea level rise, the last century or so is significantly different than any of the preceding 30 centuries.

According to AR6 WGI, the average rate of sea level rise was 1.3 mm per year between 1901 and 1971, increasing to 1.9 mm per year between 1971 and 2006, and further increasing to 3.7 mm per year between 2006 and 2018. Global mean sea level continues to rise at an accelerating rate, with an average of 4.5 mm per year observed over the period 2013–2021<sup>3</sup>.

This information can be used to estimate the average sea level in 2023, compared to that in 1900. Namely:

Average sea level in 2023 =

$$\begin{aligned} & \text{Average sea level in 1900} + 1.3\text{mm}*(1971 - 1901) + 1.9\text{mm}*(2006 - 1971) + \\ & 3.7\text{mm}*(2018 - 2006) + 4.5\text{mm}*(2021 - 2018) + 4.5\text{mm}*(2023 - 2021) \\ & = \text{Average sea level in 1900} + \mathbf{224.4 \text{ mm}} \end{aligned}$$

**In other words, average sea level has risen about 22 cm, or about a quarter of a metre since 1900.** This matches what is shown in the AR6 WGI summary report in Figure SPM.8(d).

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<sup>2</sup> IPCC (2021) Summary for Policymakers. In AR6 WGI: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Accessible at: <https://www.ipcc.ch/report/ar6/wg1/chapter/summary-for-policymakers/>

<sup>3</sup> WMO (2022) WMO State of the Climate 2021. WMO-No. 1290. Accessed at: <https://library.wmo.int/records/item/56300-state-of-the-global-climate-2021>

In terms of the impact of 'extreme sea level events', referred to in my original written submission to the Committee, it may be helpful to note that extreme sea level events are unusually high sea levels caused by combined drivers including rising sea levels, tides, storm surges, and the increasing intensity of tropical cyclones. Global heating is driving an increase in the ferocity of storms and cyclones.

Recent research indicates that even under 1.5°C of warming, thousands of global locations will experience what are now considered 'once-in-100-years extreme-sea-level events' at least once a year by 2100, with the tropics most affected.<sup>4</sup> Even more locations will experience such events annually at higher levels of global heating. Fig. 1 (below) shows the global locations studied, colour-coded by the global heating value at which extreme sea level events would become 100 times more frequent. The Australian coast line will be heavily impacted even at 1.5°C of global heating, and considerably more so for heating values a degree or more higher.

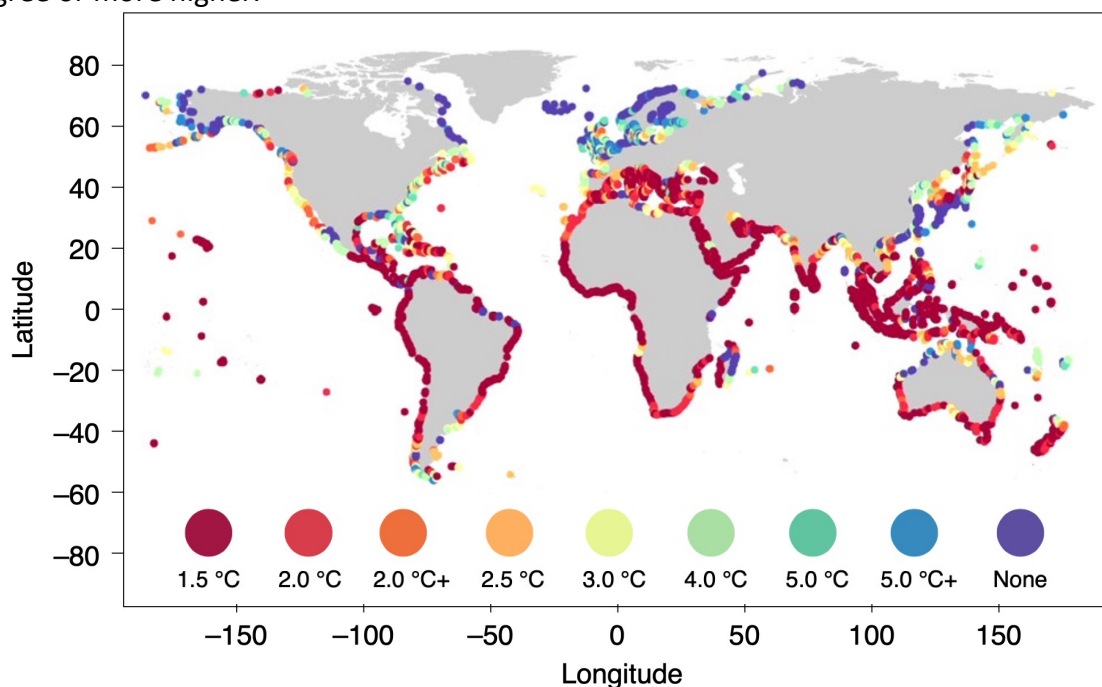


Fig. 1: The 7,238 coastal locations around the globe studied by Tebaldi et al. (2021), colour-coded by the global warming level in 2100 that would cause that location to experience at least once per year extreme sea level events that are currently considered 'once-in-100-year' events. Figure from Tebaldi et al. (2021).

