Climateworks CENTRE

NOVEMBER 2023

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Climateworks Centre decarbonisation scenarios 2023

Updated pathways for Australia to meet the Paris Agreement

Acknowledgement of Country

We acknowledge and pay respect to the Traditional Custodians and Elders – past and present – of the lands and waters of the Wurundjeri people of the Kulin Nation, on which the Climateworks Centre head office is located; and acknowledge that sovereignty has never been ceded.
We extend our respect to all Traditional Custodians and Elders of the lands and waters where Climateworks operates.

Background

Climateworks Centre has a decade-long history of using scenario modelling to inform debate around decarbonisation pathways for Australia’s economy.

There have been some major developments since our 2020 scenarios

Hydrogen is better understood and more accepted as a potential solution for hard to abate sectors.

The policy context has shifted. Australia has committed to net zero emissions by 2050, and there is more action and commitment globally.

There is a growing consensus on the need to aim for **1.5°C rather than 2°C** to avoid the worst effects of climate change.

"Holding the increase in the global average temperature to **well below 2°C** above pre-industrial levels and pursuing efforts to **limit the temperature increase to 1.5°C** above pre-industrial levels"

THE PARIS AGREEMENT

Our model shows how the Australian economy can decarbonise at the lowest cost.

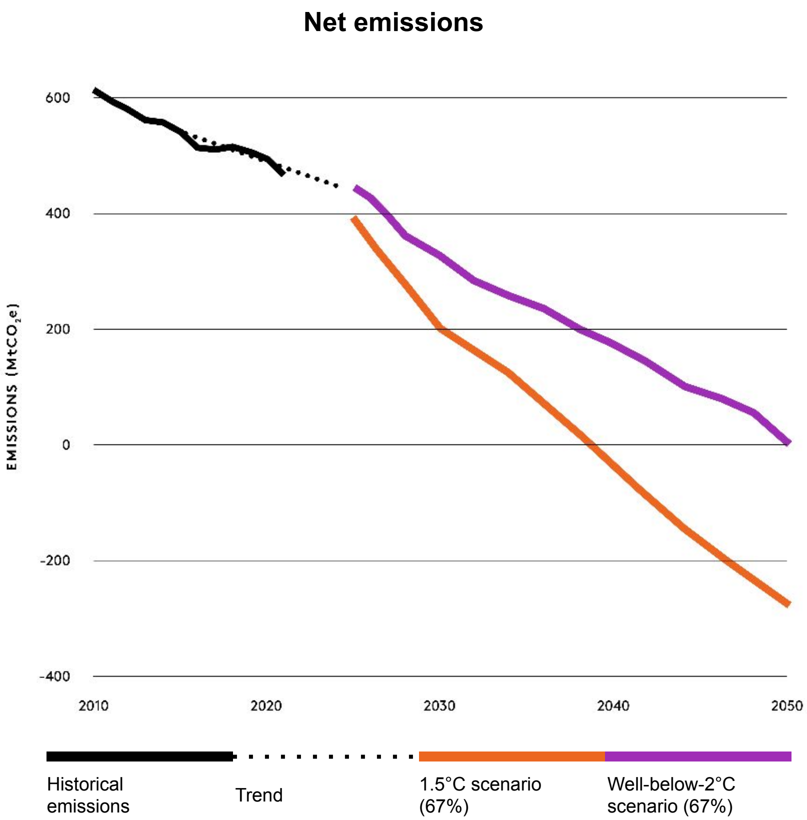
AusTIMES was developed by Climateworks and CSIRO based on the globally-recognised TIMES model from the International Energy Agency.

+ Our 2023 scenarios are our third major public release on economy-wide decarbonisation pathways for Australia.
+ The first, *Pathways to Deep Decarbonisation in 2050* was released in 2014.
+ The second, *Decarbonisation Futures,* released in 2020, produced the first explicitly Paris-aligned emissions trajectories and pathways for Australia.

Our scenarios

Our latest scenarios show Australia can reduce emissions by 85% by 2035.

- We modeled two possible scenarios, **1.5°C** and **well-below-2°C** (1.8°C).
- Our **1.5°C** scenario shows Australia rapidly reducing emissions achieving net zero by 2039.
- Our **well-below-2°C** shows a slower pace of emissions reduction achieving net zero by 2050.



