2024 Annual Report

November 2024

Net Zero Commission

Acknowledgment of Country

The Net Zero Commission acknowledges the traditional custodians of the lands and waters upon which we live and work throughout NSW.

We pay respect to Elders, past, present and future, acknowledging the diversity of First Nations peoples across NSW, and we recognise their ongoing connection to land, waters, biodiversity and culture.

We recognise the practice of intergenerational care for Country and its relevance to our work. The Net Zero Commission values Aboriginal knowledge of caring for Country. We seek to listen, learn and build strong partnerships with First Nations peoples across NSW. Cultural approaches to caring for Country have existed for millennia and can teach us ways of adapting to our changing environment.

Regrowth by Chenaya Bancroft-Davis
Artist Statement:
This piece is about the regrowth you see after a bushfire. It was inspired after a drive to Grafton, NSW a few months after the bushfires. The Landscape was blackened with tiny pops of green on the charred ground.

Published by the Net Zero Commission

2024 Annual Report

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Department or Agency reference number EH2024/0304

The Hon Penny Sharpe MLC
Minister for Climate Change
52 Martin Place
Sydney NSW 2000

Dear Minister

In accordance with the requirements of Section 21 of the *Climate Change (Net Zero Future) Act 2023*, I am pleased to provide the Net Zero Commission's annual report for 2023–24.

As the Commission commenced operations after 2023–24, this first report is necessarily an initial assessment of progress towards the primary emissions targets and the adaptation objective.

The report will be formatted by the Commission to meet Government accessibility requirements and to support tabling in the Parliament.

Yours sincerely

Dr Paul Grimes PSM
Chair, Net Zero Commission

1 November 2024

The Commission's report was provided to the Minister for Climate Change on 1 November 2024 in accordance with the requirements of the *Climate Change (Net Zero Future) Act 2023*. It was formatted to meet accessibility and other publication requirements, with no change to the content of the report, and submitted on 5 November 2024 to support tabling in the NSW Parliament. Minor typographical errors were amended and the report was republished on 17 December 2024.

Contents

Chapter 1: Introduction and overview

1.1 The Net Zero Commission

The Net Zero Commission (the Commission) has been established by the Parliament of NSW to play a central role in advising the NSW Government on strategies, programs and policies to achieve net zero by 2050 and progress towards this target. Under this legislation, it also has the responsibility to advise on policies to ensure that NSW adapts effectively to the impacts of global warming, and to provide education and information to promote action to address climate change.

The Parliament of NSW established the Joint Standing Committee on Net Zero Future to monitor and review the exercise of the Net Zero Commission's functions under the *Climate Change (Net Zero Future) Act 2023 (the Act).*

Specifically, the Act (section 15) lays out 5 key functions:

1. to monitor, review and provide recommendations on progress towards the primary emissions targets for NSW
2. to monitor, review and provide recommendations on progress towards the adaptation objective
3. to monitor and review action currently being taken in NSW to address climate change
   a) with a focus on the environmental, social and economic impacts
   b) and a specific focus on the strategies, policies and programs of the Government of NSW
4. to identify and recommend action that should be taken by the Government of NSW
5. to educate and inform the Government of NSW, business, organisations and individuals to promote action to address climate change.

This is the first annual report of the Commission following the appointment of Commissioners in July 2024. The report is constrained in its scope and depth of analysis given the Commission has had very limited time to both become established and to consider a very broad range of matters. This timing has also meant that this first annual report is not informed by the depth of stakeholder engagement the Commission expects to undertake as a fundamental part of its functions in future years. The timing specified in the Act for submission of this first annual report has necessitated its preparation before the appointment of an Agriculture Commissioner, and hence the consultation process required by section 21(2) of the Act has not been possible.

The Commission is committed to effective consultation with all interested stakeholders, and to fulfil its accountabilities with respect to addressing the guiding principles of the Act which are broad ranging (see box 1.1.A).

Box 1.1.A Section 8, Climate Change (Net Zero Future) Act 2023 – Guiding principles

The guiding principles are set out in section 8 of the Act as follows.

For this Act, the guiding principles are the principles set out in this section.