Extreme sea level events cause erosion of coastlines, incursion of salt water into inland areas, and destruction of natural habitats, ecosystems and human infrastructure, including individual homes and common societal infrastructure, such as air and sea ports. As a single example, a 2018 study<sup>5</sup> by Asia Research & Engagement estimated a potential cost of between US\$1.5 billion and US\$3.1 billion will be required to protect and elevate just nine of Australia's sea port areas in order to adapt to climate related risks.

<sup>4</sup> Tebaldi, C. et al. (2021) Extreme sea levels at different global warming levels. In Nature Climate Change, 11, 746-751, <https://doi.org/10.1038/s41558-021-01127-1>

<sup>5</sup> McCarron, B, Giunti, A. and Tan, S. (2018) Climate Costs for Asia Pacific Ports. Accessed at: [https://asiareengage.com/sdm\\_downloads/climate-costs-for-asia-pacific-ports/](https://asiareengage.com/sdm_downloads/climate-costs-for-asia-pacific-ports/)

## Question from Ms Munro

### *Context taken from the transcript:*

**The Hon. JACQUI MUNRO:** Professor, thank you so much for your submission. I found it very helpful, particularly that your recommendations were so clear and so clearly linked to the bill. On that methane question, are there countries around the world or other jurisdictions that are putting limits on methane emissions?

**PENNY SACKETT:** Yes. Again, for a more fulsome answer, I would like to take that on notice. But I can tell you here today that it's actually been several years ago, for example, when the state of California put limits on its methane emissions, recognising that the state of California has a much larger economy and a much larger population. I recognise it's not a nation, but in terms of the number of people and the industries and so forth that it had to consider, it's every bit as complex as Australia. Many other countries are taking a variety of actions on methane. I would have to take on notice how many of those actions include targets or targets in law. Australia has signed up to the Global Methane Pledge, but that pledge doesn't actually require any of the many countries that have signed it, quite frankly, to individually do anything. It is simply a commitment to try and lower methane emissions, but there is no commitment that's required of any given nation. I think that New South Wales would be a leader, definitely, if it made specific methane targets as well. I'm happy to take that on notice to give you a more fulsome answer to that question.

## My response to Ms Munro

In 2016, California set a goal in law to reduce 40% of its methane emissions by 2030 compared to 2013 levels.<sup>6</sup> Furthermore, the US state has allocated \$100 million in funding to support a constellation of satellites that can monitor for large methane plumes, and has recently announced the launch of a new climate initiative that will recruit subnational governments worldwide to commit to mitigating and reducing methane, with founding signatories from subnational jurisdictions in Mexico, South Africa, Brazil, Nigeria, and India.<sup>7</sup>

In September 2023<sup>8</sup>, Canada announced a 75% reduction target from 2012 levels for oil and gas methane emissions by 2030. The province of Alberta (Canada) has a 45% reduction target from 2012 levels for oil and gas methane emissions by 2025, and claims that it will meet that target.<sup>9</sup> In 2021, the province of British Columbia (Canada) announced a reduction target for methane emissions from the oil and gas sector of 75% below 2014 levels by 2030.<sup>10</sup>

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<sup>6</sup> California Senate Bill No. 1383. Accessed at:

[https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB1383](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1383)

<sup>7</sup> Subnational Methane Action Initiative (2023) Press Release Accessed at:

<https://calepa.ca.gov/2023/09/20/press-release-california-launches-international-methane-reduction-initiative-during-climate-week/>

<sup>8</sup> Government of Canada (2023) Update on Path Forward for Oil and Gas Sector Methane Mitigation. Accessed at: <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/reducing-methane-emissions/update-oil-gas-sector-methane-mitigation.html>

<sup>9</sup> Government of Alberta (2023) Reducing methane emissions. Accessed at: <https://www.alberta.ca/climate-methane-emissions>

<sup>10</sup> Government of British Columbia (2021) Clean BC Roadmap to 2030. Accessed at: <https://cleanbc.gov.bc.ca/>