Climate modelling

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CLIMATE CHANGE AUTHORITY

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Chair - Climate Change Authority

Keynote speech

Check against delivery

May I begin by acknowledging the traditional owners of the land where we meet, the Gadigal people of the Eora Nation.

I would like to pay my respects to elders, past, present and emerging.

We're also meeting just days after the horrific shootings not so far away from here, at Bondi.

The first night of Hanukkah, often referred to as the Festival of Light, marks the restoration of the second Jewish Temple in Jerusalem. It's typically a cherished time for joy and celebration.

At this period of great sorrow, we extend our love and care to our Jewish family, friends, fellow Australians and others caught up in Sunday's outrages.

As I note from the Jewish Climate Network's own salient comments this week, we indeed all have an obligation…

…to help Jewish Australians in their grief

…to reject antisemitism in all its forms

…to promote light so it prevails over darkness

…and ensure our unity defeats division.

In the context of last Sunday's tragedy, a discussion of climate modelling may seem obscure…but there is much riding on its success, here and abroad.

I hope by its conclusion you'll have a clearer sense of how the Climate Change Authority used modelling to inform our advice to the Government on Australia's 2035 emissions reduction targets. Advice they accepted.

I will, though, devote most of today's talks more broadly at what role climate modelling itself will need to take by 2035 – and explore the economic imperatives that flow.

In short, good economic modelling is going to need good climate modelling.

There'll also be an announcement…so stay tuned!

So, let's go over some of the modelling that went into the targets advice.

As you may recall, we recommended Australia cut 2005-levels of greenhouse gas emissions by between 62 and 70%, by 2035.

In per capita terms, the cut was 76–81%, based on our growing population.

Having recently returned from the COP30 climate summit in Brazil, I can assure you that our 2035 target was rightly viewed as ambitious – few other nations are proposing such a steep fall.

Given we are two thirds of the way between 2005 and 2035, though, but have only cut emissions about 29% so far, you can appreciate we have a lot more work to do to achieve this target. Our Annual Progress Report echoed the assessment that recent reduction rates need to be accelerated.

As you can see in the first of a couple of slides that I'll present, our advice was based on what we call a mixed-methods approach.

That work, as you see on the first slide, meant calibrating our assessment based on 5 central inputs:

- We anchored the work in the latest climate science. 2023 was the hottest year on record globally, before 2024 came along. 2025 is almost done and it'll likely end up being the third hottest. Australia itself just posted its hottest ever July-to-June period on land, and sea-surface temperatures remain near record-highs, too.
- We asked CSIRO to conduct macro-economic modelling to understand what impact the recommended cuts would have. More on this intersection of climate and economic models soon.
- We looked at each sector of the economy and examined the plausible advances of technology over the coming decade. Most of the emissions cuts since 2005 have been in the land sector but now other sectors need to step up.
- We consulted widely in the community. That approach included receiving more than 500 submissions. We also conducted a similar number of engagements to understand what feasibly could be achieved and where.
- Finally, we considered the changing and challenging geopolitics. We might be an island continent, but we're highly integrated into the world economy. There are climate modelling consequences here, too, as I'll detail shortly.

On to the second slide, there are some more details of the CSIRO modelling and also the sectoral analysis.

Our commissioned modelling analysed among other things, the complex interactions and interdependencies of various sectors, the implications of changing technology, and what is economically achievable.

The CSIRO modelling also showed how our economy could continue to grow, alongside our proposed emissions reductions.

On the right-hand column, we provide a bit more detail about our sectoral analysis based, in part, on our pathways review that we prepared in late 2024.

That analysis has held up well, and the review would reward your time, if I can put in a little plug for the Authority's work.

Having more sectors of the economy – beyond electricity and land – contributing to emissions reduction will be important. How fast we can move will hinge in part of how fast technology moves, but also the policy support.

If we can turn to the third and last of the slides, you can get a clearer notion of what I mean.

This chart shows the estimated contribution from the key sectors of the economy between 2024 and 2035 in terms of emissions cuts.

I should emphasise that we consider these portions to be illustrative. Some sectors might move faster than we expected, helping to make up for others that don't make the anticipated progress.

As you can see, the light blue section for "electricity and energy" supplies the biggest emissions cut – of the order of 125 million tonnes of CO_2 equivalent.

