



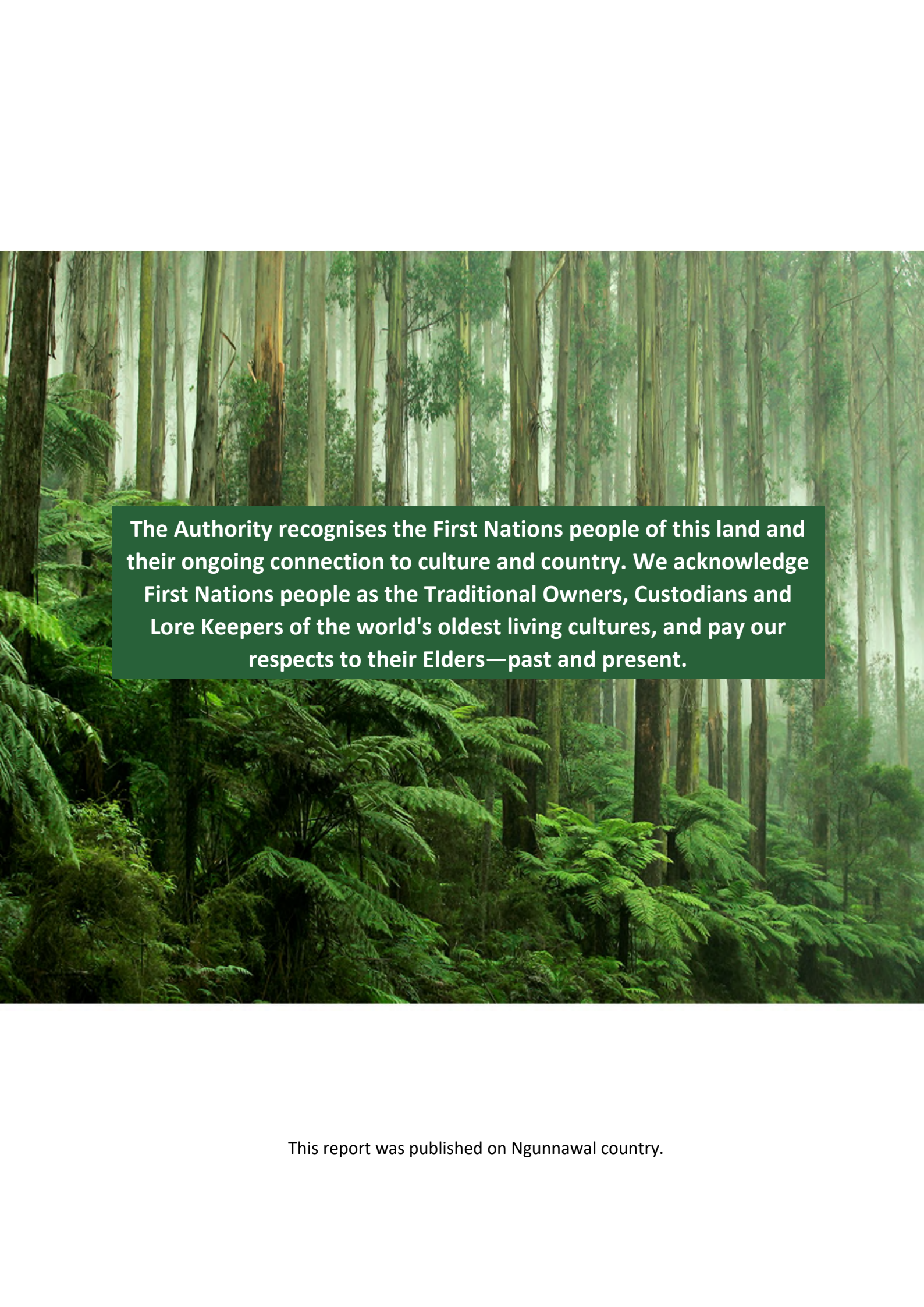
FIRST ANNUAL PROGRESS REPORT

The baseline, global context and methodology

November 2022



Australian Government
Climate Change Authority

A photograph of a lush forest. In the foreground, there are large, vibrant green ferns. The background is filled with tall, slender trees with light-colored bark, possibly eucalyptus, reaching up into a misty or overcast sky. The overall atmosphere is serene and natural.

The Authority recognises the First Nations people of this land and their ongoing connection to culture and country. We acknowledge First Nations people as the Traditional Owners, Custodians and Lore Keepers of the world's oldest living cultures, and pay our respects to their Elders—past and present.

This report was published on Ngunnawal country.

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11 November 2022

The Hon Chris Bowen MP
Minister for Climate Change and Energy
Parliament House
CANBERRA ACT 2600

Dear Minister

In response to your request of 9 September 2022, and in accordance with section 14 of the *Climate Change Act 2022* (Cth), the Climate Change Authority submits to you its advice to inform the first Annual Climate Change Statement to Parliament, entitled *First annual progress report: The baseline, global context and methodology*.

Section 14(6) of the *Climate Change Act 2022* requires the Authority to publish a copy of its advice on its website no later than the day you table your Annual Climate Change Statement in the Parliament. The Authority is also required by the Act to cause its advice to be tabled no later than the day that you table your Statement, and within 15 sitting days after giving you the advice.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Grant King'.

Mr Grant King
Chair
Climate Change Authority

 Australian Government
Climate Change Authority

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Acknowledgements

The Authority would like to thank a number of Government agencies and organisations for their assistance, including: the Department of Climate Change, Energy, the Environment and Water; the Clean Energy Regulator; the Department of Industry, Science and Resources; the Department of Infrastructure, Transport, Regional Development, Communications and the Arts; the Department of the Prime Minister and Cabinet; the Treasury; the Department of Foreign Affairs and Trade; the Bureau of Meteorology; and the Australian Research Council (ARC) Centre of Excellence for Climate Extremes.

The Authority is also grateful to the individuals and organisations who contribute time and expertise to the Authority's broader work, including those who provide submissions and participate in consultation. These contributions help inform the Authority's analysis and advice and will continue to shape our future Annual Progress Reports.

The views expressed in this *First Annual Progress Report* are the Authority's own and should not be taken as the views or positions of the entities listed above.

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Foreword

It is my pleasure on behalf of the Members of the Climate Change Authority to present the *First Annual Progress Report* to the Minister for Climate Change and Energy, as required by the *Climate Change Act 2022* (the Act).

The recent passing of the Act, with clear and legislated targets for significantly larger reductions in emissions, has evidenced a big change in community attitudes towards an appropriate Australian response to climate change. These new legislated targets and the many commitments made by Australian companies and government entities at all levels show that the debate has moved on from ‘why’ and ‘at what rate’ should we transition to a low carbon economy to ‘how’ should we do it.

Australia is not a low carbon economy and it will take a significant transition to become one. Many of the industries that have driven our national prosperity are relatively carbon intensive. It is important in managing the transition that it does not come at the expense of national prosperity and that all Australians, be they in our cities or rural and regional communities, benefit from this transition.

While moving to high levels of renewable energy in a way that preserves the reliability and affordability of electricity is a priority in achieving our shorter term targets, this report highlights the role that all sectors of the economy must ultimately play.

The facts in this report are clear and compelling. Australia needs to be moving faster and across all sectors of the economy to achieve our targets. This task is being made more difficult given the challenge that a deteriorating geopolitical and economic environment is having on the global economy and supply chains. A challenge further exacerbated by a planning and approvals process that is not keeping up with the rate that new projects need to be developed, and severe shortages in skills and labour to do the necessary work to transition our economy.

Recognising that our 2030 target for emissions reductions of 43 per cent below 2005 levels is only 85 months away, we need an elevated sense of urgency to address these challenges. Achieving net zero emissions by 2050 will require a plan that carefully sequences a combination of actions to mitigate and sequester carbon emissions across the whole economy.

The costs of failing to meet these challenges will be more than economic. Increasing extreme weather events and the physical impacts of climate change are damaging to people, our environment and ultimately to our future.

Responding to the impact of climate change is not entirely in our own hands as we are dependent on the progress that all nations make towards achieving the commitments they have made. We are as dependent on others as they are on us. It is therefore in our interests to help our neighbours, especially low lying nations in the Pacific region. It would also be wise for us to increase our focus on adaptation and building resilience to a changing climate.

The institutional architecture Australia has built to address climate change is strong and capable of expanding further to meet the needs of our nation. This report is another step on the progress we are making towards a net zero community, economy and nation.

The Authority looks forward to informing and supporting the Parliament, the Government and ultimately the Australian people on this journey.



Grant King

Chair

Executive Summary

Climate change impacts are intensifying. In 2021–22, Australian communities experienced the damage that more frequent, intense and prolonged extreme weather events can impose. Flooding in eastern Australia in February and March this year alone resulted in record insured losses for a flood event in Australia, estimated to be A\$3.35 billion. This has shown increased abatement is needed to avoid even greater impacts and Australia needs stronger adaptation and resilience efforts to keep up with the changing climate.

2021–22 was a significant year for ambition to mitigate further climate damage. Australia legislated a net zero by 2050 target and a stronger 2030 target to reduce emissions by 43 per cent below 2005 levels, and commenced implementation of the Government's *Powering Australia* plan.

Australia needs a big shift in the momentum of emissions reductions. To meet its ambitious new targets, Australia will need to decarbonise at an average annual rate of 17 Mt CO₂-e per year, more than 40 per cent faster than it has since 2009.

The Government can 'light the way' to net zero with a long-term strategy for emissions reductions—a strategy that sets expectations for when, how, and by how much, emissions should be reduced across different sectors of the economy. Everyone in Australia must be on a path to net zero, but not necessarily the same path. And a new era of Commonwealth, state and territory and local government cooperation can support the most efficient and effective outcomes. Climate change will need to be at the forefront of all government decision-making if we are to overcome barriers to meeting Australia's targets.

The technologies for meeting the 2030 target exist, but the scale and speed of the task demand close attention is paid to barriers like supply chain disruption, labour skills shortages, and long lead times in planning and approval of major projects. For example, large-scale renewable generation needs to be deployed at two to three times the rate of the previous decade, with accompanying energy storage, to get to 83 per cent renewables by 2030. Supply chains, workforce capacity and project approval timelines will need to improve dramatically to enable deployment of technology at this pace.

Companies are setting their own ambitious targets and decarbonisation paths now, but have limited time to demonstrate significant progress is being made to meet these targets before further action will need to be taken.

The time has come to look forward. For next year's Annual Progress Report, the Authority intends to establish and use leading indicators that show where the economy is heading, track the necessary transformations, and identify where action is needed to address insufficient progress.

Climate change continues and many impacts are intensifying

Many climate change-driven trends and impacts are already evident, including average Australian land warming of 1.4°C since the early 20th century and ocean warming of about 1°C over the same period. Sea-levels have been rising at over three millimetres per year, increasing the risks of coastal inundation. Rainfall patterns have shifted, with rainfall decreasing in southern Australia and increasing in the north (CSIRO and Bureau of Meteorology, 2020).

The frequency, intensity and duration of some extreme weather events have increased, including heat waves on land and in marine areas, which increase risks to human health and marine ecosystems. The incidence of extreme fire weather and the length of the fire weather season have also increased (CSIRO and Bureau of Meteorology, 2020).

The impacts of extreme weather events were particularly prominent in Australia and around the world this year. Without urgent global action, the outlook is grim. In February 2022, IPCC Working Group II concluded projected global warming under current global climate policies would leave many of the Australasian region's built and natural environments at risk from climate change impacts, making adaptation extremely challenging (IPCC, 2022a).

As climate impacts intensify, and as ambition and efforts to reduce emissions around the world take on new urgency, Australia should strengthen adaptation and resilience efforts. Calls to accelerate support and finance for adaptation are growing here in Australia and even more loudly for developing countries.

A big year for climate change policy in Australia

In Australia, a federal bipartisan commitment emerged to the goal of achieving net zero emissions by 2050. In June 2022, the Government increased Australia's 2030 target under the Paris Agreement to 43 per cent below 2005 levels. Both of these targets were subsequently enshrined in the *Climate Change Act 2022* (the Act).

The Government has also set about implementing its *Powering Australia* plan and made further commitments, including to the Global Methane Pledge under which participants agree to contribute to a collective effort to reduce global methane emissions by 30 per cent by 2030 (Bowen, 2022a).

Momentum needs to shift

Since 2009, Australia has decarbonised its economy at an average annual rate of 12 Mt CO₂-e per year, with most of these reductions delivered by the electricity and land sectors (Department of Climate Change, Energy, the Environment and Water, 2022b). This rate of change needs to accelerate to reach our 2030 and 2050 targets (Figure 1). If Australia continues to decarbonise at an average rate of 12 Mt CO₂-e per year it will underperform on its 2030 target by 73 Mt CO₂-e (in carbon budget terms).

Achieving Australia’s 2030 and 2050 targets means stepping up and sustaining a decarbonisation rate of at least 17 Mt CO₂-e per year. The Government will need to deliver on its *Powering Australia* plan and more if Australia’s targets and commitments are to be met. Climate change will need to be at the forefront of all government decision-making.

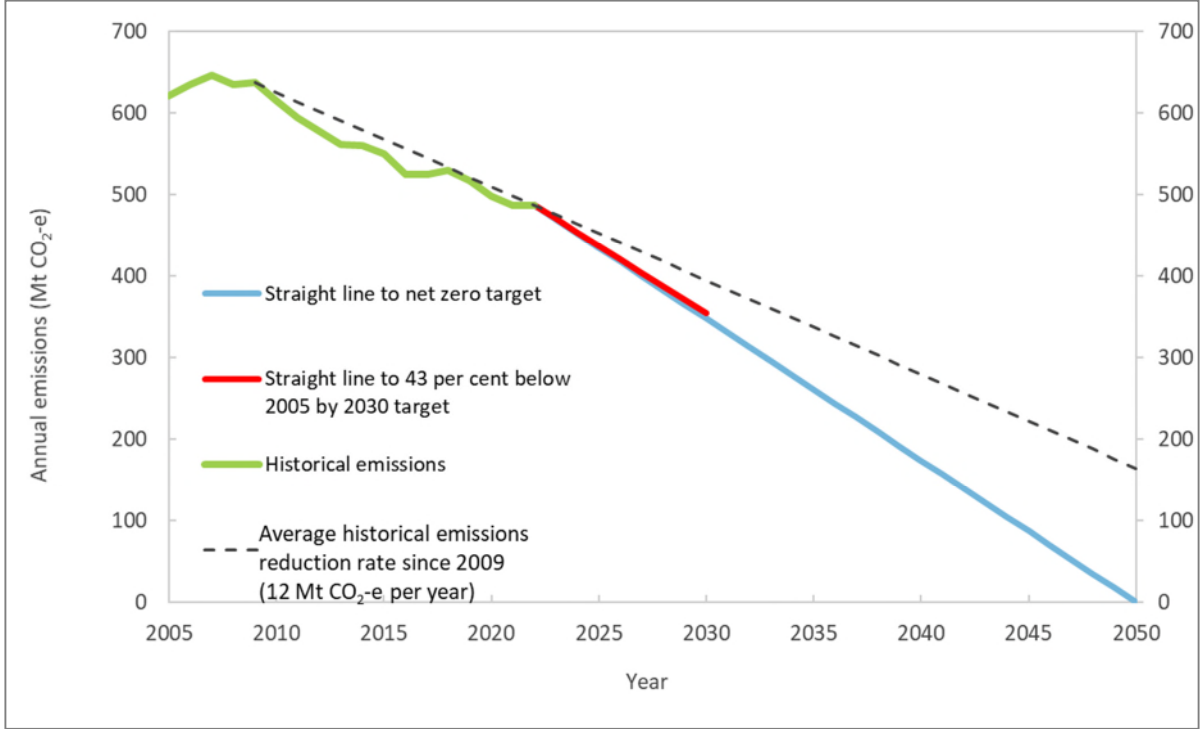


Figure 1: Historical and projected decarbonisation rate

Source: Climate Change Authority using historical data from the unpublished June 2022 *Greenhouse Gas Inventory Quarterly Update*.

Everyone in Australia must be on a path to net zero. Business has limited time to demonstrate sufficient progress is being made

Australia needs to decarbonise. Some regions and some entities (including governments, companies and community groups) will move faster than others. Unavoidable emissions will continue for some, whereas others are likely to store more carbon than they emit. Some will have more opportunities and others more challenges.

While federal, state and territory governments have economy-wide emissions reduction targets, policy interventions to drive down emissions have largely been focused in the land and electricity sectors, with limited or no targets for specific sectors. The Australian Government is now extending targets to industrial facilities covered by the Safeguard Mechanism. Progress elsewhere presently relies on a large amount of voluntary action. While the private sector has embraced ambitious emissions reduction targets for Australia, there is limited time for it to demonstrate sufficient progress is being made for Australia’s 2030 target to be met.

Governments are faced with difficult decisions because if someone won't do their fair share, someone else has to make up the difference. The time for free-riding is over. 'Fair share' is a concept that needs to take account of capabilities, costs and trade-offs. The Authority is exploring how to determine a sector's fair share of the abatement task. For example, the land use and electricity sectors have done much of the work so far, but they cannot keep reducing emissions at the same rate once the low hanging fruit has been picked. Other sectors will need to step up and make progress at a faster rate than they have before.

Achieving national goals together will take leadership and a new era of Commonwealth, state and territory, and local government cooperation

A long-term strategy can 'light the way' to net zero and beyond. The Government can provide the map, the rules (policies and regulations), the pathways (infrastructure), the education and the information to enable people, communities and businesses to navigate as smooth, supportive and speedy a journey as possible.

Sequencing, differentiation and proportionality matter.

Sequencing: If one industry is reliant on another to decarbonise, one may need to go first. The dependence of electric vehicles on renewable energy is a prime example.

Differentiation: Some sectors can mitigate and sequester carbon more readily than those with hard-to-abate emissions. An economically efficient response recognises these different capabilities and enables trade of offsets between entities.

Proportionality: If one sector does not achieve net zero emissions, other sectors will need to compensate. Australia must deliver overall average national emissions reductions of 17 Mt CO₂-e per year for the next 28 years.

Reducing emissions and preparing for a changing climate are whole-of-economy and whole-of-society issues that cut across federal, state and territory, and local government responsibilities, alongside corporate action.

A new era of Commonwealth, state and territory and local government cooperation can support more effective, integrated policy responses, avoid unnecessary duplication and regulation, and lower costs for businesses and households.