1. There is a critical need to act to address climate change, which is a serious threat to the social, economic and environmental wellbeing of NSW.
2. Action to address climate change should be taken as early as possible to minimise the cost and adverse impacts of climate change.
3. Action to address climate change should be taken in a way that—
   a) is fiscally responsible, and
   b) promotes sustainable economic growth, and
   c) considers the economic risks of delaying action to address climate change, and
   d) considers the impact on rural, regional, and remote communities in NSW.
4. Action to address climate change should be consistent with the right to a clean, healthy and sustainable environment.
5. Action to address climate change should be consistent with the principles of ecologically sustainable development described in the *Protection of the Environment Administration Act 1991*, section 6(2).
6. Action to address climate change should involve appropriate consultation with affected persons, communities and stakeholders.
7. Action to address climate change should take into account the following—
   a) the knowledge and perspectives of Aboriginal communities,
   b) the best available science,
   c) the knowledge of rural, regional and remote communities in NSW,

Box 1.1.A Section 8, Climate Change (Net Zero Future) Act 2023 – Guiding principles

d) the need to support local communities, including Aboriginal communities, who may be affected by the action, including by—

i) considering the impact on local employment and industries, and

ii) diversifying local economies, and

iii) encouraging local procurement, and

iv) optimising job creation and employment transition opportunities, and

v) considering the impact on the amenity of local communities,

e) the need for education and skills diversification,

f) the need to ensure essential utilities and infrastructure are provided, including energy, water, telecommunications and transport,

g) the impact of the action on consumer costs in NSW, including energy costs,

h) the need to reduce the risk climate change poses to human health,

i) equity and social justice impacts on socially disadvantaged groups and economically vulnerable regions,

j) the need to reduce the risk climate change poses to the survival of all species.

8. Action to address climate change should take into account the impact on animals.

9. The Government of NSW is responsible for—

i) urgently developing and implementing strategies, policies and programs to address climate change, and

ii) ensuring the Government of NSW pursues best practice in addressing climate change.

Notwithstanding the constraints, the statutory requirement to prepare and submit an annual report covering the 2023-24 financial year by 1 November 2024 provides a valuable opportunity to undertake an initial assessment to inform the development of Commission's work program for 2025 and beyond. In turn, this assessment has also identified some key themes and messages.

1.2 Approach to the Commission's initial assessment

The Act requires the Commission to prepare an annual report for the previous financial year, with this annual report to be provided to the Minister for Climate Change by 1 November 2024. In addition to summarising any reports provided to the minister in the previous financial year, the Commission is required to report on:

- NSW's progress towards the state's emissions targets
- NSW's progress in relation to the adaptation objective.

For this first annual report, there are no reports to summarise, as the Commission was not in operation in the 2023-24 financial year.[1] Nevertheless, the Commission is able to provide its initial assessment of progress towards the state's emissions targets and the adaptation objective.

The emissions targets set out in the Act are:

- by 30 June 2030 — to reduce net greenhouse gas emissions in NSW by at least 50 per cent from the net greenhouse gas emissions in 2005
- by 30 June 2035 — to reduce net greenhouse gas emissions in NSW by at least 70 per cent from the net greenhouse gas emissions in 2005
- by 30 June 2050 — to reduce net greenhouse gas emissions in NSW to zero.

The adaptation objective established by the Act is 'that NSW is more resilient to a changing climate'.

The Climate Change Authority's (CCA) Sector Pathways Review, released in September 2024, provides a national framework and meaningful insights that are directly applicable to the NSW state context. As explored further in chapter 2, the Commission has conducted its initial assessment of progress towards the emissions targets by focussing on progress for each of the sectors used in the Climate Change Authority's Sector Pathways Review, released in September 2024.

These sectors are electricity and energy, transport, resources, industry and waste, built environment, agriculture and the land sector.

[1] In addition, this annual report is not a governance annual report as the Commission commenced operations in July 2024.

For each of these sectors, the Commission has drawn on the National Greenhouse Accounts 2022: State and Territory Greenhouse Inventory (Inventory) data prepared by the Australian Government to assess longer term trends in emissions between 2005 and 2022. This data is useful in providing a high-level picture of how NSW has been tracking, but data for the 2023-24 year will only be fully available in 2026, as state and territory inventories are usually published on a calendar year basis, with a lag of over 12 months. Accordingly, the Commission has placed an emphasis on summarising how key policies and programs have been tracking more recently, including in 2023-24, drawing on information largely provided by NSW Government departments and agencies. The Commission and Office will strive to identify and establish further data sources for its 2024-25 assessment.

In relation to the adaptation objective, the Commission has also drawn on information provided by NSW Government agencies.