Much of that reduction is because renewable sources of electricity are coming online as coal-fired power stations drop out.

We have seen some of that progress but the pace will likely quicken over the coming decade. Solar panel prices, for instance, are roughly a 20th of the prices they were 20 years ago and should keep falling.

A complementary technology, batteries, are also sinking even more rapidly in recent years. Indeed, battery energy storage system costs have been plummeting by an average of 20% per year over the last decade, according to Ember, a consultancy.

The more modular the technology, the more production can be scaled, and innovations added.

Anyway, other sectors to note are transport, which will plateau in emissions over the next couple of years thanks largely to electric vehicle advances – batteries, again! – but also the popularity of hybrids.

The resources sector, too, will start to reduce its carbon pollution more. Partly the gains are from controlling fugitive emissions from coal better, but the electrification of mining machinery will also play a role.

Of course, policies can make a difference. Imagine what better uses could be made with the $4.5 billion a year or so tied up with the fuel tax credits to subsidise diesel use by miners.

If that money were to be repurposed so that it subsided the introduction of electric mining trucks, the benefits would last longer than the pump-and-dump approach to those trucks now.

Perhaps you think heavy vehicles will be hard to electrify. Don't tell the Chinese, who are expected to sell one heavy vehicle EV this year for every 4 conventional ones.

By next year, EV trucks are forecast to take 60 – six zero – per cent of the Chinese market, which trails only the US in size.

So I hope that summary helps you understand the breadth and depth of the modelling and analysis that informed our 2035 targets.

You may have other points you'd like to discuss…which we can address later.

For the second half of this speech, I'd like to take a look at climate modelling from a different angle.

Let's consider the role that climate modelling is likely to play both in helping us cut our carbon emissions, while also informing us about how we will need to adapt.

The science that goes into predicting tomorrow's weather is improving steadily, and the same has been the case for aggregated weather, also known as our climate.

However, the interactions of our atmosphere, land and oceans – and trying to predict what nations are going to do with their carbon emissions – naturally add to the challenges we face as the climate heats up.

So much is riding on understanding what changes are ahead, where these shifts will take place and when.

Climate adaptation will involve many billions if not trillions of dollars in spending in the decades ahead. And, as we know from Australia's recent climate risk assessment, the cost of inaction will always outweigh the cost of action.

Knowing what to prioritise will not just be a matter of getting good value for taxpayers. It could also mean the difference between having a growing, nimble and innovative economy, and one that's stagnant or shrinking.

Indeed, as a nation, we'll also want to know if we are approaching abrupt changes – also known as tipping points – when systems stop functioning like they had before.

And the science itself will have to be nimble and flexible to deal with relatively unanticipated events, such as the ongoing algal bloom off South Australia.

Clearly, the more we know and can prepare for, the better for our society, our economy, and our national security.

After all, as I mentioned a bit earlier, Australia isn't alone. How our neighbours fare matters to us, too.

Sharing good weather and climate science has supported our ties in the South Pacific for decades, and those links are only going to grow in importance.

You could almost say that good economic modelling is inseparable from good climate modelling – it's going to be hard to do the former without the latter.

I promised you an announcement, and it's coming.

But first, let's look at an example of how these themes can come together.

Let's imagine you were one of those emergency managers bunkered down in Brisbane earlier this year, watching Cyclone Alfred develop in the Coral Sea.

The Coral Sea, mind you, was just wrapping up a summer where sea-surface temperatures set yet another seasonal record for warmth, according to the Bureau of Meteorology.

Indeed, the most recent below-average summer for those sea-surface readings came in the summer of 1993-94. Paul Keating was still the PM.

No wonder the Great Barrier Reef has been hit with SIX mass coral bleaching events since 2016, but that's a discussion for another day.

So, back to Alfred…as you may recall, this tropical tempest strengthened to a severe category-4 tempest as it churned southwards before making an abrupt turn westwards towards the heavily populated southeast corner of Queensland.

Some weakening of the storm was expected but emergency managers still had to factor in the possibility of a cat-2 cyclone crossing the coastline near Brisbane.

No storm is quite the same as another. However, a category-2 cyclone, Seroja, crossed the Mid-West coast of Western Australia in 2021 at a similar latitude to Brisbane's.