Remote and very remote Australians are often disproportionately affected by the natural disasters in our country. Only a just transition that strives for equitable outcomes for all peoples will be a successful transition—for Australia and across the globe. Leadership and engagement must come from all communities to ensure a resilient and prosperous country for all Australians.

The time has come to look forward

Until now, lagging indicators, like emissions inventory data, have been used to measure progress. Governments, companies and consumers need more up-to-date and forward-looking indicators to inform sound decision-making in a decarbonising world.

To inform its advice, the Authority will establish and track *leading indicators* of progress towards net zero. Examples include research and development investments, patents registered, products manufactured or imported, time to project approvals, lead time for delivery of essential plant equipment, training and education enrolments, and employment rates—all in areas that contribute to or are a barrier to decarbonisation. Further examples include the number of companies with science-based decarbonisation plans, and the value of low and net zero emissions investment in rural and regional areas.

These indicators need to be adaptive to potential structural changes in the economy. The potential trends of on-shoring (or re-shoring) manufacturing in Australia, in an effort to build resilience in supply chains by bringing parts of them together within the country, may require indicators higher up the supply chain. This means tracking the production of components for products needed for the net zero economy, such as solar panels or batteries. Leading indicators could include investment in and policies to support local manufacturing activity or demand for manufacturing space.

Tracking Australia's progress is not only about the tonnes of emission reductions but also the effectiveness of decarbonisation efforts, and the economy and society's readiness for a low-carbon world. This means tracking progress of the workforce, communities, products and infrastructure needed for a net zero Australia.

To realise Australia's increased ambition, we must accelerate action and address practical barriers to success

Achieving Australia's 2030 target requires rapid deployment of the emissions reduction technologies available today. To achieve this, the practical, real world barriers to deployment must be overcome. Shocks and shortages in global supply chains put at risk the delivery of the projects essential for achieving net zero, which are required at a scale the world has not yet seen and already have lead times of years if not decades. Up-skilling the workforce, along with the planning, permitting and approvals of major renewables and other infrastructure projects must happen even faster, and must be supported by resilient supply chains. For a successful transition:

- supply chains need to deliver adequate technology and equipment supplies.
- approvals and other regulatory processes must be efficient and timely.
- skills formation programs must be in place to ensure workforce needs are met.
- private finance must be flowing to fund the net zero transition.

The passage of the Act represents real progress for climate ambition and accountability in Australia. Now the focus must turn to accelerating action on both abatement and adaptation and the hard, practical work needs to get underway in earnest—to achieve as much as possible, as soon as possible.

Australia can be a global leader on climate change action. Australia has some of the world's best renewable resources, extensive landscapes conducive to sequestration of carbon, and large reserves of the raw materials required for low emissions technologies, such as lithium, uranium, nickel and copper. Australians also have the potential to decarbonise exports with high embedded emissions, such as steel, aluminium and beef. Insufficient action will leave Australians vulnerable to the effects of climate change at huge cost. The right action will underpin the nation's resilience, prosperity and a fair contribution to the global response.

Chapter 1 – Introduction

Summary

The recently legislated *Climate Change Act 2022* (the Act) requires the Minister responsible for climate change to prepare an annual climate change statement. The Act requires the Authority to give advice to the Minister that relates to preparation of annual statements, and requires the Minister to have regard to the Authority's advice when preparing those statements.

This report is the Authority's inaugural Annual Progress Report. It contains the Authority's advice that relates to the preparation of the 2021–22 annual climate change statement, and follows a year marked by continuing changes in the climate, and extreme weather events that occurred both here and around the world.

Despite the cooling influence typically associated with La Niña events, 2021–22 was the eighth warmest financial year in Australia since 1910, and the average land temperature was about 1.4°C above the 1910 baseline. During the 2021–22 financial year Australia also experienced rainfall nine per cent above the 1961–1990 average.

The past year also saw major developments in climate change policy in Australia. In June 2022, the Government updated its Nationally Determined Contribution (NDC) under the Paris Agreement. This:

- increased the ambition of Australia's 2030 target, committing to reduce greenhouse gas emissions by 43 per cent below 2005 levels by 2030; and
- reaffirmed Australia's target to achieve net zero emissions by 2050.

In September 2022, the Act became law. This Act legislated both the 2030 and 2050 targets, sets a requirement for the Minister of Climate Change and Energy to make an annual climate change statement to Parliament on climate change, and adds new functions for the Authority.

1.1 About this report

The Authority is an independent statutory agency, established to provide expert, evidence-based advice to the Government on Australia's climate change targets, policies and progress. The Authority consists of a Chair, the Commonwealth Chief Scientist and seven other members appointed for their substantial experience or knowledge and significant standing in fields that contribute to responding to the climate challenge (Appendix A).

The recently legislated Act establishes a requirement for the Minister for Climate Change to deliver annual climate change statements to Parliament. The climate change statements will address progress towards achieving Australia's greenhouse gas emissions reduction targets, international developments, climate change policies (including their effectiveness in contributing to targets and their impact on rural and regional Australia), and risks to Australia from climate change impacts.

Section 14 of the Act requires the Authority to 'give the Minister advice that relates to the preparation of an annual climate change statement', and requires the Minister to have regard to the Authority's advice when preparing the statement (Appendix B). The Authority has opted to give this advice in the form of an Annual Progress Report. These Annual Progress Reports will be guided, at a minimum, by the requirements for the annual climate change statements in section 12 of the Act, as well as section 12 of the *Climate Change Authority Act 2011*, which sets out principles to which the Authority must have regard in performing its functions (described below).

Chapter 1 of this report includes an overview of climate-related developments in Australia and around the world. The Authority's assessment of where Australia stands in relation to achieving its 2030 and 2050 targets is presented in Chapter 2, and a summary of international policy developments in Chapter 3. In Chapter 4, the Authority describes the methodology it proposes to use to assess Australia's progress in future years.

In addition to requiring the Authority to provide advice relating to the annual climate change statements, section 15 of the Act also separately requires the Authority to 'advise the Minister on greenhouse gas emissions reduction targets to be included in a new or adjusted nationally determined contribution' or 'NDC'. Australia's next NDC is due in 2025, ahead of which the Authority will prepare comprehensive advice on Australia's targets (see Snapshot: Advising on Australia's next NDC). The Authority has not assessed Australia's targets in this *First Annual Progress Report*.

Snapshot: Advising on Australia's next NDC

Under the Paris Agreement, Australia must submit its next Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) by 2025. Parties to the UNFCCC are requested to submit updated NDCs every five years, regardless of their respective implementation timeframes (UNFCCC, n.d.). Successive NDCs must represent a progression compared to previous NDCs and reflect the country's highest possible ambition. Table 1 shows key events in the lead-up to Australia's NDC, including the preparation of the Authority's advice.

As the table shows, Australia's next NDC is due after the completion of the first global emissions stocktake by the UNFCCC in 2023. The results of the stocktake will be an important input to Australia's NDC as the stocktake will assess collective progress under the Paris Agreement, and identify gaps along with opportunities for increased ambition (UNFCCC, 2022).

Table 1: Schedule leading up to the lodgement of Australia's next NDC

Event	Year
First UNFCCC global emissions stocktake concludes	2023
Climate Change Authority advice on Australia's next NDC	2023 or 2024
Australia's next NDC due to be submitted to the UNFCCC	2025

1.2 Principles underpinning the Authority's advice

The *Climate Change Authority Act 2011* (section 12) requires the Authority to have regard to the following principles when undertaking its functions:

- a) *The principle that any measures to respond to climate change should:*
 - i. *be economically efficient; and*
 - ii. *be environmentally effective; and*
 - iii. *be equitable; and*
 - iv. *be in the public interest; and*
 - v. *take account of the impact on households, business, workers and communities;*
and
 - vi. *support the development of an effective global response to climate change; and*
 - vii. *be consistent with Australia's foreign policy and trade objectives; and*
 - viii. *take account of the matters set out in Article 2 of the Paris Agreement¹; and*
 - ix. *boost economic, employment and social benefits, including for rural and regional Australia.*
- b) *and such other principles (if any) as the Authority considers relevant.*

The Authority has also referenced its strategic approach for guiding Australia's response to climate change (Climate Change Authority, 2022b). The approach (summarised in Figure 2 below) identifies six actions and six enablers that can drive the bulk of the abatement and adaptation changes both needed and deployable today. It recognises that net zero is a collective challenge, not a challenge for governments alone. Societal choices matter. Governments can enable market forces. Indeed, only markets can mobilise and allocate the massive amounts of capital needed to make the investments required for transition to a resilient, net zero economy.

¹ Article 2 of the Paris Agreement '*aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:*

- a) *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, recognising that this would significantly reduce the risks and impacts of climate change;*
- b) *increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and*
- c) *making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.'* (UNFCCC, 2015).

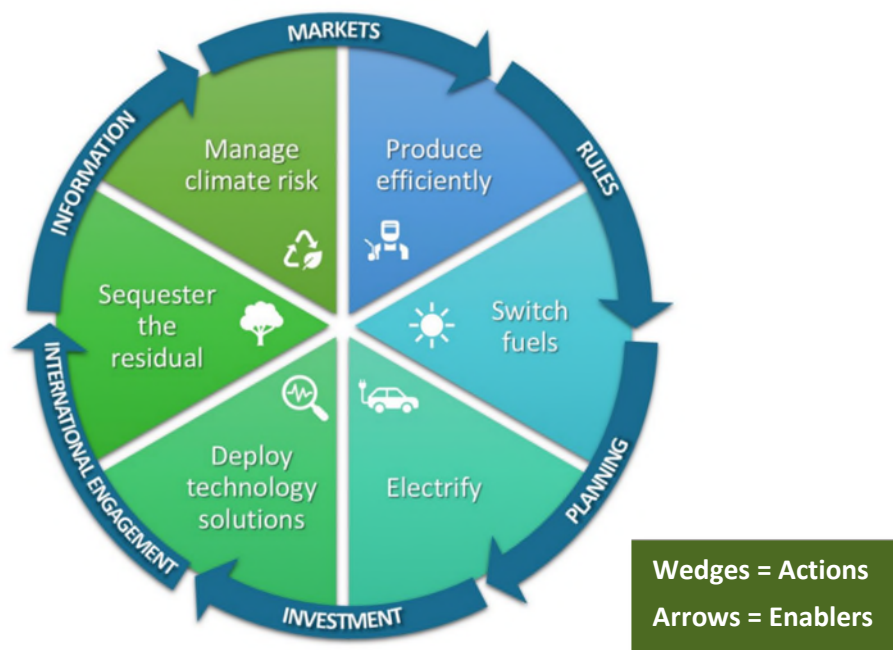


Figure 2: Six actions and six enablers of a prosperous, resilient net zero Australia

Source: Climate Change Authority

Actions

- **Produce efficiently** – Reduce the emissions intensity of production and reduce inefficient use of resources such as energy and land.
- **Switch fuels** – Shift from high emitting fuels to lower and ultimately zero-emissions alternatives.
- **Electrify** – Generate enough affordable, clean energy to meet growing demand and electrify as much as possible.
- **Deploy technology solutions** – Do as much as we can with the mitigation and sequestration technologies we already have, accelerate their deployment, improvement and the development of new technologies.
- **Sequester the residual** – Mitigate as much as possible and sequester the rest (i.e. capturing and storing, through biosequestration and geosequestration).
- **Manage climate risk** – Build resilience and plan for and manage the risks that climate change present to Australian industries, businesses, communities, the environment and our region.

Enablers

- **Information** – Not everyone has the knowledge or resources they need to play their part. Governments can help businesses and households by providing trustworthy information and implementing programs to underpin informed decisions relating to reducing emissions and adapting to climate change.

- **Markets** – Governments can enable economic forces to drive decarbonisation by ensuring open, competitive and transparent markets.
- **Rules** – Governments can use rules to solve market failures, which occur when economic forces do not optimise outcomes on their own. For example, although the production of a good or service creates emissions, the price which that good or service achieves on the open market may not, and typically does not, include the cost of abating those emissions.
- **Planning** – Governments can enable industries, workers and communities to make decisions about the future by planning and communicating their intent in advance. Urban planning, infrastructure and land use planning can enable timely and efficient mitigation, sequestration, and adaptation.
- **Investment** – Governments can use fiscal spending to invest in science and address the under-provision of public goods such as the research, development and deployment of abatement technologies. Public investment can stimulate innovation and provide high-risk capital for new technologies, shift activities down the cost curve to price parity and catalyse new markets.
- **International engagement** – The Government has a pivotal role to play in enabling Australia to pursue its interests in a competitive net zero world. Internationally consistent, transparent ways of sharing information enable sustainable finance, trade and carbon markets to play their part. Partnering with countries to support the development and deployment of clean technologies and fuels will create new trade opportunities. It will also help less-developed countries lift their disadvantaged communities out of poverty while bypassing the emissions intensive development of industrialised nations.

Government can facilitate these enablers, which in turn support the actions that individuals, communities and businesses can play through their investment decisions and spending choices, which then makes abatement and adaptation a part their everyday decisions.



1.3 Context

The Authority's *First Annual Progress Report* follows a year marked by continuing changes in the climate, extreme weather events and major policy developments, both here and around the world.

1.3.1 A changing global climate

Climate change and variability have had significant and varied impacts across the world during 2021–22. Human influences have unequivocally warmed the atmosphere, land and oceans (IPCC, 2021). Global concentrations of atmospheric carbon dioxide are now higher than at any time in approximately the past two million years (IPCC, 2021). Between the 1850–1900 baseline period and the last decade, the Earth's surface warmed by about 1.1°C (IPCC, 2021).

Global sea-level change, ocean warming, ocean acidification, shifts in rainfall patterns, land-ice and sea-ice reductions, and many other physical changes to the climate system have continued and, in many cases, accelerated over recent decades. As global warming continues, the frequency and intensity of many types of weather and climate extremes will increase. These include: terrestrial and marine heat waves; dangerous bushfire weather; sea-level rise; precipitation extremes; agricultural and ecological droughts; proportion of intense tropical cyclones; reductions in Arctic sea ice, snow cover and permafrost; ice loss in mountain glaciers; and ice loss in West Antarctic and Greenland ice sheets (CSIRO and Bureau of Meteorology, 2020; IPCC, 2021).



1.3.2 A changing Australian climate

Australia's climate trends broadly parallel global trends in land and ocean warming, sea-level rise, and changes in rainfall patterns, among others. Australia's land temperatures have increased by about 1.4°C since the early 20th century (CSIRO and Bureau of Meteorology, 2020), tracking the warming across global land areas (IPCC, 2021). Similarly Australia's ocean areas have warmed about 1°C over the past century (CSIRO and Bureau of Meteorology, 2020).

Rainfall patterns have shifted, with rainfall decreasing in southwest and southeast Australia and increasing in the north (CSIRO and Bureau of Meteorology, 2020). Sea-levels have been rising at over three millimetres per year since 1993, increasing the risks of coastal inundation and storm damage (CSIRO and Bureau of Meteorology, 2020). Rates of sea-level rise and coastal retreat show considerable regional variability around the Australian coastline.

Despite the cooling influence typically associated with La Niña events, 2021–22 was the eighth warmest financial year since 1910 (ARC Centre of Excellence for Climate Extremes, 2022) and the average land temperature was about 1.4°C above the 1910 baseline (CSIRO and Bureau of Meteorology, 2020). During 2021–22 Australia also experienced rainfall nine per cent above the 1961–1990 average (ARC Centre of Excellence for Climate Extremes, 2022).

Many impacts of climate change are now being felt. For example, the incidence of dangerous fire weather conditions has been increasing, accompanied by an increase in the length of the fire weather season (CSIRO and Bureau of Meteorology, 2020). With continued warming projected to occur over the next few decades, the historical trends above are likely to continue (CSIRO and Bureau of Meteorology, 2020).

1.3.3 Extreme weather in 2021–22

A number of extreme weather events occurred in the world in 2021–22, affecting hundreds of millions of people and many ecosystems. Attribution of specific events to climate change requires dedicated scientific analyses, known as 'attribution studies'. The role of climate change in different weather extremes varies, and not all extremes have clear and unambiguous anthropogenic climate change causation. The changing frequency of many types of extreme weather events is consistent with what science has indicated will occur in a changing climate (IPCC, 2021).

Global weather and climate extremes during 2021–22 included:

- In Pakistan, one of the worst flooding events in its history affected 33 million people, caused at least 1,100 deaths and disrupted businesses and property (WMO, 2022a).
- In China, the longest and hottest heatwave in the Chinese Meteorological Administration’s observational record has affected the Sichuan province (WMO, 2022b).
- In Ethiopia, Kenya and Somalia, the current drought is forecast to worsen as seasonal forecasts predict a fifth failed rainy season (WMO, 2022c). The current East African drought is the longest recorded in 40 years.

Australia also experienced several extreme weather events during the 2021–22 financial year:

- Western Australia experienced a series of record-breaking heat waves throughout the 2021–2022 summer in which the historical equal hottest day was recorded, as well as Perth recording its longest run of days of at least 40°C for any month in 123 years (Bureau of Meteorology, 2022)². Heat waves are some of the most significant natural hazards in Australia and are projected to become more frequent and intense as the climate warms.
- Record-breaking rainfalls led to widespread flooding in south-east Queensland and north-east New South Wales between February and March 2022. These were the costliest floods in Australia’s history, resulting in an estimated A\$3.35 billion in insured losses across affected areas (Insurance Council of Australia, 2022).

Historic floods in NSW and Queensland were caused by multiple climate drivers. Two consecutive La Niña events, combined with a negative Indian Ocean Dipole (IOD) during the winter of 2021, promoted increased rainfall across southern and eastern Australia (ARC Centre of Excellence for Climate Extremes, 2022). A combination of meteorological patterns caused persistent, heavy rainfall on already sodden catchments, culminating in the record-breaking floods of 2022.



² The coastal town of Onslow, in the Pilbara region of WA, recorded 50.7°C, while Perth recorded six days in a row above 40 °C between 18 and 23 January 2022.

1.3.4 Risks from a changing climate

Climate change increases and exacerbates risks across multiple sectors. Heat waves, amplified and made more frequent and long-lasting due to climate change, pose dangerous health risks in and of themselves, and can also increase other health risks like the spread of vector-borne diseases such as dengue fever (IPCC, 2022a). Marine heat waves pose risks to ocean ecosystems including coral reefs, by increasing risks such as heat stress and death of corals over very large areas (Great Barrier Reef Marine Park Authority, 2019).