1.3 Overview

The average temperature in NSW in 2023-24 was the fourth highest recorded in over a century, measuring 1.6 degrees above the average for the reference period used by the Australian Bureau of Meteorology.[2] Looking back over almost 125 years, the 5 warmest years, as measured by the average temperature over the entire year, have ***all*** occurred in the past decade. Together with the increase in average temperature, NSW will be increasingly exposed to increased variability in weather conditions, and some extreme weather events in the future.

NSW must play its role in confronting the challenge of global warming by acting decisively to transition our economy to a net zero emissions future. At the same time, we must also act decisively to ensure we adapt to the reality of a warmer planet.

The achievement of the emissions targets the Parliament of NSW has established for 2030, 2035 and 2050 are far from assured.

Unless action is accelerated, NSW may not reach net zero by 2050 and we will fail to meet our nearer term targets. This will require ongoing cooperation from governments at all levels, along with businesses of all sizes, as they work together with households and the wider community.

Many of the foundational elements for NSW to commence the transition towards net zero are in place.

The NSW Government's Net Zero Plan and Electricity Infrastructure Roadmap provide overarching frameworks for an array of policies and programs at the state level. At the same time, national policies implemented by the Australian Government, including the Capacity Investment Scheme, the Safeguard Mechanism, and national New Vehicle Efficiency Standards, among others, all have important roles in supporting and driving the transition to net zero in NSW. Initiatives being pursued by business, either acting individually or collectively, beyond the direct requirements of government regulation, are also essential.

However, sustained progress towards achieving net zero requires not only the effective implementation of existing policies, but also the capacity to identify where these policies must be refined or improved. It also requires the capacity to identify and fill policy gaps and determine the scope for further action. Further opportunities to accelerate progress must also be considered. The NSW Net Zero Commission has a key role to play as an adviser to the NSW Minister for Climate Change, and through the minister, to the Parliament of NSW in helping achieve the necessary progress.

[2] Australian Government Bureau of Meteorology 2024.

1.4 How is NSW tracking in reducing emissions?

NSW has made considerable progress in reducing its emissions since 2005. However, achieving the targets for 2030 and 2035 are not assured, and an acceleration in effort will be required to keep them within reach.

The most recent projections for NSW were released by the NSW Department of Climate Change, Energy, the Environment and Water in April 2024.

The April 2024 projections show NSW barely reaching its targets for 2030 and 2035, but only under the most optimistic assumptions modelled. Otherwise, the projections show NSW falling short of the targets, especially in 2030. In response to these projections, the NSW Minister for Energy and Climate Change noted in her statement on 23 April 2024 that they demanded a "redoubling of effort" and that the Government's policy was that "all sectors needed to ratchet down their emissions to meet NSW legislated targets".