Key findings

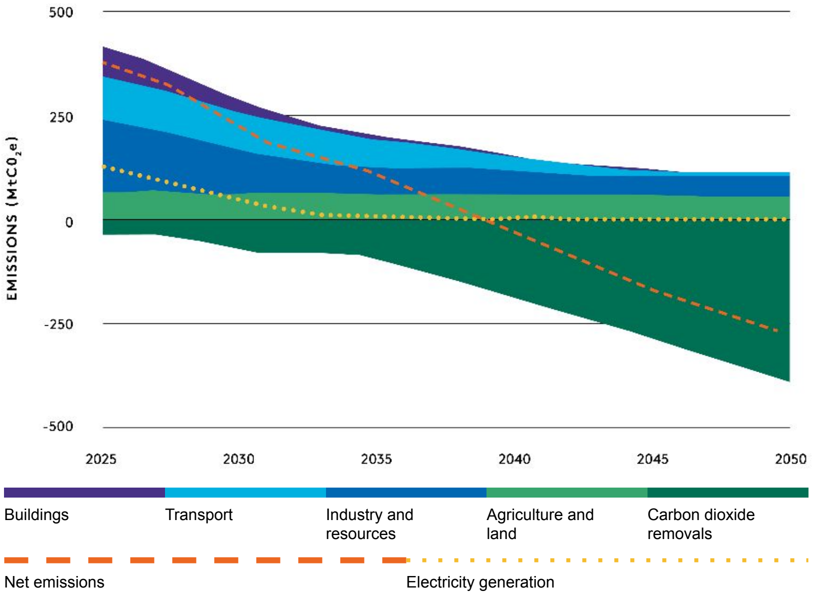
Australia's current federal government commitments fall short of Paris-aligned emissions reductions

Our modelling suggests Australia would need to urgently strengthen its legislated 2030 target to at least 48–68% below 2005 levels to ensure alignment with the Paris Agreement at lowest long-term economic cost.

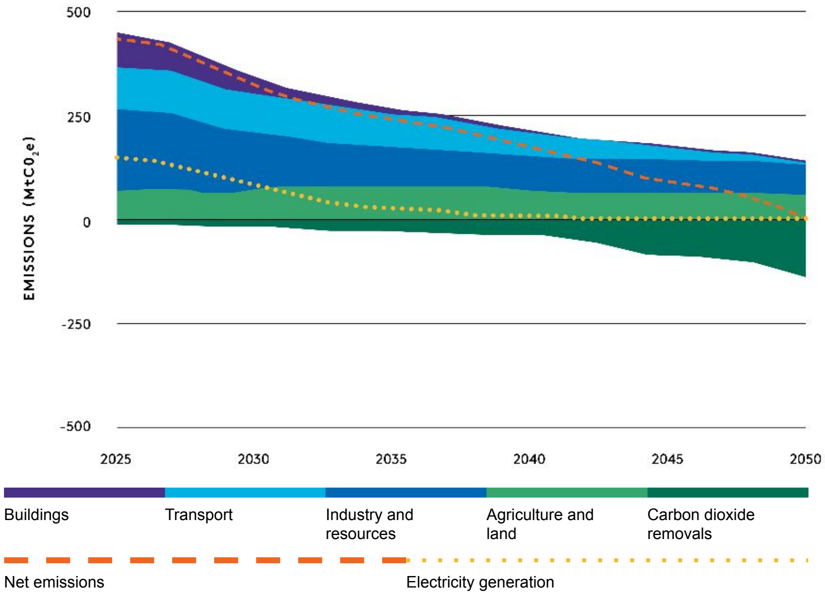
Target year	Australian federal government commitment	Well-below -2°C (67%) scenario	1.5°C (67%) scenario
2030	**43%** below 2005 levels	**48%** below 2005 levels	**66%** below 2005 levels
2035	TBC	**61%** below 2005 levels	**85%** below 2005 levels
Net zero year	**2050**	**2050**	**2039**

Cost-effective decarbonisation needs action across all sectors

Emissions by sector for 1.5°C (67%) scenario



Emissions by sector for well-below-2°C (67%) scenario



The technologies used to decarbonise the five sectors are broadly the same in both scenarios

In **BUILDINGS** efficiency and electrification of housing plays a significant role.

In **TRANSPORT** EV sales make up 56–73 per cent of new car sales in 2030.