Drought and bushfires also pose risks to terrestrial ecosystems. These impacts on ecosystems increase pressures on the management of biodiversity (IPCC, 2022a). This includes ecosystems under millennia-long custodianship by Indigenous Australians (Lyons & Harkness, 2021).

Sea-level rise increases the risks of coastal inundation to infrastructure and communities, and causes seawater intrusion into coastal aquifers creating pressures on water security (IPCC, 2022a). These impacts of sea-level rise are particularly urgent for low-lying islands including the Torres Strait Islands (Climate Systems, 2021).

Shifts in rainfall patterns affect water and food security, alter the distribution of vector-borne diseases, and affect energy security where water is needed for cooling of thermal power plants and for hydroelectricity (IPCC, 2022a).

Climate change impacts can also combine to amplify risks. For example, storms can bring both damaging winds and floods, bushfires are often accompanied by extreme heat, and extreme rainfall from tropical cycles can combine with storm surges to cause flooding from both land and sea (IPCC, 2022a).

Climate change also adds another set of risks to global and regional security challenges. Climate impacts, such as reduced water and food security, can amplify political tensions (National Intelligence Council, 2021). Changes to the frequency or intensity of climate change-related natural disasters place strains on militaries, as they are often called upon to assist both domestically and overseas (National Intelligence Council, 2021).

Tipping points

Tipping points are thresholds in natural systems from which recovery may not or cannot occur because they set in motion self-perpetuating or self-reinforcing processes. One example is the melting of sea-ice—when sea-ice is present it forms a layer on the ocean surface that reflects sunlight. When the sea-ice melts, the ocean can absorb more sunlight and heat up, and thus can melt more sea-ice. Other tipping points, such as the melting of polar ice sheets, may already be occurring. The West Antarctic and Greenland are estimated to be in states of net melting; possibly a self-perpetuating and self-reinforcing process. If these ice sheets continue to melt at current or accelerated rates they would ‘lock in’ about 10 metres of sea-level rise over coming centuries (McKay, et al., 2022).

Though tipping points provide additional reasons for concern over human impacts in the climate system, the risk they represent is difficult to quantify. Deeper scientific understanding of the climate thresholds that may trigger tipping points, their timing and their early detection is still at an early stage. The IPCC Working Group³ I notes ‘establishing links between specific [global warming levels] with tipping points and irreversible behaviour is challenging due to model uncertainties and lack of observations, but their occurrence cannot be excluded’ (IPCC, 2021, p. 59).



³ The United Nations Intergovernmental Panel on Climate Change (IPCC) assesses the state of scientific knowledge about climate change. Over 2021–22, the IPCC published three working group reports as part of its sixth assessment cycle. The Working Group I report assessed the physical science basis of climate change. The Working Group II report assessed impacts, adaptation and vulnerability. The Working Group III report assessed mitigation of climate change.

1.3.5 Legislation of new emissions reduction targets for Australia

In 2021–22, two significant advances in emissions policy were achieved:

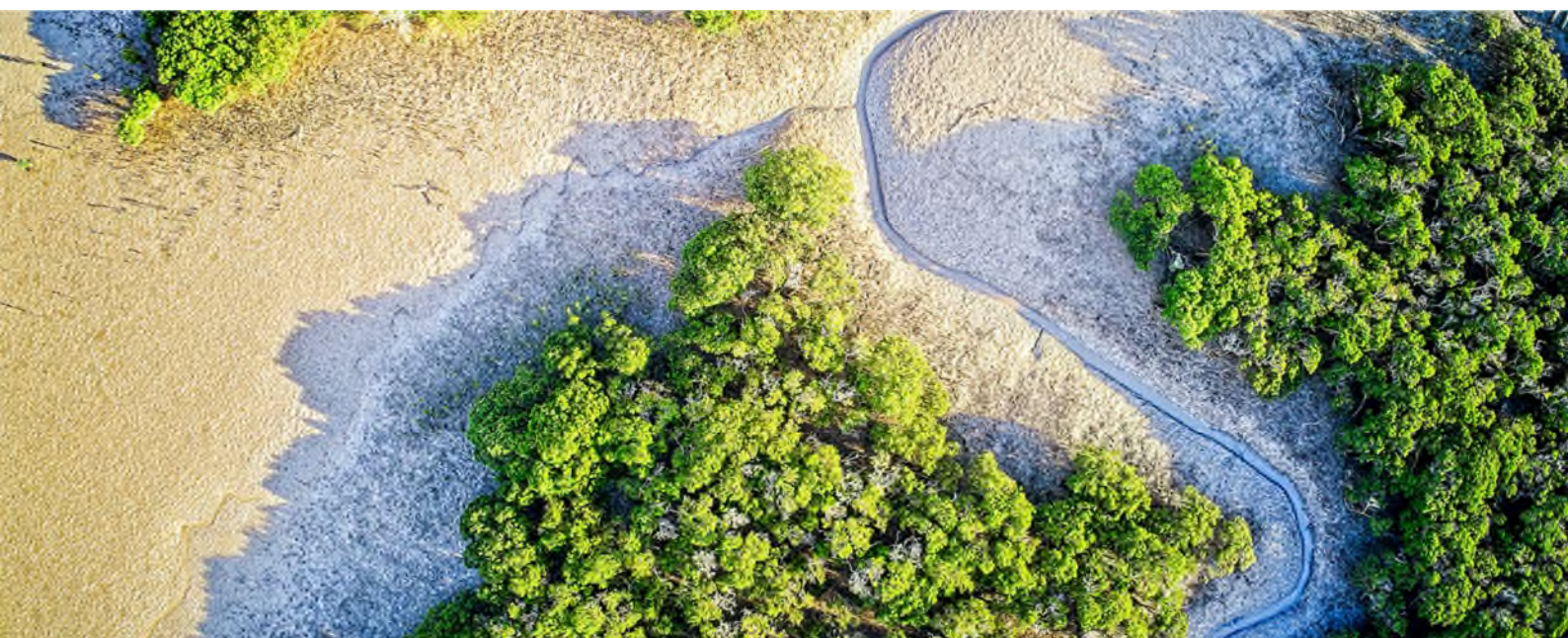
- In October 2021, bipartisan support for a commitment to a target of net zero emissions by 2050.
- In June 2022, Australia increased the ambition of its 2030 target under the Paris Agreement from a 26 to 28 per cent reduction to a 43 per cent reduction below 2005 levels (Australian Government, 2022a).

On 13 September 2022, the Act became law, which, among other things, legislated a target of net zero emissions by 2050, and a 2030 emissions reduction target of 43 per cent below 2005 levels.

The Authority supports enshrining Australia’s emission reduction targets in legislation. The inquiry into the Climate Change Bill 2022 (The Senate Environment and Communications Legislation Committee, 2022, pp. 28-29) noted that the benefits of legislating a 2030 interim and net zero target include:

- ‘providing certainty to investors, business and industry;
- creating opportunities in the renewable energy and manufacturing industries, including new export opportunities; and
- fulfilling Australia’s international commitments and sending a positive signal to international partners.’

A legislated target provides a market signal as well as ‘a durable basis for future reporting, advice and decision-making’ (The Australian Climate Roundtable, 2022, p. 2).



1.3.6 Policy developments in 2021–22

The Government's *Powering Australia* plan (Department of Climate Change, Energy, the Environment and Water, 2022a) sets out the primary policy measures by which the Government intends to achieve its 2030 target of 43 per cent below 2005 levels, including:

- Electricity measures, including funding to upgrade the electricity grid and install community batteries.
- Industry and carbon farming measures, including reforming the Safeguard Mechanism, which is a mechanism that requires Australia's largest greenhouse gas emitters⁴ to keep their net emissions below an emissions limit (Clean Energy Regulator, 2022b).
- Transport measures, including an electric car discount, establishing a vehicle fuel testing program and developing a National Electric Vehicle Strategy.

Successful implementation of the *Powering Australia* plan will be critical to meeting the 2030 and 2050 targets. Future Annual Progress Reports will examine the effectiveness of these policies and identify where additional policies will be required. In this first report, the Authority presents sectoral emissions projections to 2030 and a 2030 scenario where most sectors do their 'proportional share'⁵ of emissions reduction to meet the 2030 target (section 2.3), as a first step to identifying where additional policies (beyond the *Powering Australia* plan) will be required.

While federal, state and territory governments have economy-wide emissions reduction targets, policy interventions to compel emissions reductions have largely been focused in the land and electricity sectors. This is now being extended to industrial facilities covered by the Safeguard Mechanism (Department of Climate Change, Energy, the Environment and Water, 2022d). Currently, progress elsewhere in the economy is heavily dependent on voluntary commitments and actions, supported in some cases by government incentives. Australia's corporate sector has embraced the need for strong ambition—exemplified by the Business Council of Australia's call for a 2030 emissions reduction target of 45 per cent below 2005 levels. However, there is limited time for business to demonstrate sufficient progress is being made for Australia's 2030 target to be met. The Authority will continue to monitor the adequacy of disclosures that entities make on progress in meeting their commitments and will recommend enhancements if required.

⁴ The Safeguard Mechanism currently applies to facilities that emit more than 100,000 t CO₂-e covered (scope 1) emissions in a financial year. Businesses captured under the Safeguard Mechanism span several industry sectors, including electricity generation, mining, oil and gas extraction, manufacturing, transport, and waste (Clean Energy Regulator, 2022c).

⁵ Proportional to the amount of emissions produced by each sector at the start of the target period.

Snapshot: Voluntary action and climate-related disclosure in focus

As expectations from investors and the broader public increases, Australian companies are largely mitigating their emissions on a voluntary basis. For example, nearly 4,000 companies have either set targets or committed to developing targets under the Science-Based Targets initiative (SBTi), including 77 companies in Australia (as of October 2022) (Science Based Targets, n.d.). However, the success of national and global decarbonisation efforts is dependent on the extent to which these commitments represent practical plans for achieving real emissions reduction. Clear and consistent climate-related disclosure is crucial to communicating progress on achieving these commitments as well as ensuring their integrity.

The domestic and international sustainability reporting landscapes, however, lack standardisation and comparability, reducing market transparency and posing greenwashing risks. Addressing these issues has been a key focus for stakeholders involved in climate-related disclosures, both in Australia and internationally.

The Task Force on Climate-related Financial Disclosures (TCFD) sets out a framework for entities to consider their climate change risks and report their transition planning (Task Force on Climate-related Financial Disclosures, n.d.). The TCFD has been recognised in Australia as an appropriate baseline for voluntary reporting (Australian Securities & Investments Commission, 2021; Australian Prudential Regulation Authority, 2019). Further, the International Sustainability Standards Board (ISSB) is looking to release their reporting standards by the end of 2022, based upon the TCFD (IFRS, 2022). Either the TCFD or ISSB standards will likely be mandated in some form in Australia, suggested by the allocation of A\$6.2 million in the 2022–23 Budget towards the development and introduction of climate reporting standards in line with international reporting requirements (Australian Government, 2022b).

In Australia, the Clean Energy Regulator has developed the Corporate Emissions Reduction Transparency (CERT) report, which aims to provide a centralised avenue for large emitters to voluntarily report their climate-related targets, net and gross emissions, and energy use. The CERT report also facilitates communication of a company's use of offsets, such as carbon credits, which entities have been purchasing through non-government organisations such as Gold Standard and Verra in order to reduce their carbon footprint. The Authority recently released its *Review of International Offsets*, considering the integrity of Gold Standard and Verra as well as other schemes, and is available on our website.

Australian public authorities must also contribute to meeting Australia's emissions reduction targets. Although the Government has made progress in committing the Australian Public Service to net zero by 2030 (Australian Government, 2022b), greater efforts are needed, particularly regarding communication of climate-related risks. Public statutory authorities and corporate Commonwealth entities are not only exposed to physical and transition risks as much as private entities but also face significant liability risks (Dibley, Young, & Phillips, 2022). However, Australian public authorities remain in the early stages of understanding and disclosing climate-related risks and, moreover, such disclosure lacks standardisation and inadequately addresses transition risks (Dibley, Young, & Phillips, 2022). The development of Climate Compass is a key step taken to address broad awareness of managing climate risk in the Commonwealth Government (Department of Climate Change, Energy, the Environment and Water, 2021). However, implementation and review across the Australian Public Service is required to build resilience and prepare for climate risk.

Chapter 2 – The 2021–22 baseline: targets, emissions and trends

Summary

Australia's 43 per cent below 2005 levels by 2030 emissions reduction target is broadly consistent with a linear trajectory to achieving net zero by 2050.

Meeting Australia's 2030 and 2050 targets means sustaining a decarbonisation rate of at least 17 Mt CO₂-e per year, on average.

This a significant challenge that is getting harder as time runs out. Australia needs a big upwards shift in momentum.

The downward trajectory in electricity emissions appears likely to continue and, as a result, the electricity sector will contribute more than its 'proportional share' of emission reductions towards the 2030 target.

With the Government implementing reforms to the Safeguard Mechanism to drive emissions reductions at large industrial facilities, more attention is now required in the transport and agricultural sectors.

Meeting Australia's 2030 target will mostly be achieved by deploying technologies that already exist. The pace and scale of the rollout is now the question.

A key challenge will be ensuring the supporting and enabling factors, such as supply chains, regulations and approvals, as well as skills formation within the workforce, are all supporting achievement of Australia's targets in the necessary timeframes.

2.1 The Authority's approach to assessing progress towards emissions reduction targets

In this advice, the Authority has assessed Australia's progress towards the 2030 and 2050 targets. Progress towards the 2030 target was assessed as a point target and an emissions budget—in keeping with the way the Government has expressed the target in both the 2022 NDC update and the Act. The NDC and the Act do not mention the use of an emissions budget to track progress to the 2050 net zero target, so for now the Authority is assessing this as a point target.

2.2 Australia's 2030 and 2050 emissions reduction targets

2.2.1 Progress to 2030 and 2050 point targets

Australia's point target of reducing emissions by 43 per cent below 2005 levels by 2030 means that Australia is aiming to reduce annual emissions to 354 Mt CO₂-e by 2030. This total is 43 per cent less than emissions in 2005, which were 621.1 Mt CO₂-e (Department of Climate Change, Energy, the Environment and Water, 2022b)⁶. In the year to June 2022, Australia's emissions were 487 Mt CO₂-e, meaning annual emissions need to be 133 Mt CO₂-e lower in 2030 (Table 3).

The adoption by the Government of the 43 per cent below 2005 levels by 2030 emissions reduction target sets a medium-term milestone that puts Australia in line with a linear path to the 2050 net zero point target (Figure 3).

⁶ Note that the 2005 base year number is recalculated over time based on the latest science and hence the quantity of emission reductions required to meet the 2030 target may also change. The purpose of these recalculations is to ensure that the emissions inventory reports a consistent time-series, where variations in emissions are due to changes in activity rather than due to changes of calculation method.

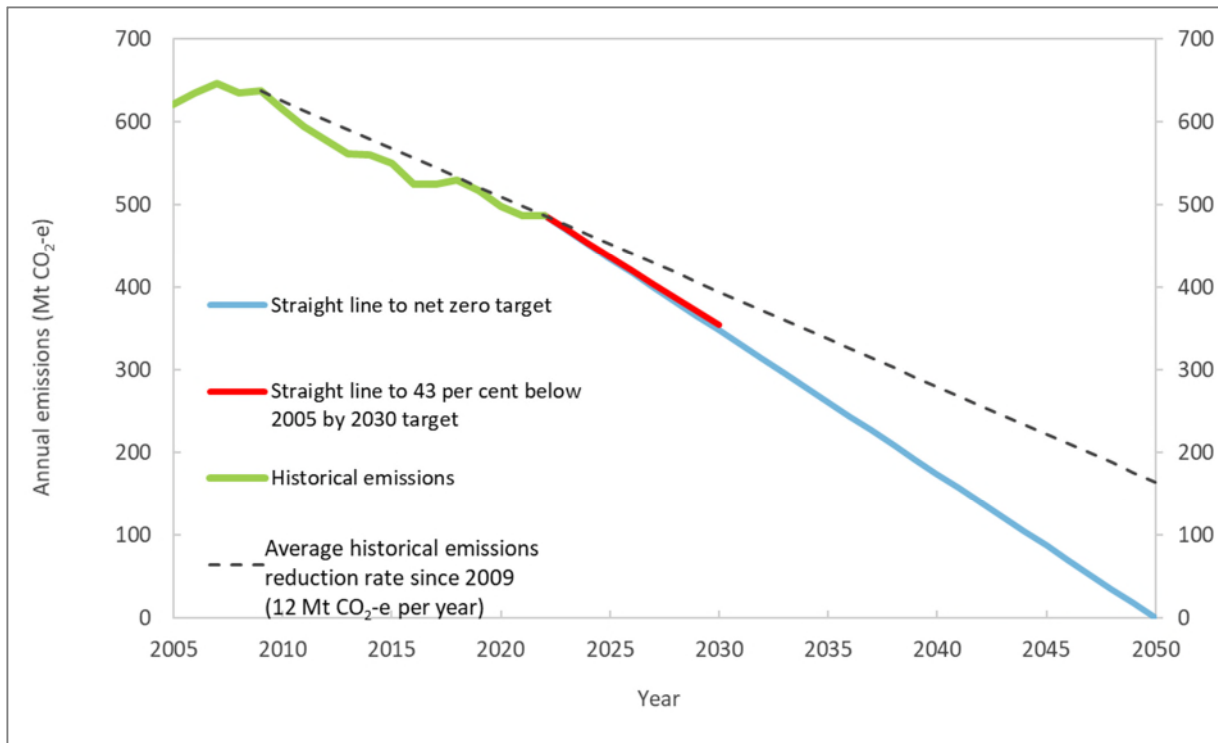


Figure 3: Historical and projected decarbonisation rate

Source: Climate Change Authority using historical data from the unpublished June 2022 *Greenhouse Gas Inventory Quarterly Update*.

Since 2009, Australia has decarbonised its economy at an average annual rate of 12 Mt CO₂-e per year (Figure 3), with most of these reductions being delivered by the electricity and land sectors. This rate of change is not enough to reach Australia’s 2030 or 2050 targets (Figure 3). If Australia continues to decarbonise at an average rate of 12 Mt CO₂-e per year, it will be more than 150 Mt CO₂-e short of the net zero target in 2050.