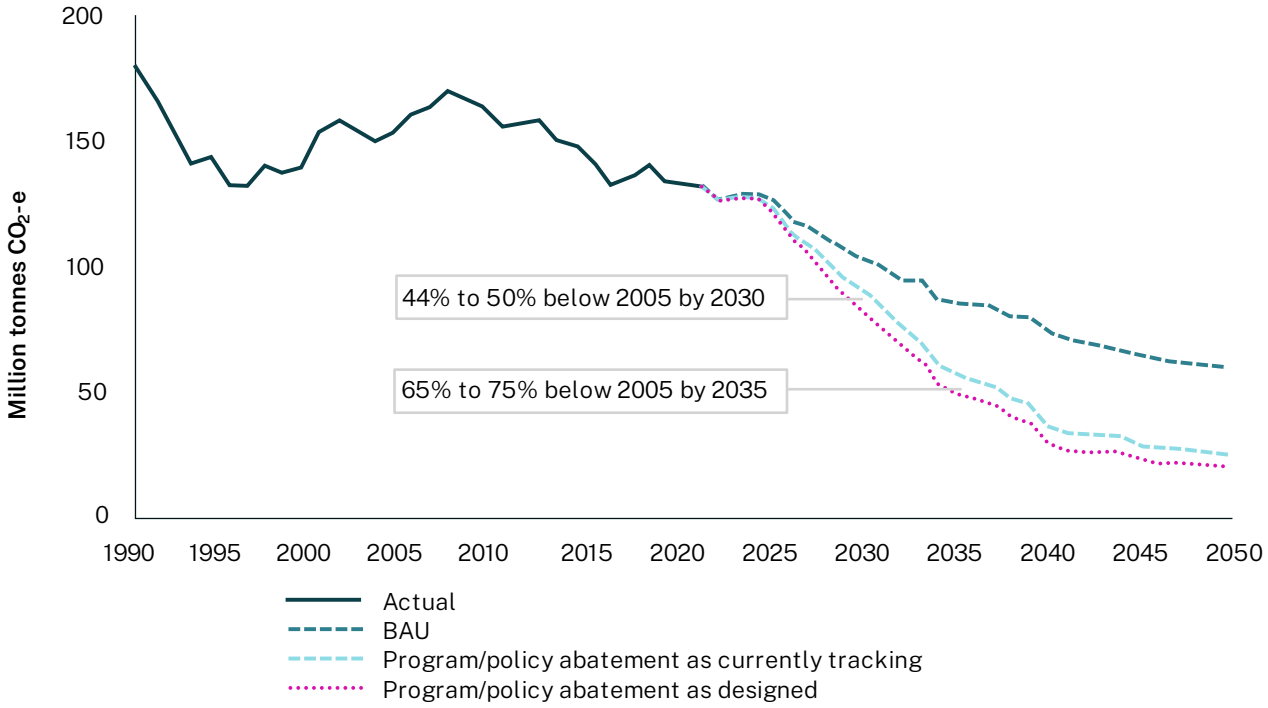


Figure 1.4.A: NSW DCCEEW Emissions Projections at April 2024 (NSW greenhouse emissions as inventoried (1990-2021) and projected business-as-usual and current policy scenarios (2022-2050)

1.5 Areas requiring specific attention

An overarching theme arising from the Commission's initial assessment is that a considerable upscaling and acceleration in activity will be required if NSW is to stay in reach of its emissions targets. As noted earlier, unless faster and more significant progress is made, the target for 2030 will not be achieved, the 2035 target could be out of reach, and the challenge of meeting net zero by 2050 may become more difficult.

In the immediate term and beyond, the electricity and energy sector remains central in the drive towards net zero, both in reducing its own emissions and enabling other sectors to decarbonise through electrification.

Further significant decarbonisation in the electricity and energy sector will be required to meet the state's targets in 2030 and 2035.

The NSW Electricity Infrastructure Roadmap (the Roadmap) provides the policy foundation for emissions reductions in the electricity and energy sector. While the NSW Government has locked in financial underwriting contracts for about half of the renewable generation and 30 per cent of the long-duration storage needed to meet the Roadmap targets for 2030, there is still work to do to accelerate the build of renewable generation and storage to ensure Roadmap targets can be met. It is also important that infrastructure projects are delivered on time. There are ongoing risks to the delivery of the Roadmap, particularly regarding transmission projects, that require close ongoing monitoring and attention. A sustained focus on addressing barriers to implementation and streamlining processes is required to ensure critical electricity infrastructure is delivered as fast as possible.

All sectors of the economy will need to play their part in meeting NSW's legislated targets for 2030 and 2035 toward achieving net zero by 2050. This will involve all areas of government being committed to the achievement of these targets in their policies and decision-making.

At the same time, the achievement of the 2030 and 2035 targets will require a step-up in progress across other sectors of the economy. This includes transport, buildings, resources and low-temperature industrial processes, among others, where commercially available technologies exist to reduce emissions.

Along with accelerated progress across the board, there needs to be a clear focus on leveraging dependencies between sectors, so action in one sector contributes to decarbonisation in another. This is well understood for the electricity grid, which is essential to decarbonise sectors such as transport or buildings through electrification. It also applies in reverse, reducing electricity use in buildings or charging electric vehicles when renewables are most abundant can greatly reduce new generation and transmission needed to decarbonise the electricity grid. This emphasises the importance of the NSW Government developing and progressing initiatives to make greater use of consumer energy resources.

Similarly, policies, programs and incentives to increase demand of low-carbon steel, cement, aluminium and other construction materials in the built environment can create market drivers to boost the pace of investment to decarbonise industrial activity. Leveraging these relationships between sectors offers major opportunities for policy making, to complement the existing suite of NSW Government initiatives.

The Commission is concerned about the risks to the state's targets from increased emissions in the resources sector.

There are pressures for increased emissions associated with new coal mining projects (extensions and expansions of existing mines), with a sizeable pipeline of projects that have been submitted for consideration and determination through the planning process.

Any emissions increases associated with extended or expanded projects would require all other sectors to make greater emissions reductions if the state is to meet its emissions reduction targets.[3] The emissions increases pose a major challenge for the state's regulatory arrangements.[4]

Uncertainties around the contribution the land sector will make to the state's emissions targets must be highlighted.