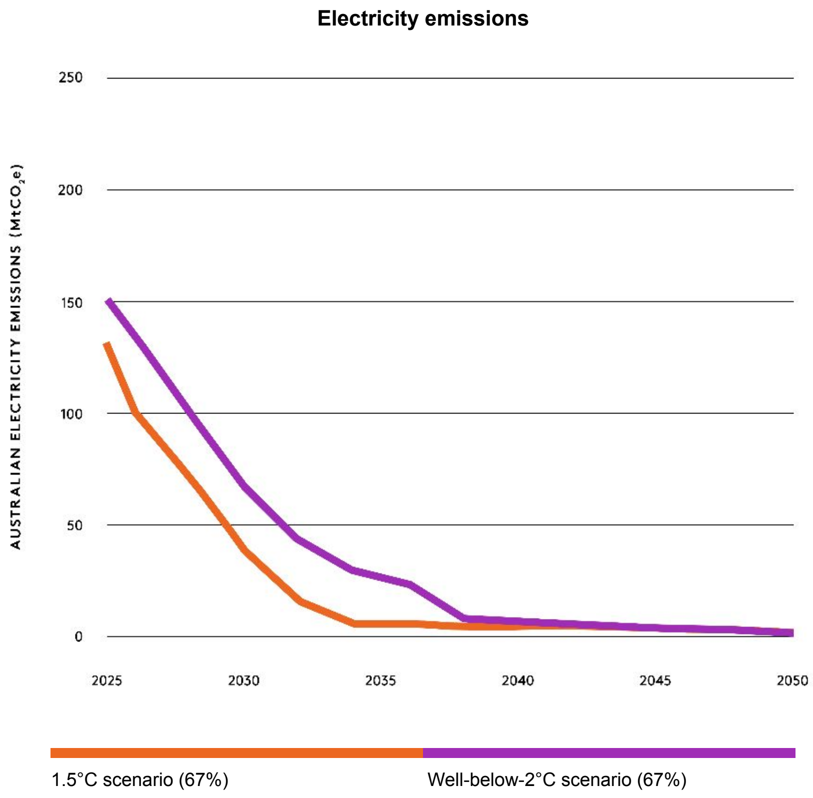
In **INDUSTRY**, significant emissions reductions of 54–67 per cent by 2050 on current levels are possible.

In **AGRICULTURE AND LAND** emissions reduction includes algae in livestock feeds and slow and controlled release fertilisers.

In both scenarios, Australia needs to **REMOVE CARBON DIOXIDE** from the atmosphere. The 1.5°C scenario includes significantly more carbon dioxide removal.

Clean electricity supply is central to Paris-aligned decarbonisation

- Electricity emissions reduce rapidly in both our scenarios, reaching near zero emissions by 2034–2038.
- Over the past decade, renewable energy prices have fallen dramatically. In many instances, technology costs have fallen even faster than were forecast.

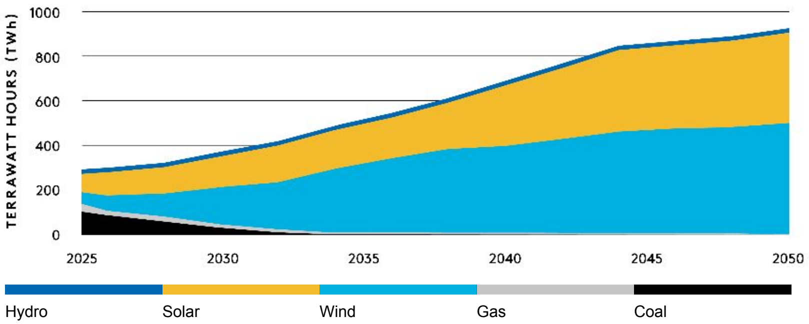


Rapid decarbonisation of the electricity system is central to both scenarios

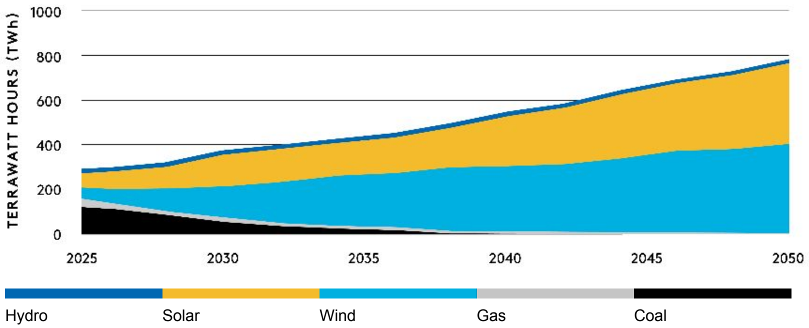
+ In both scenarios, renewable electricity generation grows to 83–90 per cent share of generation by 2030. This increases to nearly 100 per cent by 2050.