Achieving Australia’s 2030 and 2050 targets means sustaining and stepping up its decarbonisation rate to at least 17 Mt CO₂-e per year, *on average*, for the next eight years to 2030 (Figure 3)⁷. That means continuing with the progress of previous years and adding more. Compared to now, on average emissions need to be 17 Mt CO₂-e lower in year one, 34 Mt CO₂-e lower in year two, and so on until the end of the decade.

This step-up in emissions reductions is achievable and will be supported by the Government putting in place, and expanding on, the emissions reduction policies that it took to the 2022 federal election.

⁷ Australia’s annual emissions must decrease by 133 Mt CO₂-e over the next eight years to meet the 2030 target, equating to an average reduction of 16.6 Mt CO₂-e per year. Similarly, to meet the 2050 target, Australia’s annual emissions must reduce by 487 Mt CO₂-e, equating to an average reduction of 17.4 Mt CO₂-e per year.

To give a sense of the scale of the task:



Australia's fleet of light commercial vehicles (approximately 3.5 million utes, small buses and vans) emits approximately 17 Mt CO₂-e each year⁸.



Australia's largest emitting coal fired power station and mine emitted 19 Mt CO₂-e in 2020–21⁹.



Fugitive emissions from oil and natural gas production (including LNG) are approximately 23 Mt CO₂-e¹⁰; and



Enteric fermentation from pasture-based beef production generates approximately 30 Mt CO₂-e of emissions each year¹¹.

The good news is that Australia can reduce those emissions and it does not need to do it all at once. Australia could make progress towards its target by doing a bit of everything, such as:



Transitioning the light commercial vehicle fleet of utes, vans and small buses to electric versions charged with renewable electricity.



Adding wind turbines and solar systems (supported by appropriate grid firming and storage infrastructure) while coal-fired power stations are closing down over the next few years.



Addressing fugitive emissions by deploying carbon capture and storage and using high integrity offsets to address residual emissions, and in the longer term switching to alternative fuel production such as hydrogen.



Reducing emissions from beef production (see section 2.3.2) and establishing forests to store carbon or managing crop and grasslands to store soil carbon.

The progress each year will need to be 17 Mt CO₂-e of new abatement on average. That means progress can be more or less in some years. More early progress will mean less pressure in later years and might even enable an increase in the target. Starting later will mean there's even more ground to make up, even faster, to stay within Australia's emissions budget.

⁸ Emissions relating to light commercial vehicles (sector 1.A.3.b.ii under Australia's national greenhouse accounts) were 16.9 Mt CO₂-e in 2019–20. Data available at: <https://ageis.climatechange.gov.au/>

⁹ Loy Yang Power Station and Mine emitted 19.2 Mt CO₂-e in 2020–21 (Clean Energy Regulator, 2022a)

¹⁰ Emissions relating to fugitives from oil and natural gas (sector 1.B.2 under Australia's national greenhouse accounts) were 22.9 Mt CO₂-e in 2019–20. Data available at: <https://ageis.climatechange.gov.au/>

¹¹ Emissions relating to enteric fermentation from pastured-based beef production (3.A.1.b.i) were 30.4 Mt CO₂-e in 2019–20. Data available at: <https://ageis.climatechange.gov.au/>

Snapshot: An 83 per cent renewable grid by the end of the decade

The Government has recognised that decarbonisation of the National Electricity Market (NEM)¹² is central to achieving Australia’s target of reducing emissions to 43 per cent below 2005 levels by 2030, as well as net zero by 2050 (Department of Climate Change, Energy, the Environment and Water, n.d.).

The Australian Market Energy Operator (AEMO) has modelled a grid with renewables generating 83 per cent of electricity in the NEM by 2030–31 (AEMO, 2022), which it considers closely aligned to Australia’s national emissions reduction target for 2030 (AEMO, 2022). This compares with the current share of renewables in the NEM of around 30 per cent of electricity generated (Clean Energy Regulator, 2022d), highlighting the magnitude of the transition ahead.

AEMO models that an 83 per cent renewables generation outcome is consistent with:

- 60 per cent of coal-fired generation exiting the NEM by 2030;
- installation of large-scale variable renewable energy capacity at record rates every year until the end of the decade; and
- over half of households with rooftop solar by the early 2030s (AEMO, 2022).

This would also result in a decline in dispatchable capacity to the mid-2030s before a projected rise to 2050 (AEMO, 2022). This change requires variable renewables to be deployed across the decade at a rate of two to three times as much as the previous decade (Table 2).

Table 2: NEM variable renewables capacity change, 2010–2020 and 2020–2030 and difference in installation rates

	Change 2010-2020 (GW)	Change 2020-2030 (GW)	Increase in installation rate
Wind	7	24	3x
Utility solar	4	8	2x
Residential solar	10	24	2x

Source: (AEMC, n.d.), (AEMO, 2022), Climate Change Authority analysis.

This penetration of variable renewables into the grid would require substantial transformation of capacity in the NEM both in total capacity and generation technology (Figure 4) and a pressing need for dispatchable storage in the next decade to manage this variability (AEMO, 2022).

¹² The NEM spans Australia’s eastern and south-eastern coasts and comprises of five interconnected states that also act as price regions: Queensland, New South Wales (including the Australian Capital Territory), South Australia, Victoria, and Tasmania (AEMO, 2021).

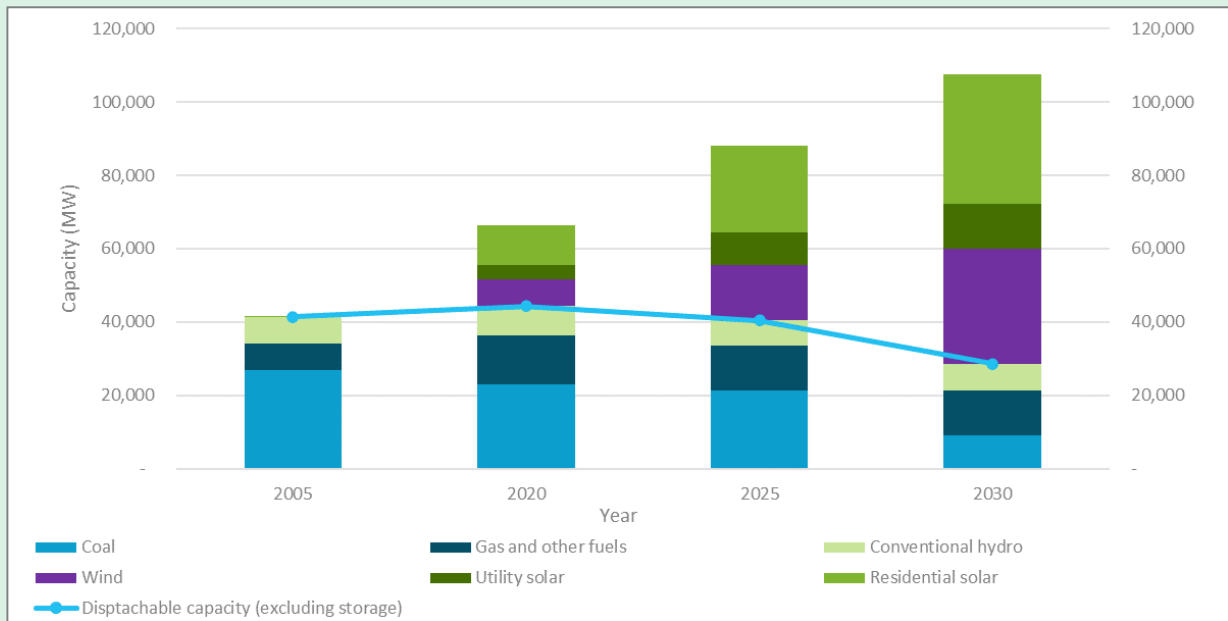


Figure 4: NEM historical and projected capacity excluding storage, AEMO Step Change scenario

Source: (AEMC, n.d.), (AEMO, 2022), Climate Change Authority analysis.

2.2.2 Emissions in 2021–22

As shown in Table 3, over the year to June 2022, Australia’s total greenhouse gas emissions are estimated to have held steady at 487 Mt CO₂-e—the same total as the previous financial year (to June 2021). The data shown in Table 3 are gross emissions in each sector. The emissions inventory reports emissions when and as they occur and there is no offsetting between sectors.

Table 3: Emissions in the year to June 2021 and preliminary estimates for the year to June 2022

	Year to June 2021 (Mt CO ₂ -e)	Year to June 2022		
		Preliminary (Mt CO ₂ -e)	Change (Mt CO ₂ -e)	Change (per cent)
Electricity	164	158	-6	-4
Stationary energy	99	103	3	3
Transport	92	91	-1	-1
Fugitives	49	50	2	3
Industrial processes and product use	32	32	0	0
Agriculture	77	80	3	3
Waste	13	13	0	0
LULUCF	-39	-39	0	0
Total	487	487	0	0

Source: Unpublished emissions data for 2021–22 provided by the Department of Climate Change, Energy, the Environment and Water based on the June 2022 quarterly update of the National Greenhouse Gas Inventory.

Notes: Numbers may not sum due to rounding. LULUCF refers to the land use, land use change and forestry sector.

The most notable movement in sectoral emissions over the year to June 2022 is the ongoing decline in emissions from the electricity sector. In 2021–22, emissions in the electricity sector declined by 6 Mt CO₂-e (Table 3). This continues the trend for this sector over recent years, reflecting the ongoing transition from coal-fired generation to wind and solar. However, the 6 Mt CO₂-e decline in emissions in the electricity sector was more than offset by increases in stationary energy, agricultural and fugitive emissions (Figure 5).

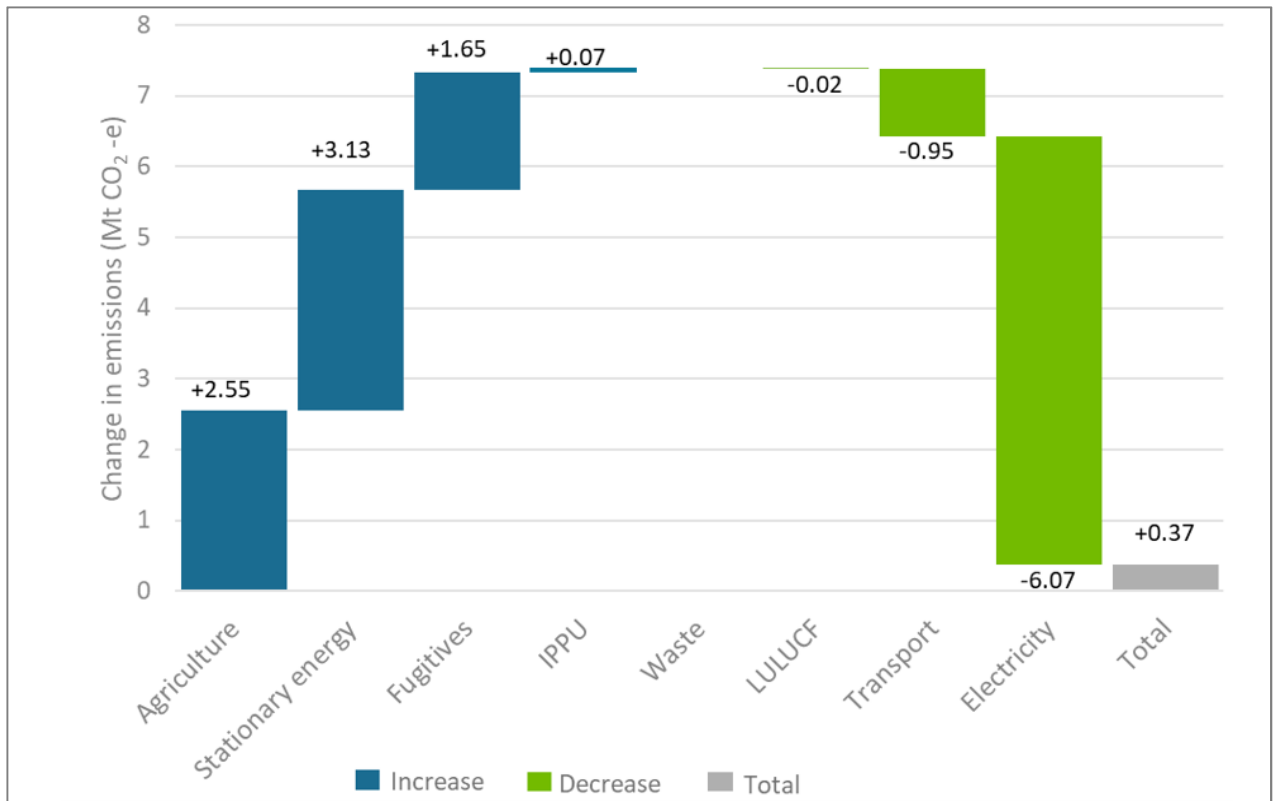


Figure 5: Emissions change from 2020–21 to 2021–22 by sector

Source: Climate Change Authority, using unpublished emissions data for 2021–22 provided by the Department of Climate Change, the Environment and Water based on the June 2022 quarterly update of the National Greenhouse Gas Inventory.

Notes: IPPU refers to industrial processes and product use. LULUCF refers to the land use, land use change and forestry sector.

Stationary energy emissions, mainly the combustion of diesel and gas associated with manufacturing and mining activity, and building heating, follow the upward trend in mining activity, particularly coal and natural gas (Office of the Chief Economist, 2022). The increase in emissions in the agricultural sector reflects recovery of the sector from the drought of 2017–20 and, in particular, the rebuilding of the grazing cattle herd back to pre-drought levels (ABARES, 2022).

Emissions declined in the transport sector by one per cent during 2021–22 (Table 3) due to the policy and behavioural responses to the global pandemic, including working from home and shutdowns. This decline in transport emissions is not expected to continue without significant policy, behavioural or technological change (Department of Industry, Science, Energy and Resources, 2021).

2.2.3 Progress on the emissions budget for the 2030 target

The following section discusses the emissions budget for Australia’s 2030 emissions reduction target. The Authority will present a broader discussion on the design of emissions budgets in its upcoming work on Australia’s next NDC.

As illustrated in Figure 6, Australia implements its emissions budget as a trajectory drawn from the 2020 target of 5 per cent below 2000 levels (541 Mt CO₂-e) to the 43 per cent below 2005 levels by 2030 target (354 Mt CO₂-e). This results in the calculation of an emissions budget for the decade 2021–2030 of 4,381 Mt CO₂-e¹³.

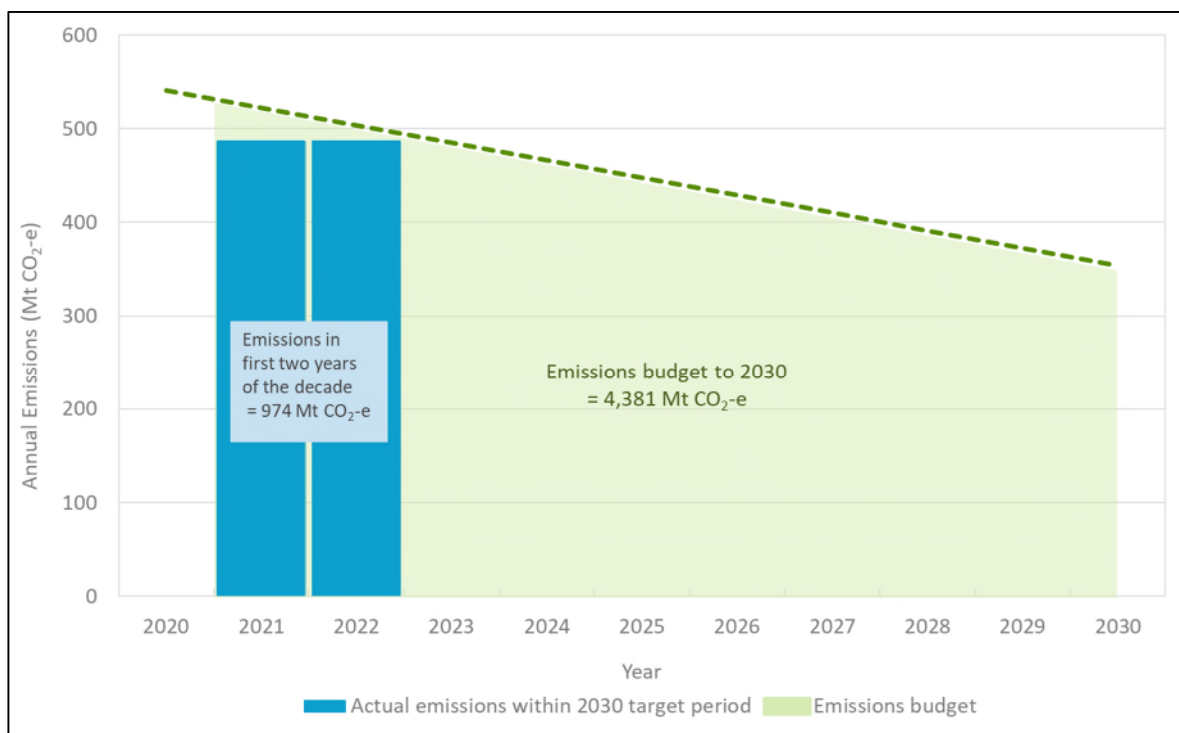


Figure 6: Australia’s emissions from 2021 to 2022 and emissions budget from 2021 to 2030

Source: Climate Change Authority.

As Figure 6 shows, Australia is currently tracking ahead of its 2030 emissions budget—emitting a total of 974 Mt CO₂-e over the first two years of the decade (out of a total of 1026 Mt CO₂-e allowed by the budget over the first two years of the decade). This outcome is assisted by the choice of the starting point for the emissions budget—that is, Australia’s 2020 emissions reduction target, which was higher than actual emissions in 2020.

¹³ The budget is calculated by finding the area under the straight line trajectory from the 2020 target to the 2030 target.

2.3 Examining the pathway to the 2030 target

2.3.1 Sectoral trends to 2030

While the electricity sector remains by far the largest emitter of all sectors in 2021–22 (Table 3), *Australia's Emissions Projections 2021* report indicates that electricity emissions will fall below both stationary energy and transport emissions by 2030 (Department of Industry, Science, Energy and Resources, 2021). The stationary energy sector is projected to be the largest single sector source of emissions by 2030, followed by the transport sector. While transport emissions decreased recently as a result of the pandemic, they are expected to rebound over the next few years and peak in 2024 (Department of Industry, Science, Energy and Resources, 2021).