As discussed in chapter 2, the land sector's ability to store carbon will be greatly affected by the future impacts of climate change. Retaining the current levels of carbon storage in forests, oceans, wetlands, and soils will be a significant challenge in the coming decades. There are uncertainties around the measurement of biological carbon stock over time, and the land sector emissions estimates are subject to ongoing revisions, including significant revisions in past estimates. Among other things, this means that the 2005 benchmark that is used to judge whether the state achieves its targets is itself subject to ongoing revision, as are more recent estimates. This is not a situation that is unique to NSW but rather one that applies to national emissions estimates for Australia as a whole.

The land sector has made a major contribution to the state's emissions reductions since 2005, but increased focus now needs to be placed in reducing emissions in other sectors.
Figure 1.5.A below shows that total emissions in NSW, including the land sector, decreased by 27 per cent between 2005 and 2022. However, excluding the land sector, emissions in NSW decreased by only 18 per cent during the same period.

[3] NSW Environment Protection Authority 2024.
[4] Sharpe 2024; Faehrmann MP 2024.

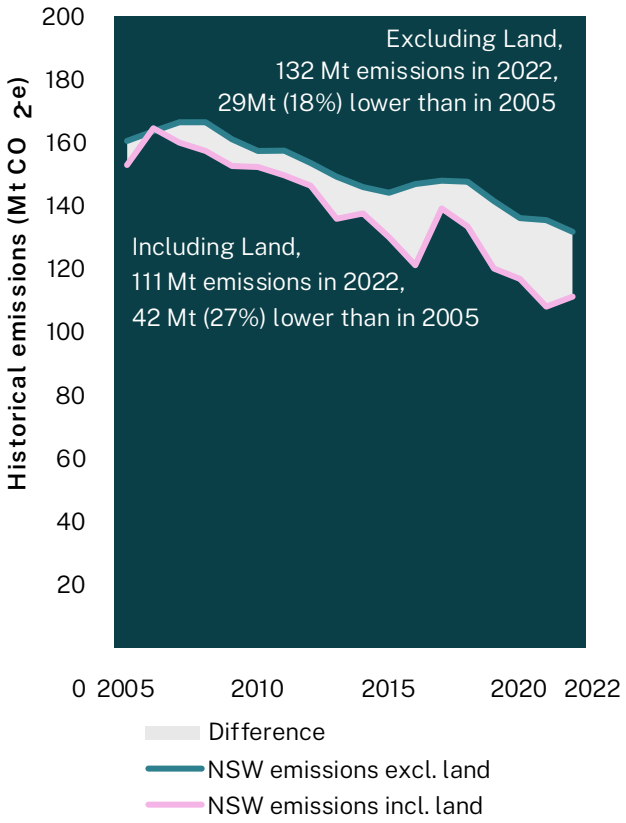


Figure 1.5.A: Estimated emissions in NSW, with and without the land sector, 2005 to 2022

Priority should now be given to completing the state-wide climate risk assessment, following the recent delivery of the NSW Climate Change Adaption Action Plan 2025-2029 and the updated NSW and Australian Regional Climate Modelling (NARCliM 2.0).

NSW has established the foundation of its climate change adaptation approach through the NSW Climate Change Adaptation Strategy, and the recently delivered action plan. The completion of the state-wide risk assessment, which is a key element to inform adaptation action, should now be prioritised.

Building resilience to a changing climate will require actions from all levels of government, business and industry, communities and individuals.

1.6 How does the Commission intend to progress its work?

There is more work to be done to bed down the office supporting the Commissioners. The aim is to have this phase completed as quickly as possible, setting up the Commission to progress its work in 2025.

A team of analysts and administrative support for the Commission is provided by the NSW Department of Climate Change, Energy, the Environment and Water. The department assigned interim Directors to lead the Office of the Net Zero Commission, with recruitment of an ongoing head of office currently underway in accordance with departmental appointment arrangements.

Informed by its initial progress assessment for 2023-24, the Commission will be developing its work program for 2025 and identifying potential focus areas for reports that could be undertaken over the following 4 years.

A central responsibility will be the preparation of the Commission's Annual Report for 2024-25.

In undertaking its work, the Commission intends to take a considered approach, underpinned by effective consultation. The Act formally requires the Commission to consult with persons the Commission considers relevant or necessary for the exercise of its functions (section 17), and appropriate consultation with 'affected persons, communities and stakeholders' is one of the Act's Guiding Principles (section 8 – see box 1.1.A).