Cyclone Seroja damaged about 70% of the structures in towns such as Kalbarri.

It goes without saying that a similar ratio of damage in the Brisbane and the Gold Coast would have left a catastrophic repair bill, not to mention the many lives placed at risk.

The knock-on effects would have been costly, too. Our housing industry is already under strain without having to divert all those tradies and construction materials to Queensland.

It hardly bears thinking about, but think about it we must, and plan for it.

Ultimately, Cyclone Alfred ended up crossing Morton Island as a Cat-1 system. It weakened further to a tropical low when it crossed the mainland coast, north of Brisbane.

We can thank a couple of late meanderings by Cyclone Alfred that slowed its wind speed.

Mind you, it's not like we dodged the bullet entirely, even if the media largely moved on at the time – focusing on a delayed federal election, for one thing!

Southeast Queensland copped power outages of a scale we hadn't seen before, save for the system black event in South Australia in 2016.

And, as of last May, there were about 116,000 insurance claims from floods and other damage totalling $1.2 billion.

Alfred left Australia's biggest disaster bill this year. Fingers-crossed that we don't see a competitor during what's left of 2025.

Cyclones don't usually track so far south. The previous ones, Cyclones Zoe and Wanda, landed in 1974 in the Brisbane area.

Will warming oceans fuel more such cyclones in the future at a shorter interval than 50 years?

Authorities, you might think, might want to know, as would the communities in what's Australia's fastest-growing population zone.

And even if Brisbane and the Gold Coast might avoid such rare events, how about places further up the coast?

Cyclone construction codes that require sturdier buildings came into force after Cyclone Tracy devastated Darwin in 1974.

In the Queensland region, those codes currently extend southwards almost to Bundaberg – but that's about 350 kilometres north of Brisbane.

We at the Climate Change Authority would like to have those building codes reviewed. Perhaps they need to be extended to the NSW border, a conversation that should be happening between governments and communities.

Good climate modelling would help us make informed decisions.

For now, though, cyclones are not well-represented in our future models. According to CSIRO and BOM, we expect more severe cyclones to form in the Australian region, even if the total number of such storms is projected to fall. However, there are uncertainties around the scale of these changes, due to challenges with modelling in low resolution.

Greater investment in the computational power to create so-called digital twins of the earth and a virtual one can provide policymakers with better tools to plan for what's coming, and for businesses and households to make appropriate adjustments, too.

Most of the present global climate models used for Australian projections are based on a 100-by-100-kilometre grid.

In these global climate models, Sydney, for instance, is represented as a single entity even though the climate risks vary greatly between our east and west, particularly for heatwaves. The ACT is treated as half a grid. Australian scientists have to 'downscale' these global projections to make them useful on a city-scale.

The best climate models globally are now achieving resolutions of just a couple of kilometres, according to Christian Jakob, Director of the ARC Centre of Excellence for the Weather of the 21st Century based at Monash University. The most advanced are down to a single kilometre by a kilometre scale.

In a recent article published by The Conversation, Professor Jakob said the difference in models was "like going from a grainy black and white television to an ultra high-definition one".

Australia's supercomputer used for climate work, known as Gadi, was 24th best when introduced in 2020. It's now ranked 179th, behind nations such as Kazakhstan, he noted.

Others such as Professor Andy Pitman has pointed out that Australia wouldn't put up with being ranked 179th in the Olympics, and we cannot afford to fall behind in this critical field.

I began this talk about the Authority's 2035 targets and what they were based upon, including climate science.

It's important that we also look at what target we want to set for climate science itself in a decade's time since we're going to want to know even more about the mitigation of emissions and the adaptation to climate change by then.

To that end, I would like to announce that before this week is out, the Climate Change Authority will be sending out invitations for a 2035 Climate Science Roundtable to be held in Canberra early next year.

The working date is 13 February, which we intend not to be a Black Friday.

We hope key ministers will attend, and senior officials in key climate-related agencies from the Bureau of Meteorology to CSIRO and the National Computational Infrastructure, among others.

We hope leading scientists will attend, along with some economic modellers from Treasury and elsewhere.

As I said earlier, economic modelling won't be worth much without well-informed climate modelling.

Thanks for your time, and I look forward to your questions.