However, *Australia's Emissions Projections 2021* does not account for the policies being implemented through the Government's *Powering Australia* plan. Australia's emissions projections should start to take these policies into account. For example, subject to final design, the proposed reforms to the Safeguard Mechanism will impact the emissions projections for the stationary energy, transport, industrial processes and product use and fugitives sectors (as the emissions from the facilities to which the Safeguard Mechanism applies fall into these sectors). The following section presents a scenario which builds on *Australia's Emissions Projections 2021* and incorporates an illustrative example of how emissions could decline under the Safeguard Mechanism to contribute to meeting the 2030 target.

2.3.2 Sectoral proportional share

The Safeguard Mechanism Reforms consultation paper introduced a concept of Safeguard facilities being responsible for their 'proportional share' of emissions reduction as one option for assigning a share of Australia's 2030 target to the Safeguard Mechanism (Department of Climate Change, Energy, the Environment and Water, 2022d).

- The main premise is that Safeguard facilities, excluding grid-connected electricity generation (which is subject to a sectoral baseline), were the source of 28 per cent of national emissions in 2020–21 and should contribute this share towards the target.
- Under this approach, net emissions from Safeguard facilities would need to fall from 137 Mt CO₂-e in 2020–21 to 99 Mt CO₂-e by 2030, which is 28 per cent of the point target of 354 Mt CO₂-e.

The Safeguard Mechanism ‘proportional share’ approach is effectively a sectoral emissions reduction target for heavy industry in Australia, outside of the electricity sector. Sectoral targets have merit as they enable governments and the businesses within sectors to plan for the emissions reductions they need to make, and to understand how the target will be achieved overall. This includes understanding interdependencies between sectors. The Authority will further investigate the concept of sectoral targets in its upcoming work on Australia’s next NDC.

The Authority has developed a simple, purely illustrative scenario to investigate how the proportional share concept plays out for other sectors (Table 4). In the scenario, the proportional share approach was applied to all sectors, except:

- *The electricity sector:* Electricity emissions were 34 per cent of national emissions in 2020–21 (Table 4) and are projected to decline more rapidly than other sectors (Department of Industry, Science, Energy and Resources, 2021), so that trend was applied in this scenario.
- *The agriculture sector:* Agriculture emissions are projected to remain relatively stable through to 2030 (Department of Industry, Science, Energy and Resources, 2021), so it was assumed this is what occurs given the currently limited number of, and limited capacity to deploy, emissions reduction technologies in this sector.

The projection for agriculture emissions means the sector has an important role to play. In practice, abatement in the agriculture sector and sequestration in the land sector will be an important source of offsets for entities with a Safeguard liability. A number of approved methodologies already exist under the Emissions Reduction Fund (ERF) to enable agricultural land managers to produce carbon offsets as part of their farm business. Information on these methodologies is available on the Clean Energy Regulator’s website. An *Integrated farm management* ERF methodology is being developed with the goal of allowing separate land-based activities to be combined or 'stacked' on the same property or aggregated properties (Clean Energy Regulator, 2022e).

Over the longer term, significant emission reductions in the agriculture sector will be needed for Australia to meet its commitment to net zero emissions by 2050.



Snapshot: FutureFeed Pty Ltd¹⁴

Woolworths, GrainCorp and Harvest Road announced in 2020 that they would become joint venture partners in FutureFeed, a company established by the CSIRO to commercialise Asparagopsis. Asparagopsis is a natural seaweed product that, when fed to cattle and sheep, accelerates their growth while reducing the methane emissions that are produced in the digestive fermentation process. A joint field trial by the CSIRO and the University of California has demonstrated promising results, finding that supplementing 0.25 per cent (low dose) or 0.5 per cent (high dose) of a cow's daily feed with Asparagopsis resulted in a reduction in methane emissions of 45 and 68 per cent respectively over a 147 day period (Roque et al., 2021). The company holds the relevant commercial intellectual property rights to the technology developed by the CSIRO, Meat and Livestock Australia and James Cook University (FutureFeed, n.d.).

The proportional share scenario was also based on the following assumptions.

- No exemptions are provided to any Safeguard facilities, such as Emissions Intensive Trade Exposed (EITE) entities or if they are, the burden is shifted onto other Safeguard facilities so that the overall contribution of the Safeguard Mechanism to the 2030 target remains at the proportional share of 28 per cent.
 - The Safeguard Mechanism Reforms consultation paper identifies several options for assisting EITEs including financial assistance for emissions reductions, such as grants from the Powering the Regions Fund and finance from the National Reconstruction Fund; direct provision of Safeguard Mechanism credits; and differentiated baseline decline rates (Department of Climate Change, Energy, the Environment and Water, 2022d).
- For simplicity, it was assumed that no offset trading occurs and hence all emissions numbers shown here are gross emissions in each sector. However, the Department's proposed design of the Safeguard Mechanism would allow the use of offsets from outside the mechanism, for example Australian Carbon Credit Units (ACCUs) generated in the agriculture and land sectors, to be used to meet liabilities under the scheme.

¹⁴ As featured as a case study in the Authority's [Paris Plus: Trade and investment trends in a decarbonising world report, November 2021](#).

There were four observations of the results of this scenario (Table 4).

- The electricity sector is projected to provide more than its proportional share of emissions reduction, moving from 34 per cent of total emissions in 2021 to 27 per cent of national emissions in 2030.
- The agriculture sector increases emissions by 5 Mt CO₂-e, and its share of total emissions increases, as beef cattle numbers recover from drought conditions late in the decade to 2020 (ABARES, 2022).
- Emissions at non-Safeguard facilities in the stationary energy, fugitives and industrial processes sectors need to decline by 14 Mt CO₂-e beyond what is currently projected for these sectors between 2022 and 2030 to maintain the sectors' proportional shares (Table 4).
- Transport emissions not covered by the Safeguard Mechanism are projected to increase to 2030, and will instead need to decline by 28 Mt CO₂-e compared to projected outcomes in 2030 to maintain this sector's proportional share.

There are opportunities to consider near-term emissions reductions from sources not addressed through measures in the Government's *Powering Australia* plan.

For example, around half of the stationary energy emissions attributed to non-Safeguard facilities for this analysis are associated with the combustion of gas for heating of buildings in commercial and residential settings¹⁵. The remaining emissions are associated with processes at smaller industrial facilities such as those for food manufacturing. The Government has announced that it will be consulting on a Commonwealth-led National Energy Performance Strategy (Bowen & McAllister, 2022).

Transport emissions not covered by the Safeguard Mechanism must be 28 Mt CO₂-e less than was reported in the Government's 2021 emissions projections by 2030 to contribute their proportional share (Table 4). While technologies for emissions reductions in the transport sector are available (e.g. electric vehicles), the sector is currently projected to fall only 3 Mt CO₂-e from 2019 levels by 2030 (Department of Industry, Science, Energy and Resources, 2021). Additionally, supply chain issues are limiting the expansion of electric vehicle markets globally (IEA, 2022d). The Government's announcement that it is considering vehicle fuel efficiency standards is a welcome development (Department of Infrastructure, Transport, Regional Development, Communications and the Arts, 2022).

¹⁵ Total scope 1 emissions for fuel combustion in commercial and institutional spaces, and residential stationary combustion (sectors 1.A.4.a and 1.A.4.b.i under Australia's national greenhouse accounts, respectively) is approximately 17 Mt CO₂-e in 2019–20, data available at: <https://ageis.climatechange.gov.au/>. This is approximately 62 per cent of non-Safeguard facilities stationary energy emissions in 2020–21 (Table 4). This calculation assumes the majority of these emissions relate to gas consumption, and there are no major changes in the composition of this sector between 2019–20 and 2020–21.

Table 4: Results of a scenario to apply the proportional share concept for sectoral emissions to the 2030 target

		Emissions 2020–21 (Mt CO ₂ -e)	Proportional share of emissions 2020–21 (per cent)	Proportional share of emissions 2029–30 (per cent)	Projected emissions 2029–30 (Mt CO ₂ -e)	Required emissions 2029–30 (Mt CO ₂ -e)	Difference between required and projected 2030 emissions (Mt CO ₂ -e)
	Sector						
Safeguard facilities ^a	Stationary energy	72	15	15	73	52	-20
	IPPU	23	5	5	21	17	-4
	Fugitives	35	7	7	37	26	-12
	Transport	6	1	1	6	4	-2
	Total Safeguard	137	28	28	137	99	-38
Non- Safeguard facilities	Stationary energy	27	6	6	28	20	-8
	IPPU	9	2	2	8	6	-2
	Fugitives	13	3	3	14	10	-4
	Transport ^b	86	18	18	90	62	-28
	Total non-Safeguard	135	28	28	140	98	-41
Other	Electricity ^c	164	34	27	95	95	0
	Agriculture ^c	77	16	23	81	81	0
	Waste	13	3	3	11	9	-2
	LULUCF	-39	-8	-8	-40	-29	11
	Total other	215	44	44	147	156	9
Grand total		487	100	100	424	354	-70

Source: Climate Change Authority using historical data from the unpublished June 2022 *Greenhouse Gas Inventory Quarterly Update*.

Notes: Numbers may not sum due to rounding. IPPU refers to industrial processes and product use. LULUCF refers to the land use, land use change and forestry sector.

^a Based on the Safeguard Mechanism Reforms consultation paper, total emissions covered by Safeguard facilities were 137 Mt CO₂-e in 2021 (Department of Climate Change, Energy, the Environment and Water, 2022d). To find the sectoral breakdown of emissions covered by Safeguard facilities, the Authority assumed that 72.5 per cent of stationary energy, industrial processes and product use, and fugitives are from Safeguard facilities; and that transport emissions covered by Safeguard facilities was 6 Mt CO₂-e, in order to make up to the 137 Mt CO₂-e stated in the Safeguard Mechanism Reforms consultation paper.

^b The majority of transport emissions are not covered by the Safeguard Mechanism. For example, passenger vehicles and light commercial vehicles, which make up approximately 50 per cent of transport emissions, are not covered.

^c Assumed the emissions trend from 2022 to 2030 for this sector as published in Australia's Emissions Projections 2021 applies. The trend from 2022 to 2030 was added to 2021–22 emissions data from the NGGI June Quarterly provided by the Department of Climate Change, Energy, the Environment and Water.

2.3.3 Carbon sequestration in the land sector

The sequestration of carbon into trees, harvested wood products, grasses and soils is reported in Australia’s national greenhouse gas inventory in the Land use, Land Use Change and Forestry (LULUCF) sector. In 2021–22 the land sector is estimated to have provided a net ‘sink’ (or to put it another way, net negative emissions) of 39 Mt CO₂-e (Table 3). This sequestration estimate is reported on a ‘net’ basis because it accounts for losses of carbon that occur due to land clearing, forest harvesting and controlled burning activities, among other sources of emissions.

The Authority is currently working with the CSIRO and the Clean Energy Regulator to investigate nature-based and engineered capture and sequestration of carbon in Australia. This includes the potential for the land sector to deliver carbon sequestration at an annual rate beyond the 2021–22 estimate of 39 Mt CO₂-e. The Authority and the Clean Energy Regulator have commissioned the CSIRO to prepare a technical report on this topic, due for publication in 2022, though further research and analysis will be needed to understand how much carbon sequestration is realistically achievable in Australia. In the meantime, action can be taken to address barriers, bolster incentives, and start making difficult decisions about trade-offs between different uses of land, water and other resources.



2.3.4 State and territory targets

Every Australian state and territory has committed to net zero emissions by at least 2050, with most supported by interim 2030 emissions reduction targets (Table 5). The following section serves as a baseline summary of state and territory emissions reduction targets and any progress that has been made towards those targets.

Setting targets is the right way to start, but with only eight years to go until 2030, it is crucial that states and territories produce the practical plans needed to get to these targets. For example, the New South Wales Net Zero Plan Stage 1: 2020–2030 has supported the development of the Electricity Infrastructure Roadmap, the NSW Waste and Sustainable Materials Strategy and the Electric Vehicle Strategy. The Plan has also been influential, leading in part to the state’s Environment Protection Authority introducing a climate action policy and plan regulating greenhouse gas emissions from major developments (Environment Protection Authority, 2022).

Table 5: Australian state and territory emissions targets and progress

Jurisdiction	2030 emissions reduction target (per cent)	Baseline year	2020 emissions compared to 2005 levels (per cent)	2050
New South Wales	50	2005	-18.1	Policy target of net zero by 2050
Victoria	45–50	2005	-29.8	Legislated net zero by 2050
Queensland	30	2005	-19.3	Policy target of net zero by 2050
South Australia	50	2005	-31.1	Policy target of net zero by 2050
Western Australia	No 2030 target (80 per cent government target)	2020	+4.0	Policy target of net zero by 2050
Tasmania	Net zero emissions or lower by 2030	N/A	-127.8	Net zero emissions or lower by 2030
Northern Territory	No 2030 target	N/A	+36.2	Policy target of net zero by 2050
Australian Capital Territory	65–75	1990	-18.5	Legislated net zero by 2045

Source: (Department of Climate Change, Energy, the Environment and Water, 2022c; NSW Government, 2021a; Queensland Government, 2022; McGowan and Whitby, 2022; Western Australian Government, 2020); *Climate Change Act 2017* (Vic); *Climate Change and Greenhouse Emissions Reduction Act 2007* (SA); (South Australian Government, n.d.), *Climate Change (State Action) Act 2008* (Tas); (Tasmanian Government, 2017); *Climate Change (State Action) Amendment Bill 2021* (Tas); (Northern Territory Government, 2021; Northern Territory Government, n.d.).

Notes: *Climate Change (State Action) Amendment Bill 2021* (Tas) introduced a target of net zero emissions from 30 June 2030. Tasmania has been net zero for the past seven years.

Local government plays an important role in supporting state and territory targets. Often with a more direct connection to communities, local government plays a key educative role on climate change. Local government also has capacity to action localised mitigation strategies such as greening spaces to encouraging walking or specific waste-management plans limiting emissions (Climate Systems, 2021). The connection to community also means local government is heavily involved in adaptation and natural disaster emergency response management (Royal Commission into National Natural Disaster Arrangements, 2020), and must have the support of the states and territories that have ultimate responsibility for disaster management (Royal Commission into National Natural Disaster Arrangements, 2020).

Reducing emissions is a whole-of-economy issue that cuts across federal, state and territory, and local government responsibilities. The Authority has previously identified that coordination across levels of government leads to more effective, integrated policy responses, avoiding unnecessary duplication and regulation, and lowering costs for businesses and households (Climate Change Authority, 2020). Equally, stable and predictable policies also provide investment certainty (Climate Change Authority, 2016).

Currently, the states and territories with 2030 emissions reduction targets contribute substantially to the national target of 43 per cent below 2005 emissions levels by 2030 (Table 6). The Australian Government’s policy actions, independent of sub-national action, builds a national framework to support and accelerate emissions reduction efforts, particularly where the Commonwealth has specific national policies and convening powers. This enabling role can help accelerate sub-national action and facilitate an equitable distribution of large decarbonisation projects, such as ensuring renewable energy hubs are placed in the most strategic geographical locations, to encourage a more just and cost-effective transition.



Table 6: Impact of Australian state and territory 2030 emissions targets on the national target

	Emissions in base year (Mt CO ₂ -e)	Emissions in 2030 if target met (Mt CO ₂ -e)	Emissions in 2020 (Mt CO ₂ -e)	Emissions reductions needed between 2020 and 2030 to meet target (Mt CO ₂ -e)
New South Wales	162	81	132	52
Victoria	119	62	83	21
Queensland	197	138	159	21
South Australia	37	18	25	7
Western Australia	<i>No 2030 target. Western Australia has a 2030 Government-wide 80 per cent below 2020 levels target.</i>			
Tasmania	<i>Tasmania has been at net zero emissions since 2013.</i>			
Northern Territory	<i>No 2030 target.</i>			
Australian Capital Territory	1	0.3	1	1
Total absolute emission reductions below 2020 if 2030 targets met				101
Total absolute emission reductions below 2020 for the national 43 per cent below 2005 levels target to be met				144
Change on 2005 levels if state and territories targets are met (per cent)				-36

Source: (Department of Climate Change, Energy, the Environment and Water, 2022c) and Climate Change Authority calculations.

Notes: numbers may not sum due to rounding. While the Northern Territory and Western Australia have several emissions reduction initiatives, neither have whole-of-economy 2030 targets.

2.3.5 Turning potential barriers into enablers of ambitious emissions reductions

Achieving emissions reductions to 2030 can mostly be achieved by deploying technologies that already exist. For the global energy system, for example, the International Energy Agency (IEA) concluded that all the technologies needed to sufficiently reduce emissions by 2030 already exist (IEA, 2021a). In the Australian context, Beyond Zero Emissions (BZE) in a recent report concluded 81 per cent emissions reduction on 2005 levels is achievable by 2030 with an ambitious rollout of clean technology over the next five years which exist today (BZE, 2022). BZE also notes, however, that the success of their plan for achieving the 81 per cent emissions reduction ambition depends on supporting factors including ‘investment and coordination, skilled people and reliable supply chains’ (BZE, 2022, p. 2).



The Authority is of the view that meeting the 2030 target is now a question of implementation, in other words how quickly and at what scale can clean technologies be rolled out.

The scale and the pace of the change required to meet the 2030 target is substantial, requiring renewable deployment of two to three times the amount seen in the previous decade (see Snapshot: An 83 per cent renewables grid by the end of the decade). For example, in a recent speech, the Minister for Climate Change and Energy stated that ‘to achieve Australia’s emissions reduction target of 43 per cent below 2005 levels by 2030, we [Australia] will need to install about forty 7-megawatt wind turbines every month until 2030’; and ‘for solar, more than 22,000 five hundred-watt panels every day—and [in total] 60,000,000 by 2030’ (Bowen, 2022b).

The timely rollout of clean energy technologies requires a number of supporting factors to be in place and which should be factored into policy considerations:

- supply chains
- planning and approvals
- skills and workforces
- financing and incentives.

The Authority has not done a comprehensive analysis of each of these supporting factors this year. However, there are indications there will be implementation challenges for Australia and other countries.