The Commission intends to pursue best practice community consultation as one of the ways it can contribute to delivering on its responsibilities and satisfy the Guiding Principles for its work under the Act in driving positive change in NSW net zero transformation journey. The Commission will engage and consult broadly to represent a variety of experiences and perspectives, including with communities, industry stakeholders, governments, non-government organisations, First Nations peoples, and a broad range of expert bodies, universities and research institutions.

In this engagement, the Commission intends to seek input and listen in an open and transparent way and use the views and concerns and other responses received, together with information from other sources, when formulating its advice and recommendations.

The Commission's assessments for 2024-25 will form the basis of any recommendations that it provides to the Minister for Climate Change and Energy in conjunction with its next annual report.

The Commission will endeavour to maintain the capacity to prepare advice in priority areas.[5] A targeted approach will be necessary to ensure that high quality advice can be provided.

In preparing any significant policy-focused reports, the Commission intends following a considered process that provides meaningful opportunities for stakeholder input and engagement, such as:

- formal opportunities for submissions
- opportunities for engagement with the Commission
- appropriate transparency around the Commission's processes.

In general, the Commission's intended processes will include:

- a formal call for initial submissions to inform development of an intended report, supported by an initial issues paper or similar document
- an opportunity for final submissions to be made following the release of an interim report or other appropriate opportunity for comment and feedback to be provided by stakeholders. Stakeholder roundtables, and other opportunities for engagement may also be appropriate, depending on the nature of the report, to ensure that the Commission undertakes its functions with a proper degree of consultation.

In addition to representing good practice for a central advisory body, a structured approach will ensure that the Commission meets its statutory obligations under the Act.

In preparing its future annual reports, the Commission will also consult with the Agriculture Commissioner as required by the Act (section 21(3)).[6]

1.7 Next Steps

The Commission intends on releasing its draft forward work program for stakeholder information no later than early March 2025. This will be in conjunction with the publication of a high-level issues paper to support the development of stakeholder submissions to inform the Commission's 2024-25 annual report.

[5] Including capacity for any reports commissioned by the Minister for Climate Change in accordance with the provisions of the Act (section 19).

[6] An Agriculture Commissioner was, however, not appointed at the time of preparation of the 2023-24 Annual Report, precluding the capacity to meet this requirement for this year.

Chapter 2: Mitigation measures

2.1 Emissions assessment

This chapter presents an initial assessment of progress towards the NSW legislated emissions reduction targets by sector.

For this initial assessment, prepared under tight time constraints, the Commission has drawn heavily on data for each sector in NSW, as reported in the Australian Government's National Greenhouse Accounts 2022: State and Territory Greenhouse Gas Inventory[7] (Inventory) between 2005 and 2022. The Inventory figures are used throughout this chapter.

For this analysis, the NSW economy is discussed in line with the sectors used by the Australian Government and the Climate Change Authority in their respective Net Zero Plan and Sector Pathways review.[8]

The sectors presented in this chapter are listed based on their total contribution to NSW emissions in 2022, from largest to smallest.

Emissions discussed in this chapter generally refers to direct emissions, or Scope 1 emissions as per the Inventory. Where relevant, some sections also discuss indirect emissions, or Scope 2 and 3 emissions, to highlight notable impacts of a sector's activities on emissions elsewhere.

[7] Australian Government Department of Climate Change, Energy, the Environment and Water 2024.
[8] Australian Government Department of Climate Change, Energy, the Environment and Water 2024b; Climate Change Authority 2024a.