+ Renewable electricity generation capacity, currently around 55 GW, increases in both scenarios to 137–151 GW by 2030 and 363–398 GW by 2050.

Electricity generation mix for 1.5°C scenario

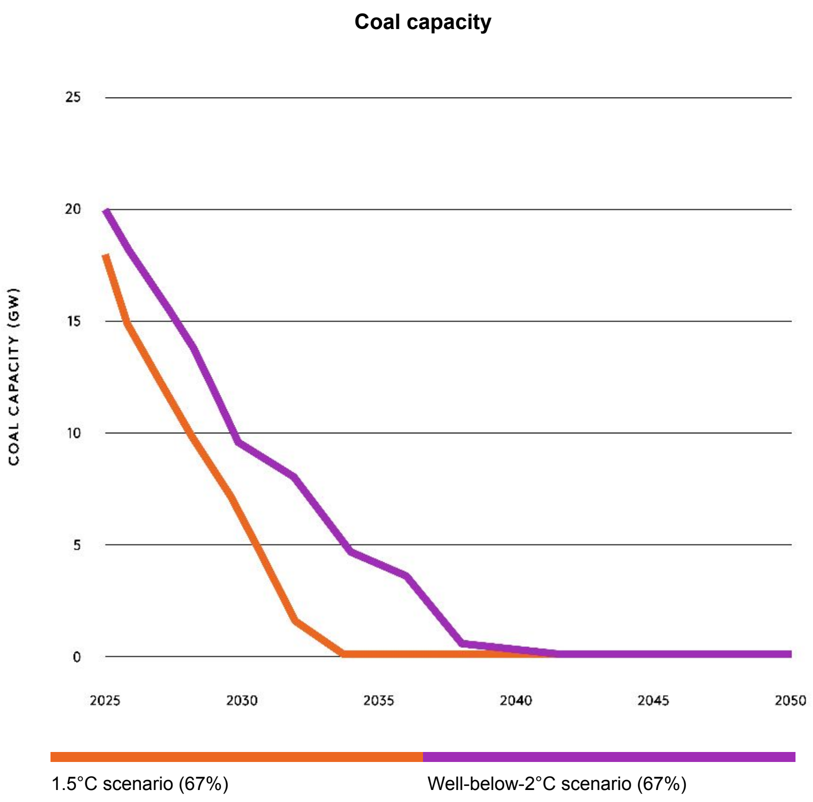


Electricity generation mix for 2°C scenario



Coal-powered electricity generation disappears by late-2030s or earlier.

+ Around the same time period, gas-powered electricity generation is greatly reduced.
+ By 2050, gas-fired power stations contribute less than 1 per cent of total generation, and would be used for what is known as ‘firming’.



The inclusion of hydrogen is one of the most significant changes in our model since our previous economy-wide scenario release.

- Hydrogen could potentially be used in industry processes requiring heat, in transportation through the use of fuel cells, and as a replacement for natural gas in buildings.
- In our scenarios, domestic hydrogen demand grows to 304–394 petajoules by 2050, or around 10–14 per cent of total energy demand in 2050 across Australia.

Support for hydrogen technology has increased substantially in recent years

Our modelling accounts for three different types of hydrogen production technologies:

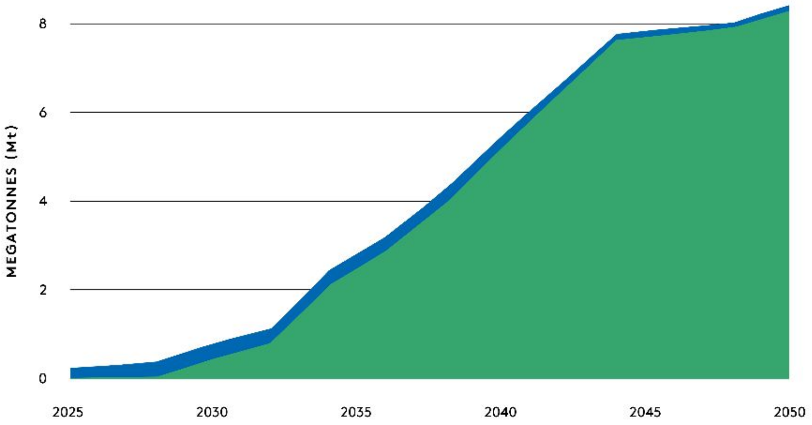
Green hydrogen:	Produced by splitting water into hydrogen and oxygen using a renewable electricity-powered electrolyser. This process does not create any greenhouse gases.
Blue hydrogen:	Extracted from natural gas using ‘steam reforming’. This process releases greenhouse gases, but these gases are captured and stored.
Grey hydrogen:	Also uses steam reforming but the resulting greenhouse gases are released into the atmosphere. (Not taken up in model)