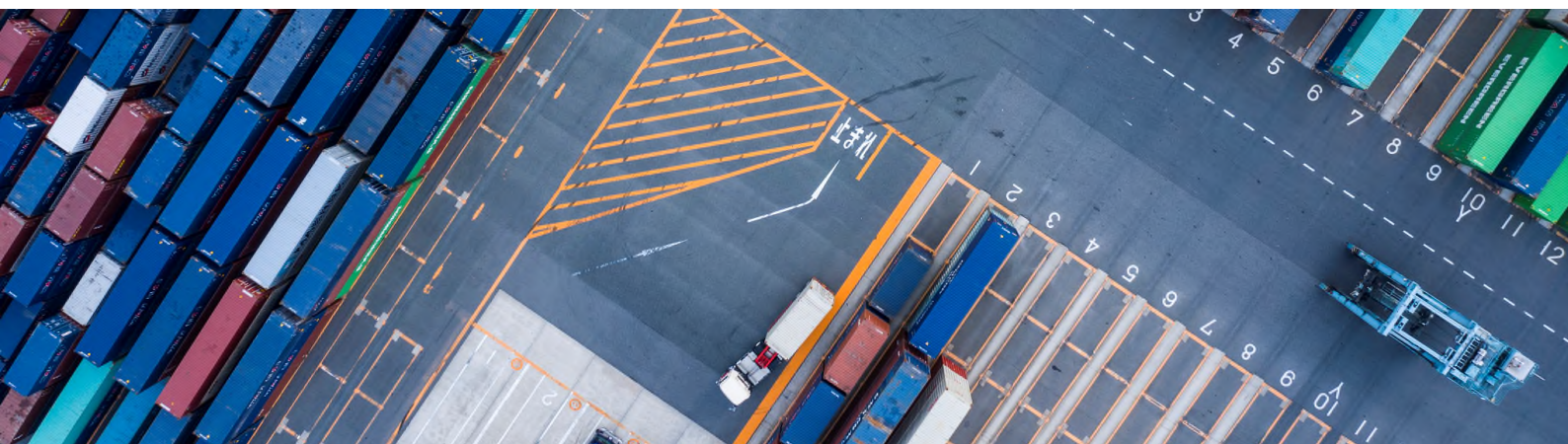
On supply chains, the IEA found that the current and planned manufacturing capacity of the solar PV supply chain is insufficient to meet the IEA Net Zero trajectory to 2050 (IEA, 2022b). Beyond the manufacturing supply chain, ramping up solar photovoltaic (PV) production also requires adequate critical mineral supplies. In 2021, solar PV demand already claimed 11 per cent of global silver production, over six per cent of metallurgical-grade silicon and over 40 per cent of all refined tellurium produced (IEA, 2022b). The IEA estimated that PV industry supply of critical materials would have to expand 150–400 per cent by 2030 from 2021 levels (depending on the material) to attain their IEA Net Zero trajectory. (See section 3.4.1 for more on supply chains.)

The substantial rollout of renewables projects that is required is limited by the practicalities of deployment. Engineering consultants Aurecon estimate that a completely new onshore wind project has a total project timeline of five to seven years¹⁶ (Aurecon, 2022), with a trend towards longer overall development times for new projects in light of developments including new requirements for grid connection (Aurecon, 2022). This timeframe extends to a decade for offshore wind, noting the lack of a current market in Australia (Aurecon, 2022).

Long duration storage, which will be essential for maintaining grid stability at high shares of renewables, can also require long lead times. Research from the United States suggests pumped hydro projects take up to over a decade from conception to commissioning (ARENA, n.d.) and the NSW Government expects the period from development to construction to take up to eight years (NSW Government, n.d.).

On workforce and skills, the Clean Energy Council (CEC) found that a massive step change in the deployment of clean energy will require significant growth in the clean energy workforce to ensure that the skilled workforce is in place to deliver these projects in a sustainable, safe and efficient way (Clean Energy Council, 2022). The CEC noted around 30,000 people are currently employed in Australia across large-scale renewable energy construction, operation and maintenance and small-scale rooftop solar design and installation, and that there are already shortages across many areas of the existing workforce, particularly in fields such as engineers and electricians (Clean Energy Council, 2022).

Beyond the above considerations, community acceptance of, or ‘social licence’ for, the deployment of low and zero emissions technologies, and the changes that accompany them, will be an important element of a successful and enduring transition to Australia’s net zero economy. Meaningful consultation and communication with communities on the net zero transition can support this outcome.



¹⁶ This includes three to five years for development, which includes pre-feasibility, design and approvals, and two years from a notice to proceed to the commissioning of the last turbine.

2.4 Examining the pathway to net zero

When looking beyond 2030, the policy environment for enabling net zero is less clear, with the Government yet to set out a detailed long-term strategy.

The Government's *Powering Australia* plan is focused on measures to achieve the 2030 target. This is appropriate—the risk of tipping points (section 1.3.4) and the fact that parts of the climate system respond very slowly to changes in emissions mean that emissions reductions this decade will have a far more important impact on achieving the Paris climate goals than if those same reductions occurred in a later decade. However, it is also important the Government commence planning for net zero by 2050.

A net zero strategy is needed to define Australia's pathway to reaching the 2050 target. At a high level, to deliver any strategy, climate change must be embedded in decisions at all levels of government.

A key role that a net zero strategy can serve is to provide a framework for prioritising the investment in research and development to deliver the technologies needed to meet the net zero goal. A net zero strategy can also (Climate Change Authority, 2020):

- integrate economic development planning with emissions reduction and climate resilience policies (Vener, Fransen, Levin, Baumwoll, & Ross, 2019), with the goal of taking advantage of the opportunities and adequately mitigating the risks;
- enhance certainty for businesses making investments in long-lived assets—assets that will be in use well beyond 2030—and help avoid near-term decisions that would 'lock in' high emissions activities and lead to stranded assets, given the need to achieve deeper cuts in emissions over time;
- inform short- and medium-term emissions reduction target setting under the Paris Agreement's 'review, refine and ratchet' mechanism for NDCs (Vener, Fransen, Levin, Baumwoll, & Ross, 2019);
- provide an informed basis for policy makers and communities to plan for an equitable transition, particularly for workers in emissions-intensive industries. It would provide an opportunity to assess and anticipate social and employment impacts of the transition to a low-emissions economy and identify new opportunities for emerging industries and job creation (Vener, Fransen, Levin, Baumwoll, & Ross, 2019; European Commission, 2018);
- set out long-term infrastructure investment plans such as low-emissions electricity transmission systems and urban infrastructure and transport systems;

- Remain relevant and dynamic by having periodic delivery and review mechanisms (Stern, 2018); and
- helps prioritise technology investment (see section below).

The Authority's Review of International Offsets recommended the Government publish a National Carbon Market Strategy, which would, amongst other things, map out Australia's use of offsets to 2050 (Climate Change Authority, 2022a). This strategy could inform or be formulated in parallel with the development of a net zero strategy.

Planning for net zero by 2050 could also be bolstered by extending the Government's emissions modelling out to 2050. Up to 2022, the Government's projections have only gone out to 2030 (Department of Industry, Science, Energy and Resources, 2021). In fact, the NSW government became the first Australian state to make greenhouse gas emissions projections out to 2050. It has made this and local-scale emissions data publicly available (NSW Government, 2022b).

2.4.1 The role of technology in meeting the 2050 target

As discussed in section 2.3.5, meeting Australia's 2030 target will mostly be achieved by deploying technology that already exists. This is not the case for meeting Australia's 2050 target. Meeting the 2050 target will involve innovation as well as continued rapid deployment of mature technologies. In reference to global energy systems, for example, the IEA concluded that reaching net zero will require widespread use of technologies not yet on the market as well as rapid deployment of existing technologies (IEA, 2021a).

Technology and innovation will therefore need to remain a focus of the Government's climate and energy policy. As a complement to the *Powering Australia* plan, there would be benefit in the Government developing a plan for technology research, development and deployment for all sectors. By assessing technology availability and readiness, as well as the cost trajectory for different technologies, the Government could present a clear picture of the technology transition benefits and costs (and timing of these costs) for different sectors. This information would help policymakers and investors to focus and sequence funding, and set sectoral targets.

The Authority notes that the recent consultation paper on the Safeguard Mechanism discusses the role for technology in meeting declining baselines in facilities covered by the mechanism.

Chapter 3 – International developments

Summary

Global greenhouse gas emissions are still rising. There have been increases in global ambition to respond to climate change, but there is an enormous amount to do to align with the Paris Agreement temperature goals.

The COP26 outcome agreed by Parties to the Paris Agreement, called the Glasgow Climate Pact, strengthened the commitment to pursue efforts to limit temperature increase to 1.5°C above pre-industrial levels by the end of the century.

COP26 also saw Parties conclude negotiations on rules for international carbon markets, mitigation, emissions reporting, adaptation, and finance.

The information provided through the enhanced transparency framework under the Paris Agreement will be vital in assessing the relative progress of countries towards their targets and the expenditure of the global emissions budget.

Global supply chains and changing markets for Australia's exports present risks and opportunities, and a role for Government to support Australia as a prosperous economy and a global leader on climate change.

In the face of volatile geopolitical circumstances, Australia and the rest of world must maintain a focus on building and accelerating momentum towards achieving net zero emissions.

In future reports, the Authority will compare Australia's progress to its targets with progress being made by other countries, including major economies and key trading partners and competitors.

3.1 Global emissions and ambition

A stocktake of cumulative emissions reductions pledges by the United Nations Environment Programme (UNEP) found as of October 2021, that national pledges were inadequate to match the aims of the Paris Agreement (UNEP, 2021).

This is consistent with the recent IPCC Sixth Assessment Report (AR6) that concluded, based on current NDCs (that is, NDCs prior to COP26), projected emissions to 2030 would lead to global temperatures exceeding 1.5°C this century (IPCC, 2022c). For a 66 per cent chance of limiting warming to 1.5°C, AR6 reports that the world has a remaining carbon budget of 360 Gt CO₂—or nine years of current emissions. All global emissions pathways that limit warming to 1.5°C involve rapid, and in most cases immediate, emission reductions in all sectors (IPCC, 2022c).

Enhanced emissions reduction commitments made by countries in the lead up to and during COP26 in Glasgow, including Australia's commitment to a target of net zero by 2050, were a positive step. For the first time, global ambition, including net zero targets, has put the world on track to warming of less than 2°C (Birol, 2021; Climate Action Tracker, 2021; Meinshausen, Lewis, Nicholls, & Burdon, 2021).

Following COP26, countries with the largest emissions profiles have continued to take steps to better align ambition and implementation with the Paris Agreement goals by submitting updated NDCs. For example:

- India's new emissions intensity reduction target of 45 per cent below 2005 levels by 2030 (Climate Action Tracker, 2022a), ratchetting up their previous target of 33 to 35 per cent.
- China's target of reaching net zero before 2060 (Government of the People's Republic of China, 2021).
- Japan's new 46 per cent emissions reduction target below 2013 levels by 2030 in addition to a long-term goal of achieving net zero by 2050 (Climate Action Tracker, 2022b).

However, the recent 2022 Emissions Gap Report by the UNEP finds that global ambition is still not matched by current policies and emissions levels, which instead point to an outcome of more than 2°C warming this century (UNEP, 2022). The Authority will consider this latest information on global progress, and any new information, in its 2023 Annual Progress Report and in its work on Australia's next NDC.

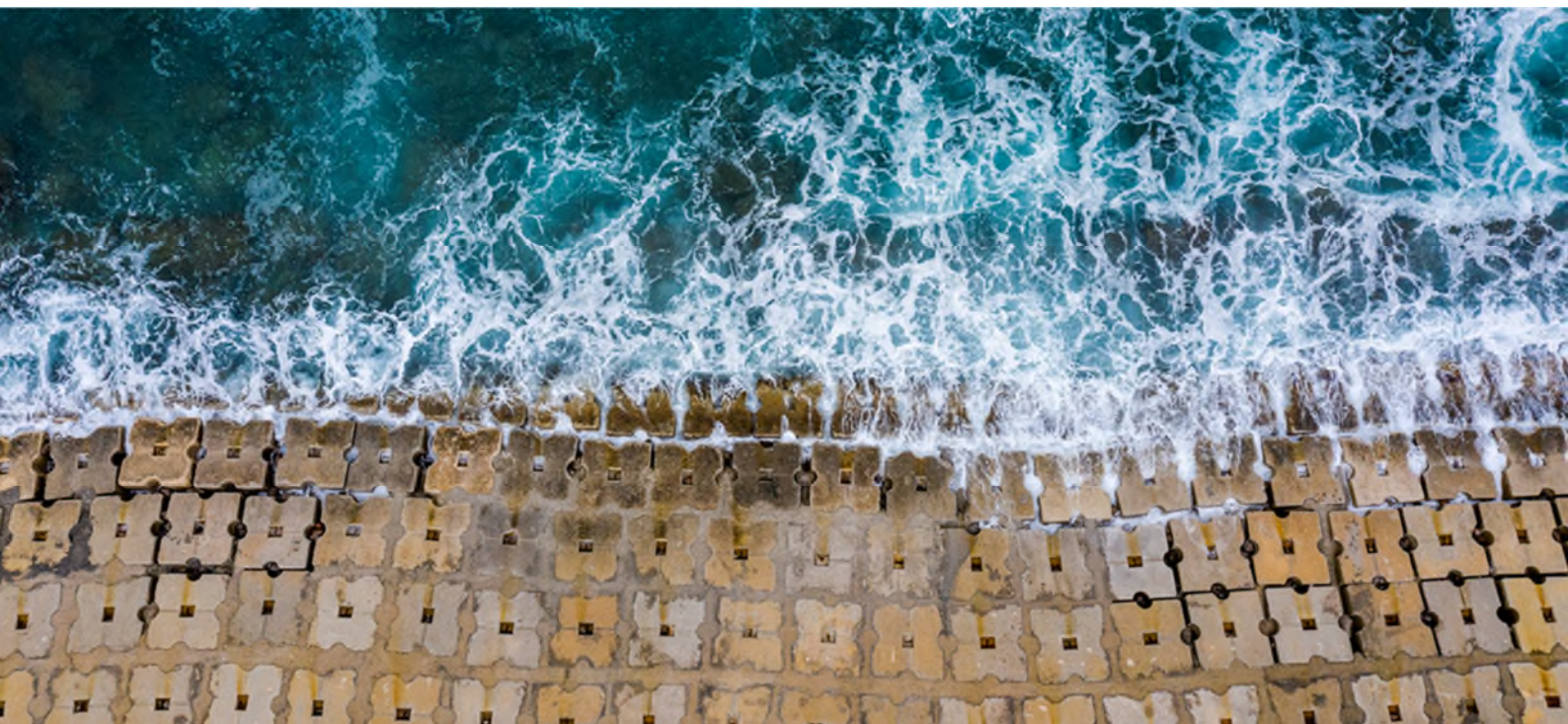
3.1.1 *Future assessments by the Authority on global emissions and ambition*

In future Annual Progress Reports, the Authority will present data on progress of other countries to their emission reduction targets. Tracking the progress of other countries will provide a measure of Australia’s relative progress, as well as an indication of global emissions trends and, by extension, the likely level of warming for which Australia must prepare.

The Paris Agreement Rulebook, agreed at COP26, included an enhanced transparency framework which provides one common system for all parties to report against (United Nations, 2022a). The information reported through this framework—for example, national greenhouse gas emissions reporting, implementation of NDCs and financial resources—will be vital in assessing the relative progress of countries towards their targets and the expenditure of the global emissions budget.

3.2 Global developments in adaptation

Globally, there has been growing attention paid to the need for climate adaptation—in both private and public sectors—with increases in the number of policy and legal frameworks as well as spending dedicated towards adaptation. In 2021, for example, US President Joe Biden directed all federal agencies to develop adaptation and resilience plans to address their most pressing climate risks and vulnerabilities (Federal Government of the United States, 2021). The UK has developed successive National Adaptation Programmes in accordance with the Climate Change Act 2008 (United Kingdom) (UK Government, 2018).



The ambition, scope and progress on adaptation have risen among governments at the local, national and international levels, along with businesses, communities and civil society. However, many funding, knowledge and practice gaps remain for effective implementation, monitoring and evaluation (IPCC, 2022a). Further, observed adaptation efforts are typically small, incremental, and reactive to extreme weather events. As the AR6 concludes, adaptation planning needs to move from focusing on the short-term to the development of long-term, concerted pathways with enabling conditions for ongoing adaptation (IPCC, 2022a). This focus must shift for all actors across both the private and public sector.

AR6 also found that climate resilience and adaptive capacity is highly unequal both within and between countries and regions (IPCC, 2022a). Low-income and especially conflict-affected areas experience large climate risk management gaps, a key driver of which is insufficient funding.

Although private sector finance for climate change action has increased since 2015, more support specifically directed towards climate adaptation is needed. For example, financial contributions towards climate adaptation in 2018 were 0.05 per cent of total climate finance (IPCC, 2022a). Limited private sector financing of adaptation is especially true in developing countries. From 1990–2019, Africa received only 3.8 per cent of global adaptation research funding (IPCC, 2022a).

Other systemic barriers to effective adaptation in vulnerable sectors, regions and social groups include limited resources, lack of citizen engagement and political leadership and, crucially, an insufficient sense of urgency.

Adaptation strategies must be fit for purpose and consider social and ecological issues to result in inclusive, equitable and just climate adaptation. Sustained political commitment and mobilisation of human and financial capital are crucial.

3.3 International climate policy developments

In the lead up to COP26, the UK presidency set the ambitious task of ‘keeping 1.5°C alive’, referring to the Paris Agreement goal to avoid some of the most destructive impacts of climate change. Whether COP26 succeeded in that goal or not is up for debate. Many welcomed the progress made, but others around the world were disappointed (Kühn, 2022).

The COP26 outcome agreed by Parties to the Paris Agreement, called the Glasgow Climate Pact, strengthened the commitment to pursue efforts to limit temperature increase to 1.5°C above pre-industrial levels by the end of the century (UNFCCC, 2022). The Pact represents the consensus of almost 200 countries after negotiations at COP26, and includes:

- Urging countries that have not yet communicated new or updated targets to do so as soon as possible, and requesting countries to revisit and strengthen their 2030 targets as necessary to align with the Paris Agreement temperature goal by the end of 2022.
- Emphasising scaling up of action and support for adaptation to climate change, and urging developed countries to increase their provision of adaptation finance to developing countries.
- Calling upon countries to accelerate the development, deployment and dissemination of technologies and adoption of policies to transition to low emissions energy systems, including rapid scale-up of clean power generation and energy efficiency measures, and accelerate efforts towards the phasedown of unabated coal power and phase-out of inefficient fossil fuel subsidies.
- Inviting countries to consider opportunities to reduce non-carbon dioxide greenhouse gas emissions by 2030, including methane.