Box 2.1.A: NSW net emissions

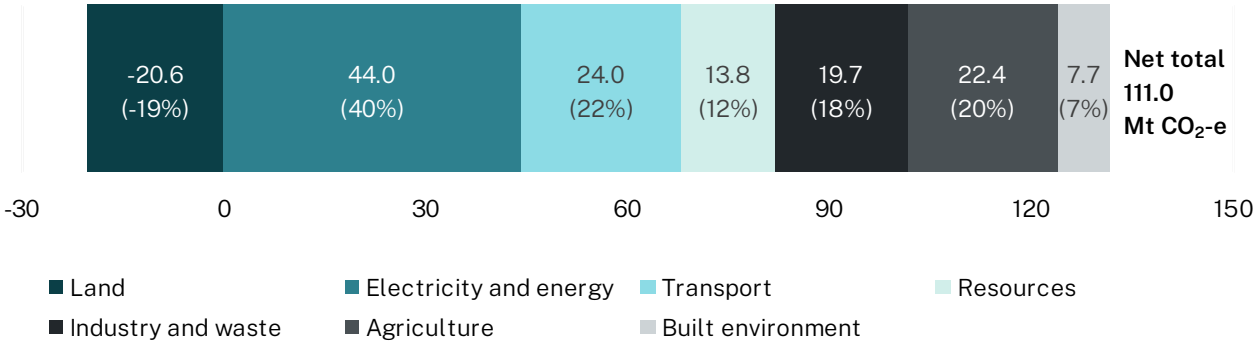


Figure 2.1.A: NSW net emissions by sector in 2022

According to the Inventory, NSW's net greenhouse gas emissions in 2022 are estimated at 111 million tonnes (Mt) of carbon dioxide equivalent (CO_2-e), representing approximately 26 per cent of emissions nationally (Figure 2.1.A). Within NSW, the electricity and energy sector remains the largest source of emissions (44.0 Mt CO_2-e), followed by transport (24.0 Mt CO_2-e) and agriculture (22.4 Mt CO_2-e). In 2022, the land sector was estimated to have a negative net emissions balance of 20.6 Mt CO_2-e. Total state emissions decreased by around 42 Mt CO_2-e between 2005 and 2022, a reduction of 27 per cent. A breakdown of emissions by sector can be found in Table 2.1.A.

Sector	2005 (Mt CO_2-e)	2022 (Mt CO_2-e)	Change from 2005 (Mt CO_2-e)	Change from 2005 (%)
Electricity and energy	61.2	44.0	-17.3	-28
Transport	24.2	24.0	-0.2	-1
Resources	20.8	13.8	-7.0	-34
Industry and waste	26.5	19.7	- 6.8	-26
Built environment	4.0	7.7	3.7	92
Agriculture	23.5	22.4	- 1.1	-5
Land	-7.6	-20.6	-13.0	-172
Total	**152.6**	**111.0**	**-41.7**	**-27**

Table 2.1.A. NSW greenhouse emissions by sector, and change between 2005 and 2022

2.2 Electricity and energy sector

Summary of the Commission's initial assessment of progress

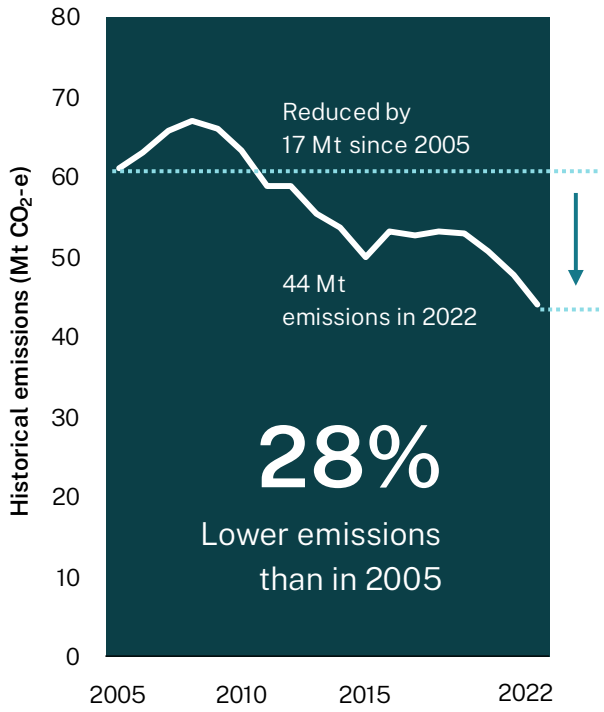


Figure 2.2.A: Annual emissions from the electricity and energy sector, 2005–22

The rapid decarbonisation of the electricity and energy sector is critical to NSW achieving its emissions reductions targets. It is the single greatest contributor to NSW emissions, and electrification underpins many emissions reduction measures in transport, industry and buildings. In 2023-24, 64 per cent of NSW's electricity generation was from coal and 34 per cent from renewables, and electricity emissions reduced by 2.5 per cent compared to 2022-23.

Further emissions reductions in this sector will be underpinned by expansions in wind and solar power generation and energy storage. These are supported by the NSW Electricity Infrastructure Roadmap (the Roadmap) and the Australian Government's Capacity Investment Scheme. Unless the pace of build of renewable generation is accelerated, the Roadmap targets will not be achieved in 2030.