Blue hydrogen is quickly displaced by green hydrogen

- Our modelling shows blue hydrogen plays a role in the short term to help create a domestic market for hydrogen.
- As the cost of renewable electricity falls, blue hydrogen quickly gets displaced in the market by green hydrogen produced via renewable-powered electrolysis.
- Green hydrogen production in Australia grows steadily until 2030 and then increases more rapidly to 2045.
- No role for grey hydrogen was found in these scenarios.

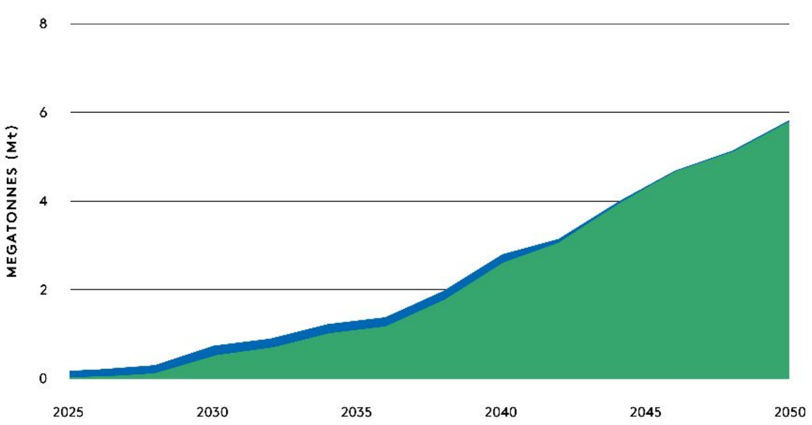
Green hydrogen is cost effective from 2030 onwards

Hydrogen production for domestic use in 1.5°C scenario



Blue hydrogen
Green hydrogen

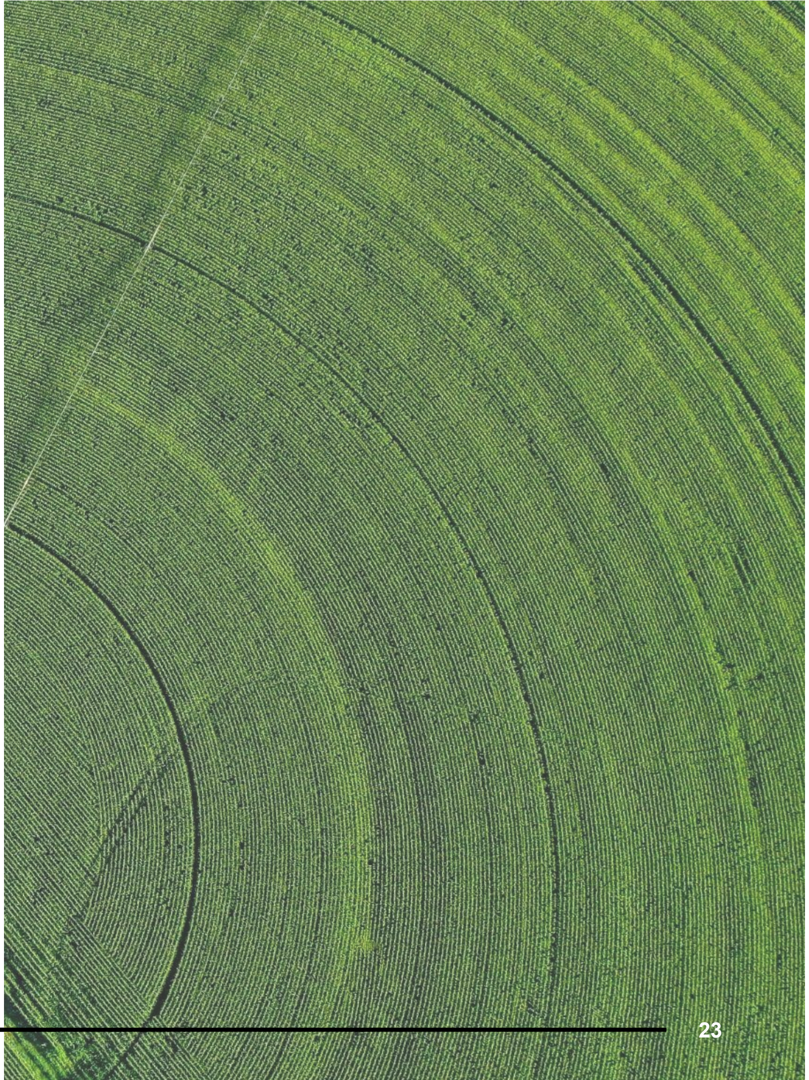
Hydrogen production for domestic use in well-below-2°C scenario