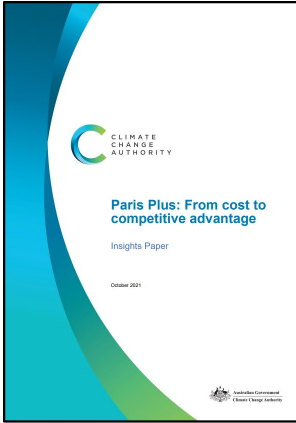
Also at COP26, Parties concluded negotiations on the Paris Agreement Rulebook, including international carbon markets, mitigation, transparency of emissions reporting, adaptation, and finance. One key element was the finalisation of the rules for managing the trading of mitigation outcomes between countries under Article 6 of the Paris Agreement (UNFCCC, 2021a; UNDP, n.d.; UNFCCC, 2015). Countries must now align domestic policy and legislative settings to facilitate the transfer and accurate accounting of internationally transferred mitigation outcomes either through bilateral arrangements or through the centralised United Nations mechanism. This development is also supported by the transparency framework which maintains common reporting standards for all countries.

At the time of finalising this report, COP27 was underway in Sharm El-Sheikh, Egypt. COP27 is seeking to build on the outcomes of COP26, focusing on driving action to urgently reduce greenhouse gas emissions; building resilience and adapting to the inevitable impacts of climate change; and delivering on the commitments to finance climate action in developing countries (United Nations, 2022b).

While the Paris Agreement is the centrepiece of international cooperation on climate change, a new global climate architecture is emerging, with increased action by businesses, communities and individuals. The Authority has published three reports on the opportunities and challenges this presents for Australia:

[Paris Plus: From Cost to Competitive Advantage, October 2021](#)

This Insights Paper outlines the Authority's strategic framework and priorities for work to ensure Australia can set increasingly ambitious emissions reduction goals for all economic sectors and policies backed by a strong evidence base.



[Paris Plus: Trade and Investment Trends in a Decarbonising World, November 2021](#)

This research report examines the global reorientation in trade and investment underway in the transition to net zero emissions, and what this shift means for Australia. Customers for Australia's exports, and the investors who finance their development, are increasingly ambitious in their response to climate change. Australian jobs, regions and the broader economy are exposed to risks related to shifting markets for emissions intensive goods. Rapidly reducing emissions makes good sense, not just to mitigate climate change but to position the Australian economy to prosper, rather than falter, as the world decarbonises.



[Review of International Offsets, August 2022](#)

This review finds the international carbon market is still evolving in response to the Paris Agreement, and calls for publication of a National Carbon Market Strategy that makes the most of this opportunity for Australia to accelerate ambition on emissions reduction.



Snapshot: Other developments

125 countries, including Australia, signed the Global Methane Pledge, a US-EU led initiative to **cut methane emissions by 30 per cent by 2030**.¹

39 countries, excluding Australia, and development banks committed to **stop public financing for international unabated fossil fuel projects** by the end of 2022 as part of the Statement on International Public Support for the Clean Energy Transition.²

145 countries, including Australia, responsible for **over 90 per cent of the world's forests** have endorsed the Glasgow Leaders' Declaration on Forests and Land Use, pledging to end and reverse deforestation.³



30% The Australian Government set a national goal in 2022 to protect 30 per cent of our land (and 30 per cent of our oceans) by 2030. Currently, **22 per cent of Australia's landmass is protected** by the National Reserve.⁴

\$3 tn

In Australia, the Investor Group on Climate Change, whose members hold more than \$3 trillion in Australian funds under management, released **recommendations for investment policy** to facilitate the transition to net zero.⁵



The United Kingdom has a **legislated 2030 and 2050 target**. Inroads have been made in electric vehicle sales and renewable electricity, particularly due to the substantial scaling up of offshore wind.⁶

\$130 tn

The Glasgow Financial Alliance for Net Zero, a coalition of banks, insurers and investors with US\$130 trillion at their disposal, pledged to put combatting climate change at the centre of their work.¹³

55%

On 29 July 2021 the EU Climate Law came into force, setting an emissions reduction goal of **55 per cent reduction on 1990 levels by 2030**.⁷ The legislated target is backed by policy changes, for example, a proposed new target to reduce emissions from the sectors covered by the EU Emissions Trading Scheme by 61 per cent by 2030 compared to 2005 levels.⁸ The REPowerEU plan will improve renewable penetration.



The US and China reached a bilateral agreement – the **'US-China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s'** – for cooperation on climate matters.⁹

\$369 bn

The US has passed the Inflation Reduction Act (IRA), investing USD\$369 billion in clean energy and climate measures.¹⁰ It includes tax credits for installing solar panels and purchasing electric vehicles, investment in **950 million solar panels, 120,000 wind turbines and 2,300 battery plants** and increased protection of national forests.¹¹ The IRA also expands tax incentives for carbon removal, utilisation, storage and direct air capture.¹² The IRA is anticipated to reduce US's carbon emissions by around **40 per cent by 2030**.¹⁰

Sources: ¹ (Climate and Clean Air Coalition Secretariat, n.d.); ² (United Nations, 2021); ³ (UNFCCC, 2021b); ⁴ (Australian Government, 2022c); ⁵ (IGCC, 2022); ⁶ (Climate Change Committee, 2022); ⁷ (European Commission, 2021a); ⁸ (European Commission, 2021b); ⁹ (US Department of State, 2021); ¹⁰ (Mahajan, Ashmoore, Rissman, Orvis, & Gopal, 2022); ¹¹ (Federal Government of the United States, 2022a); ¹² (Federal Government of the United States, 2022b); ¹³ (GFANZ, 2022).

3.4 Geopolitics, economics and investment

3.4.1 Pressures on global supply chains

The interplay between geopolitics and energy will continue to impact clean energy. The Ukraine crisis spurred Europe to further consider the risks posed by the ongoing dependence of their energy systems on fossil fuels. For example, both Germany and the UK set more aggressive targets for renewables during 2021–22 (Wood Mackenzie, 2022). While the transition to renewables and electrification offers longer term opportunities for Europe to transition to zero emissions production systems, in the short and medium term it is prioritising alternative sources of natural gas, principally through seaborne LNG and pipeline imports from Norway (IEA, 2022a).

While renewable energy sources may provide long term energy security for countries by facilitating domestic power generation, renewable energy infrastructure is typically imported—mostly from China (IEA, 2022b). Although the development of the Chinese solar PV industry has helped bring down the costs of PV panels, there is also now less diversity in the supply chain; China’s share in all the manufacturing stages of solar panels exceeds 80 per cent and, based on manufacturing capacity under construction, will soon reach almost 95 per cent (IEA, 2022b). Since 2011, China has invested more than US\$50 billion in new PV supply capacity and created more than 300,000 manufacturing jobs across the solar PV value chain. There are also concentrations in the supply chains for electricity storage technologies. For example, around three quarters of the world’s production capacity for battery cells and more than half the global raw material processing of lithium, cobalt and graphite, are located in China (IEA, 2022c).

High commodity prices and challenges with supply chains led to an increase of 20 per cent in PV panel prices over 2021, compared with 2020 (IEA, 2022b). However, increases in commodity prices did not dampen demand for solar PV. Across the EU, for example, roughly 25.9 GW of new solar PV capacity was installed in 2021, a 34 per cent annual increase (SolarPower Europe, 2021). The ongoing demand may have contributed inflationary pressure to the costs of solar PV, and could continue to do so unless sufficient supply is developed. Increases in prices for key commodities have flow-on impacts for the costs of solar modules, wind turbines, electric vehicle batteries and power lines (IEA, 2021b). In certain cases, Australia can play a role in alleviating supply constraints by helping to diversify concentrated supply chains. For example, the Ukraine crisis also caused nickel, a key component of lithium-ion batteries, to surge to exceptionally high price levels over uncertainty of Russian supply, which Australia could help fill (IEA, 2022d).



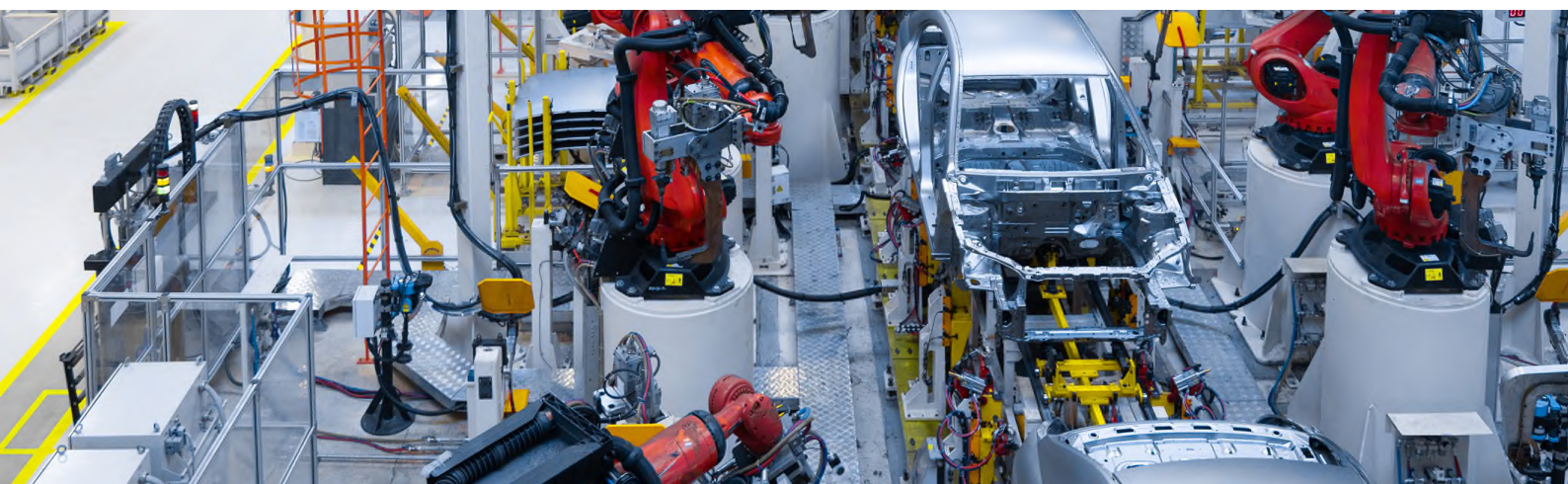
3.4.2 Emerging export opportunities for Australia in the transition to a lower emissions world

The shift to a net zero world will present economic opportunities for Australia, which has some of the world's largest reserves of critical minerals: titanium, zircon, cobalt, tungsten and lithium (Austrade, 2021), as well as non-critical minerals important for low emissions technologies: nickel, copper, bauxite and iron ore. The Government's Resources and Energy Quarterly for June 2022 predicts Australia's resource exports to show further significant growth over the next few years (Office of the Chief Economist, 2022). The production of EVs and new energy technologies will see growing demand for metals such as copper, aluminium, lithium and nickel (Office of the Chief Economist, 2022).

Lithium, of which Australia has the potential to become the world's largest producer, is a case in point: lithium is a key input to batteries including for electric vehicles. Australia's lithium production is forecast to increase by more than 50 per cent in the near term, rising from 278,000 tonnes of lithium in 2021–22 to 438,000 tonnes in 2023–24 (Office of the Chief Economist, 2022). Australia's lithium export earnings are projected to more than double over the same period, from A\$4.1 billion in 2021–22 to A\$9.4 billion in 2023–24 (Office of the Chief Economist, 2022). However, around three quarters of the world's production capacity for battery cells and more than half the global raw material processing of lithium, cobalt and graphite, are located in China (IEA, 2022c).

Another emerging opportunity is the export of renewable energy, including via undersea cables or in energy carriers e.g. hydrogen and ammonia—and the private sector, governments and researchers are already advancing on this opportunity. For example, as of 31 October 2021, there were 21 large-scale hydrogen projects¹⁷ under development, worth some A\$133–185 billion (Office of the Chief Economist, 2021). As a further example, the Australian National University’s Zero-Carbon Energy for the Asia Pacific Grand Challenge initiative is exploring the opportunity for Australia to build new export industries, based on Australia’s abundant renewable energy resources (Australian National University, n.d.). The initiative has six programs on: hydrogen; renewable metal refining; renewable energy systems; Indigenous engagement with renewable energy industries; renewable energy policy and governance in Asia-Pacific countries; and regulatory frameworks for renewables-based trade and investment (Australian National University, n.d.).

As the Authority highlighted in its 2020 report *Prospering in a low-emissions world*, and its 2021 report *Paris Plus: Trade and Investment Trends in a Decarbonising World*, Australia must take advantage of the opportunities of the net zero transition. Australia can be a global leader on climate change action. Australia has some of the world’s best renewable resources, extensive landscapes conducive to sequestration of carbon, and large reserves of the raw materials required for low emissions technologies, such as lithium, uranium, nickel and copper. Australia also have the potential to decarbonise exports with high embedded emissions, such as steel, aluminium and beef. A global increase in demand for lower emissions products and services has the potential to open up new areas of jobs and growth in Australia in diverse economic sectors such as sustainable agriculture, new clean-tech industries, and environmental and financial services. Australia can leverage its skilled workforce, stable democracy and sophisticated science and engineering skill base, alongside its location to essential resources to an effective competitive advantage in a net zero world.



¹⁷ The project list captures hydrogen and ammonia projects, including those with carbon capture and storage. However, the report notes the majority of the proposed projects are for renewable hydrogen (Office of the Chief Economist, 2021).

Chapter 4 – The methodology for assessing progress

(it's not just about emissions)

Summary

Reducing emissions and preparing for a changing climate are whole-of-economy and whole-of-society challenges.

The Authority has developed a methodology for assessing Australia's progress in responding to climate change for future Annual Progress Reports.

In consultation with stakeholders, the Authority will continue to refine this methodology and identify and develop the indicators that will inform our advice on progress, with a particular emphasis on leading indicators.

In assessing the effectiveness of Australia's climate change policies, the Authority will examine both the impact of policies on emissions and the broader consequences of those policies for the economy, including regional and rural impacts.

The methodology is designed to illuminate policy gaps as new challenges and opportunities arise.

4.1 The Authority's task

The Authority's task is to provide advice to inform the Minister's preparation of the annual climate change statement. The Act (extracts at Appendix B) requires the Minister to prepare an annual climate change statement that canvasses:

- progress made during the year towards achieving Australia's emissions reduction targets
- relevant international developments
- climate change policy generally
- the effectiveness of Commonwealth policies to achieving emissions reductions
- the impact of those policies on rural and regional Australia including job creation and investment
- the risks to Australia from climate change impacts.

This chapter sets out the Authority's methodology for assessing progress for our future annual statement advices. Commencing next year, the Authority intends to consult widely, refine its approach, and apply it comprehensively.

4.2 Our proposed methodology for assessing progress

To understand how Australia is progressing towards net zero, the Authority has developed its methodology for preparing Progress Reports in future years, including data collection, consultation and analysis, guided by the framework set out in Figure 7. Figure 7 shows how future Progress Reports will address each of the components the Minister must report on in the annual climate change statement, as described in section 12 of the Act.

The methodology includes assessments and analysis across four core elements: wellbeing, emissions, policies and context.



WELLBEING	<i>Climate Change Act 2022</i> s 12(e), s 12(1)f	Progress towards a just transition and resilient nation			
		Economic impacts and opportunities	Physical impacts and adaptation	First Nations	Regional and rural Australia
EMISSIONS	<i>Climate Change Act 2022</i> s 12(1)a	Progress towards national greenhouse emissions reduction targets			
		Leading indicators of change	Point target compliance	Emissions budget tracking	Emissions sectoral trends
POLICIES	<i>Climate Change Act 2022</i> s 12(1)c, s 12(1)d	Progress in implementing policies			
		Mitigation and adaptation policy stocktake	Policy gap analysis	Indicators of direct effectiveness	Indicators of indirect effectiveness
CONTEXT	<i>Climate Change Act 2022</i> s 12(1)b	Developments in the broader operating environment			
		Climate science and global impacts	Geopolitics	International ambition and policies	Voluntary corporate action

Figure 7: The Authority's methodology for assessing progress

4.2.1 Wellbeing

Measuring wellbeing is about having a sense of Australia's progress on the things that matter to Australian's quality of life. The impacts of climate change and climate-related policies affect the wellbeing of Australians in different ways. Climate-related wellbeing in turn affects social licence to proceed with policies to guide the changes Australians need to make.

Section 12 of the Act explicitly requires the annual climate change statement canvass 'the impact of the Commonwealth's climate change policies to achieve Australia's greenhouse gas emissions reduction targets on rural and regional Australia' and the *Climate Change Authority Act 2011* requires that the Authority have regard to the principles set out in Chapter 1.2.

The Authority intends in future years to assess social, environmental and economic impacts, positive and negative, through the concept of wellbeing. This will include considering the impacts in Australia of the response to climate change—policies and decisions implemented here and abroad—as well as the physical impacts of climate change.

4.2.2 Emissions

The Authority will use indicators to assess progress towards Australia's emissions targets, realising opportunities and managing risks. Indicators are data about the actions and outcomes necessary to achieve objectives, such as skills and jobs, secure supply chains, and investment needed for the transition. For example, indicators could include the number of people enrolled in battery installation training, and the proportion of new car sales that are sales of electric vehicles. Each indicator will have a relevant benchmark against which it can be assessed and feed into the Progress Report. The Authority intends to use data readily available to measure the indicators, such as from the ABS, and to work with appropriate entities on new data collections where helpful and feasible.

Leading indicators are useful to anticipate how the economy and its emissions intensity are likely to change, including early notice of the sectors and regions on track for economic growth or decline. A single leading indicator often lacks predictive power. However, when taken together and used in conjunction with other sources of information, leading indicators provide a picture of progress and future developments (Climate Change Authority, 2021).

Snapshot: A leading indicator in focus

One of the largest sources of emissions in Australia is the combustion of fuel associated with transport activities (Table 4), more than half of which is emitted by passenger and light commercial vehicles (Department of Industry, Science, Energy and Resources, 2021).

The Authority considers progress in the transition to low and zero emissions passenger and light commercial vehicles will be signalled by a range of indicators:

- progress to retail price parity between low carbon vehicles and internal combustion engine vehicles
- Government policy settings to support supply and demand for low emissions vehicles
- the quantity of new, low emissions vehicles arriving in Australia
- the installation of electric vehicle charging and hydrogen refuelling infrastructure
- investment in local electricity distribution infrastructure to support electric vehicle charging
- the development and delivery of motor trades skills and training to maintain a mostly electric vehicle fleet
- production of batteries for use in electric vehicles or low and zero emissions vehicles, potentially resulting from the trend of on-shoring (or re-shoring) (Executive Summary).

The Authority plans to seek the community's feedback on the draft methodology, including the datasets that the Authority should track for chosen indicators.

4.2.3 Policies

The annual climate change statement advice must canvass ‘climate change policy’. Climate change requires a whole-of-economy transition. Australia recognises this requirement through its economy-wide emissions reduction target. As a consequence, climate change policy considerations should be embedded in all government decision-making processes.

As a first step in this Progress Report, the Authority has considered state and territory emissions reductions targets in relation to Australia’s NDC (Chapter 2). The Authority intends that in future years the report will present high-level insights in sectors of the economy, along with cross-cutting or nation-wide policies.

Fundamental to the task of considering Australia’s progress towards achieving its greenhouse gas emissions reduction targets, at both a sectoral and whole-of-economy level, is understanding the cumulative effectiveness of its policies.

The Authority considers assessing effectiveness goes beyond just considering actual emissions reductions achieved in one year, but must also consider the qualitative impacts associated with policies, both positive and negative. The Authority considers effectiveness can be categorised as direct or indirect.

A primary measure for establishing *direct effectiveness* is how many tonnes of carbon dioxide equivalent (t CO₂-e) have been mitigated, that is, reduced, or removed due to a particular policy. There are two main ways to present the quantity of emissions mitigated.

- Emissions mitigated in one year—this is typically reported relative to a base year (such as the current or recently past year, or year used as baseline for targets), or projected to a target year (such as 2030 or 2050).
- Cumulative emissions mitigated—this is the total of emissions mitigated each year over a set time period. The most useful time periods typically align with the time periods for Australia’s emissions reduction targets, especially if targets are tracked using an emissions budget.

As Australia’s emissions reduction targets are a mix of both point targets and emissions budgets (section 2.1), this report considers both the quantity of emissions abated in one particular year, cumulative abatement over time, and likelihood of future abatement in assessing the effectiveness of climate policies. The Authority intends to use a similar (though more qualitative) approach when assessing progress on adaptation policies.

It is also important to consider the broader impacts and benefits climate change policies have on the economy, the environment, and society, which the Authority broadly considers *indirect effectiveness*.

There are significant opportunities for Australia on the net zero pathway, but there needs to be consideration as to how the transition can best be managed to benefit everyone. Indirect effectiveness also includes consideration of the impacts of the Commonwealth's climate change policies on rural and regional Australia as well as the broader community.

Assessing indirect effectiveness involves a range of data including environmental valuation, financing, innovation, supply chain, demand, workforce and co-benefits, among others.

4.2.4 Context

There are factors that affect Australia's progress but are largely beyond the direct control of Australian governments and citizens, such as geopolitics, the science and global impacts of climate change, decisions of other nations, and voluntary corporate action. The Authority's advice will be developed with an understanding of the context in which outcomes are to be delivered, as set out in the second core element of the framework, as well as opportunities to influence the context (e.g. through international engagement).

4.2.5 Continuous improvement of the methodology

The Authority intends to conduct public consultation in the development of its Annual Progress Report in 2023, as is required by the Act each year following the first year's report.

The methodology should be viewed as an initial approach proposed by the Authority as the basis for consultation. The Authority will seek feedback on the methodology, including on:

- the assessment framework
- indicators and datasets that the Authority should track
- data gaps that, if filled, would assist in tracking progress.

The Authority appreciates the individuals and organisations who contribute time and expertise to our work. In the year ahead, the Authority looks forward to consulting widely and collecting evidence and experiences from across the country to inform our future Annual Progress Reports and other climate policy advice to the government.

Appendix A – Members of the Climate Change Authority



Mr Grant King, Chair

Mr King is a leading voice in the Environmental, Social and Governance (ESG) space. He is currently the Chairman of HSBC Bank Australia, GreenCollar and CWP Renewables, a Director of the Great Barrier Reef Foundation and a Fellow of the Australian Institute of Company Directors. Mr King was President of the Business Council of Australia from 2016 to 2019 and, prior to that, held leadership roles in Origin Energy Ltd, Boral Energy, BHP Billiton Limited, Contact Energy Ltd, Envestra Ltd and the Australian Petroleum Production and Exploration Association Ltd (APPEA), Australia Pacific LNG, Oil Company of Australia Ltd and the Energy Supply Association of Australia (ESAA).



Dr Cathy Foley AO PSM FAA FTSE, Chief Scientist, Ex Officio Member

Dr Foley commenced as Australia's ninth Chief Scientist in January 2021 after a lengthy career at Australia's national science agency, the CSIRO; where she was appointed as the agency's Chief Scientist in August 2018, the second woman to hold that role. Dr Foley's scientific excellence and influential leadership have been recognised with numerous awards and fellowships, including being elected to the Australian Academy of Science in 2020, along with an Order of Australia for service to research science and to the advancement of women in physics. She was elected as a Fellow of the Australian Academy of Technological Sciences and Engineering in 2008 and was elected as an Honorary Fellow of the Australian Institute of Physics in 2019.



Professor Lesley Hughes, Member

Professor Hughes is an academic ecologist and climate change scientist. She is the former Interim Executive Dean of the Faculty of Science and Engineering at Macquarie University. Her research focuses on the impacts of climate change on species and ecosystems.

Professor Hughes has been a Climate Councillor with the Climate Council since 2013 and a Director since 2021. She is a former federal Climate Commissioner and has regularly co-authored reports on climate change and its impacts, including for the Intergovernmental Panel on Climate Change (IPCC) Fourth and Fifth Assessment Reports.



Mr Mark Lewis, Member

Mr Lewis has had a lifetime commitment to agriculture growing up on farms in Central Queensland and later owning cattle and sheep properties in South West Queensland. Mr Lewis was elected a member of the Western Australia Parliament in 2013 and later became Minister for Agriculture and Food. He now sits on a number of government and private sector authorities and boards and provides corporate advisory services to a range of companies.



Dr Virginia Marshall, Member

Virginia is the Inaugural Indigenous Postdoctoral Fellow with the Australian National University's School of Regulation and Global Governance (RegNet) and the Fenner School of Environment and Society. She is a practising lawyer and duty solicitor, a former associate and researcher with the Federal Court of Australia in Sydney, and professional member of the NSW Law Society and Women Lawyers Association of NSW. Virginia is the winner of the WEH Stanner Award for the best thesis by an Indigenous author, titled, 'A web of Aboriginal water rights: Examining the competing Aboriginal claim for water property rights and interests in Australia'.



Mr John McGee, Member

Mr McGee is currently a director of the Infrastructure Australia and Sydney Local Health District boards. He recently served on the board of Airservices Australia from September 2015 to December 2019 and was Managing Director of BNY Mellon Australia Pty Ltd for nine years, heading up the Bank of New York's corporate trust operation in Australia. Mr McGee has also served on other boards in non-executive roles, including the Private Health Insurance Administrative Council (PHIAC), Westpac Funds Management, Delhi Petroleum, and other companies in the financial and pharmaceutical industries.



Ms Sam Mostyn AO, Member

Sam Mostyn AO is a businesswoman and sustainability adviser, with a long history of executive and governance roles across business, sport, climate change, the arts, policy, and not for profit sectors.

She serves on the boards of Mirvac, Transurban, the Sydney Swans and is the Chair of Citi Australia's consumer bank. She previously chaired the Climate Council and 1 Million Women and was recently presented the distinguished 2020 United Nations Day Honour Award in recognition of

her outstanding efforts in the advancement of sustainable development and her leadership in the areas of diversity and inclusion in Australia. In 2021 Sam was awarded an AO in the Australia Day Honours for distinguished service to business, sustainability and the community, through seminal contributions to a range of organisations and to women.



Dr Russell Reichelt AO FTSE, Member

Dr Reichelt is the representative of the Australian Prime Minister on the High-Level Panel for a Sustainable Ocean Economy and a board member of the Great Barrier Reef Foundation. He was Chairman of the Great Barrier Reef Marine Park Authority from 2007 to 2018 and has served as CEO of the Australian Institute of Marine Science, Chairman of Australia's Fisheries Research and Development Corporation, and as a

member of Australia's State of the Environment Committee. He is an Adjunct Professor at the University of Queensland and Queensland University of Technology, and a Fellow of the Australian Academy of Technological Sciences and Engineering as well as the Institute of Marine Engineering, Science and Technology. In 2021 Dr Reichelt was awarded an AO for his distinguished service to marine conservation, Great Barrier Reef ecosystem management, and climate change research.



Ms Susie Smith, Member

Ms Smith's areas of expertise include climate change policy and environment and resource management. She has been the CEO of the Australian Industry Greenhouse Network (AIGN) since March 2017 and was previously General Manager, Carbon and Sustainability at Santos. Susie has contributed to both the Intergovernmental Panel on Climate Change taskforce on oil and gas fugitive emissions and was part of the

Global Reporting Initiative: Oil and Gas Sector Supplement working group. Ms Smith is an experienced executive in climate change, and sustainability. Her contributions include as a member of the Expert Panel examining low-cost abatement; the Corporate Emissions Reduction Transparency reference panel; the Leadership Group for Industry Transition roundtables; IPCC's stakeholder meetings on fugitives; and the GRI's taskforce for sustainability reporting sector guidelines. She is also active with the Australian Cooperative Research Centres as a Director, previously with CRC CARE and currently with the Future Energy Exports which is creating a living laboratory to implement decarbonisation energy pathways.

Appendix B – Extracts from the *Climate Change Act 2022*

How the *Climate Change Act 2022* legislates annual climate change statements

Section 12 outlines the tasks for the Minister

- (1) Within 6 months after the end of each financial year, the Minister must prepare a statement that relates to:
 - (a) the progress made during the year towards achieving Australia's greenhouse gas emissions reduction targets; and
 - (b) international developments during the year that are relevant to addressing climate change; and
 - (c) climate change policy; and
 - (d) the effectiveness of the Commonwealth's policies in contributing to the achievement of Australia's greenhouse gas emissions reduction targets and reducing emissions in the sectors covered by those policies; and
 - (e) the impact of the Commonwealth's climate change policies to achieve Australia's greenhouse gas emissions reduction targets on rural and regional Australia, including the social, employment and economic benefits being delivered by those policies in rural and regional Australia; and
 - (f) risks to Australia from climate change impacts, such as those relating to Australia's environment, biodiversity, health, infrastructure, agriculture, investment, economy or national security.
- (2) A statement under subsection (1) is to be known as an ***annual climate change statement***.
- (3) The Minister must cause a copy of an annual climate change statement to be tabled in each House of the Parliament within 5 sitting days of that House after the completion of the preparation of the statement.

Section 14 outlines the tasks for the Authority

- (1) The Climate Change Authority must give the Minister advice that relates to the preparation of an annual climate change statement.
- (2) If a period is:
 - (a) specified in an agreement between the Minister and the Climate Change Authority; and
 - (b) designated by the agreement as the advice period for a particular annual climate change statement;advice under subsection (1) that relates to the preparation of the annual climate change

statement must be given within the advice period designated by the agreement.

(3) In considering advice to be given to the Minister under subsection (1) in relation to the first annual climate change statement, the Climate Change Authority may make provision for public consultation.

(3A) In considering advice to be given to the Minister under subsection (1) in relation to:

(a) the second annual climate change statement; or

(b) a subsequent annual climate change statement;

the Climate Change Authority must make provision for public consultation.

...

(6) If the Climate Change Authority gives the Minister written advice under subsection (1), the Climate Change Authority must:

(a) publish a copy of that advice on its website no later than the day the annual climate change statement to which the advice relates is tabled in a House of the Parliament in accordance with subsection 12(3); and

(b) cause a copy of that advice to be tabled in each House of the Parliament:

(i) within 15 sitting days of that House after giving the advice to the Minister; and

(ii) no later than the day the annual climate change statement to which the advice relates is tabled in that House in accordance with subsection 12(3).

Additional requirements of the Minister under Section 14

(4) If the Climate Change Authority gives the Minister advice under subsection (1) that relates to the preparation of a particular annual climate change statement, the Minister must have regard to that advice in preparing that statement.

(5) Subsection (4) does not prevent the Minister from having regard to other advice.

...

(7) If:

(a) the Climate Change Authority gives the Minister written advice under subsection (1) that relates to the preparation of a particular annual climate change statement; and

(b) the Minister decides not to accept one or more material aspects of that advice;

then:

(c) the Minister must prepare a written statement of reasons for the decision not to accept those aspects of that advice; and

(d) the Minister must cause a copy of the statement of reasons to be tabled in each House of the Parliament within 5 sitting days of that House after the completion of the preparation of the annual climate change statement.

Glossary of terms

Abatement	Stopping the increase of greenhouse gases in the atmosphere. It includes mitigation and sequestration.
Adaptation	Actions to build resilience and protect communities, economies, and the environment from the impacts of climate change.
Carbon credit	A tradable unit that represents one tonne of greenhouse gas equivalent abatement.
Carbon farming	The process of changing agricultural practices or land use to increase the amount of carbon stored in the soil and vegetation (sequestration) or to reduce greenhouse gas emissions from livestock, soil or vegetation (avoidance).
Carbon offset	A type of carbon credit that represents a reduction in emissions – whether prevented from entering the atmosphere or removed from the atmosphere – that is used to compensate for emissions that occur elsewhere.
Carbon neutrality	Having a balance between emissions and absorption of greenhouse gases from the atmosphere.
Climate finance	Refers to local, national, or transnational financing, which may be drawn from public or private sources, critical to addressing both mitigation and adaptation.
Emissions budget	A cumulative amount of greenhouse gases that can be emitted, e.g. 4,000 Mt CO ₂ -e during a specified time period, e.g. from 2021–2030.
Emissions intensity	A measure of the amount of emissions associated with a unit of output—for example, emissions per unit of gross domestic product or electricity production.
Emissions intensive, trade exposed industry (EITE)	Businesses or industries that are involved in activities that produce with a high level of emissions intensity and are exposed to international trade competition.
Emissions reduction	Reducing the emissions from an activity, such as through efficiency improvements.
Emissions removal	Activities that involve capturing and durably storing emissions from the atmosphere.

Fugitive emissions	Emissions that occur during production, processing, transmission and distribution of fossil fuels.
Gold Standard	An offset scheme that produces Verified Emissions Reductions (VERs).
Greenhouse gas	Any gas (natural or produced by human activities) that absorbs infrared radiation in the atmosphere, including carbon dioxide, water vapour, nitrous oxide, methane and ozone.
Greenwashing	The act of disseminating inaccurate information to present a business, product or operation as environmentally responsible when there is little or no merit to the claims.
Just transition	Involves maximising the social and economic opportunities of climate action, while minimising and carefully managing any challenges—including through effective social dialogue among all groups impacted, and respect for fundamental labour principles and rights.
Kyoto Protocol	An international agreement adopted under the United Nations Framework Convention on Climate Change in 1997 and which expired in 2020. It included binding national targets for developed countries and flexible mechanisms including the Clean Development Mechanism (CDM).
Nationally Determined Contribution	A submission made to the UNFCCC secretariat that outlines and communicates a country's actions to reduce national emissions and adapt to the impacts of climate change, as required by Article 4, paragraph 2 of the Paris Agreement. NDCs are submitted every five years and each successive NDC is to represent a progression compared to the previous NDC.
Net zero emissions	An overall balance between greenhouse gas emissions and removals.
Mitigation	Reducing emissions.
Ocean acidification	The lowering of the pH of seawater as a result of the chemical processes of carbon dioxide dissolving in oceans.
Ocean warming	Increases in the temperature of oceans as they absorb increasing amounts of solar radiation.

Paris Agreement	An international agreement negotiated under the United Nations Framework Convention on Climate Change in 2015.
Point target	A level of emissions reduction, e.g. 43 per cent below, to be achieved by a designated target year, e.g. 2030, compared to emissions in a base year, e.g. 2005.
Resilience	The capacity of people and communities to cope with a hazardous event, trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation.
Science-based targets	Science-based climate-related targets are those that are theoretically feasible, quantifiable such that progress is measurable, and are supported by clear, analytical rationale for why they were set at a given level.
Scope 1 emissions	The release of greenhouse gases into the atmosphere as a direct result of activities occurring within a responsible entity's control (or geographic boundary).
Scope 2 emissions	The indirect release of greenhouse gases into the atmosphere from the consumption of purchased electricity, heating, cooling or steam that is generated outside of a responsible entity's control (or geographic boundary).
Scope 3 emissions	All indirect emissions (not included in scope 2) that occur in the value chain of the reporting entity, including both upstream and downstream emissions.
Stationary energy	The burning of fuels for energy used directly, in the form of heat, steam or pressure.
Safeguard Mechanism	A legislated obligation on Australia's largest greenhouse gas emitters, or 'Safeguard facilities', to keep their net emissions below an emissions limit (a baseline).
Safeguard facility	A facility with Scope 1 emissions of more than 100,000 tonnes of carbon dioxide equivalent per year.
Sequestration	Storing greenhouse gases away from the atmosphere.
Verra	The organisation that runs the Verified Carbon Standard, which administers Verified Carbon Units (VCU), CCBs and SD VSta.

Abbreviations

AR6	The Intergovernmental Panel on Climate Change 's (IPCC's) 6 th Assessment Report
ARC	Australian Research Council
CCB	Climate, Community and Biodiversity
CER	Clean Energy Regulator
CERT	Corporate Emissions Reduction Transparency
COPGFANZ	Conference of Parties to the UNFCCC Glasgow Financial Alliance for Net Zero
GWh	Gigawatt hour
GW	Gigawatt
IEA	International Energy Agency
ISSB	International Sustainability Standards Board
IRA	<i>Inflation Reduction Act 2022 (United States)</i>
IPCC	Intergovernmental Panel on Climate Change
NDC	Nationally Determined Contribution
Mt CO ₂ -e	Million tonnes of carbon dioxide-equivalent emissions
PV	Photovoltaic, in reference to solar panels
SBTi	Science Based Targets initiative
SDVISTA	Sustainable Development Verified Impact Standard
TCFD	Task Force on Climate-related Financial Disclosures
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

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