Blue hydrogen
Green hydrogen

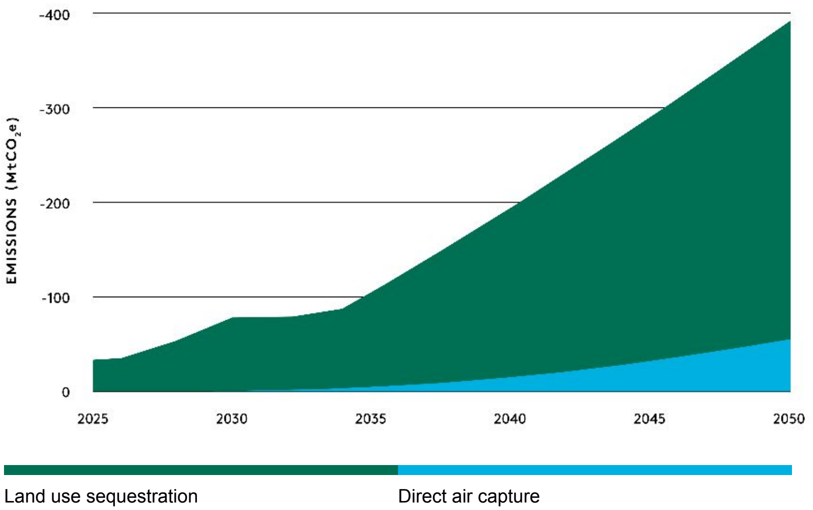
An unprecedented scale of effort to absorb carbon dioxide is needed

+ The amount of carbon dioxide removal (CDR) varies greatly depending on the level of ambition, from 1.4 gigatonnes of CDR in the well-under-2°C scenario to 4.6 gigatonnes in the 1.5°C scenario.
+ A minority of the carbon removals in the 1.5°C scenario come from speculative technology such as Direct Air Capture. However, even if this technology does become viable in the future, our modelling does not see a role for it until the 2040s.

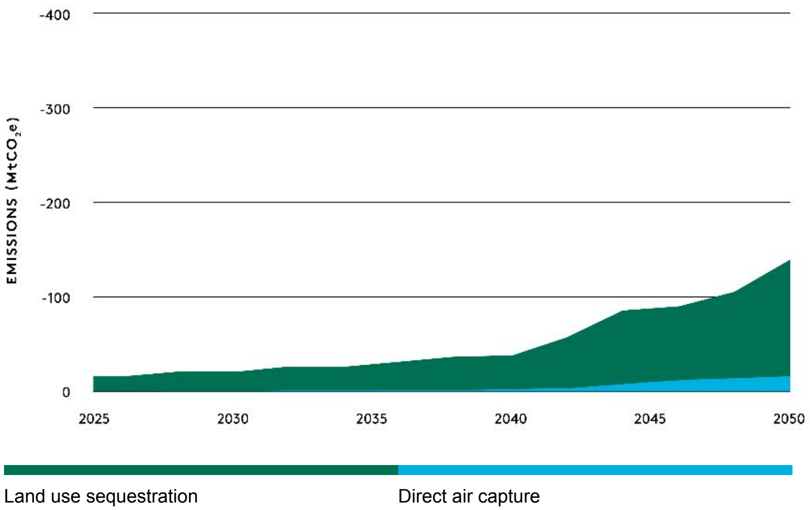


The amount of carbon dioxide removal varies greatly depending on the level of ambition

Carbon dioxide removals in 1.5°C scenario



Carbon dioxide removals in well-below-2°C scenario



These two futures become possibilities if Australia acts quickly to play its part in stopping the worst effects of climate change – while seizing the enormous opportunities that fast decarbonisation presents.

Thank you for your time.

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Climateworks CENTRE

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Co-founded by philanthropy and Monash University, Climateworks Centre is an independent not-for-profit working within the Monash Sustainable Development Institute.