The NSW Government has provided financial underwriting through Long Term Energy Service Agreements but this does not guarantee that supported projects will proceed. The delivery of the transmission networks needed to enable additional large scale renewable generation is a key risk to the delivery of the Roadmap. As part of addressing this risk, NSW needs to make greater use of existing transmission and distribution networks to connect new renewable generation. Continued expansion of consumer energy resources also needs to be a priority.

The May 2024 decision to provide support to defer the closure of the Eraring power station on the grounds of ensuring power security, emphasises the need to redouble efforts to deliver the Roadmap and accelerate the rollout of renewables. Every year that Eraring continues operations beyond 2025 means the state's emissions will be significantly higher than with an earlier closure.

Energy and electricity sector emissions are dominated by fossil-fuel-based electricity generation (see Box 2.2.A). In 2023-24, 64 per cent of electricity generation came from coal and 2 per cent from gas. The proportion of renewables in the generation mix continues to increase. It was only 5 per cent in 2005–06, the baseline year for the NSW emissions reduction targets. In 2022–23 it was 31 per cent, and 34 per cent in 2023–24 (see Figures 2.2.B and 2.2.C).[9] However, emissions fell by only 2.5 per cent (1 Mt CO_2-e) between 2022-23 and 2023-24 compared to an average 5.4 per cent (2.6 Mt CO_2-e) annual reduction over the previous 4 years.[10]

Box 2.2.A: NSW electricity and energy sector emissions profile

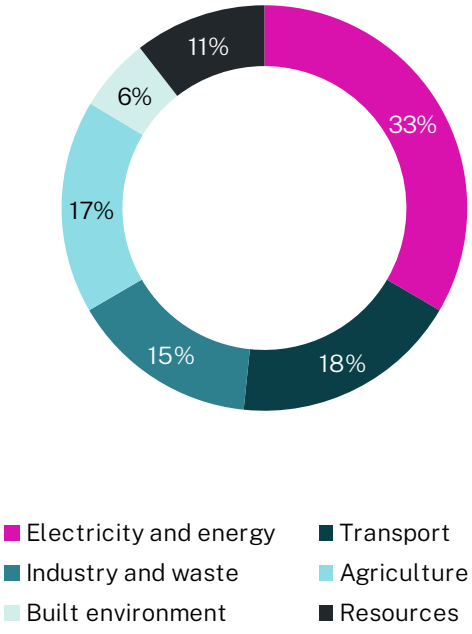


Figure 2.2.B: Electricity and energy emissions as part of NSW emissions, excluding the land sector, 2022

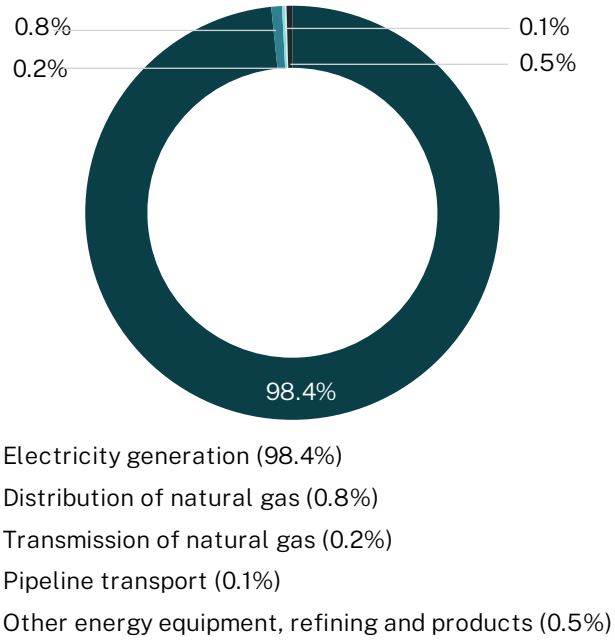


Figure 2.2.C: Emissions in the NSW electricity and energy sector, 2022

The electricity and energy sector includes electricity generation as well as the transport and supply of gas and liquid fuels. According to the Inventory, 98.4 per cent of the sector's 44 Mt CO_2-e of emissions in 2022 came from electricity generation (see Figure 2.2.B), of which 96 per cent was from coal combustion.[11] This sector was the source of 33 per cent of NSW's emissions in 2022, excluding the land sector (see Figure 2.2.A).[12]

[9] Open Electricity 2024.

[10] Open Electricity 2024.

[11] Australian Government Department of Climate Change, Energy, the Environment and Water 2024; Australian Clean Energy Regulator 2024.

[12] Australian Government Department of Climate Change, Energy, the Environment and Water 2024.

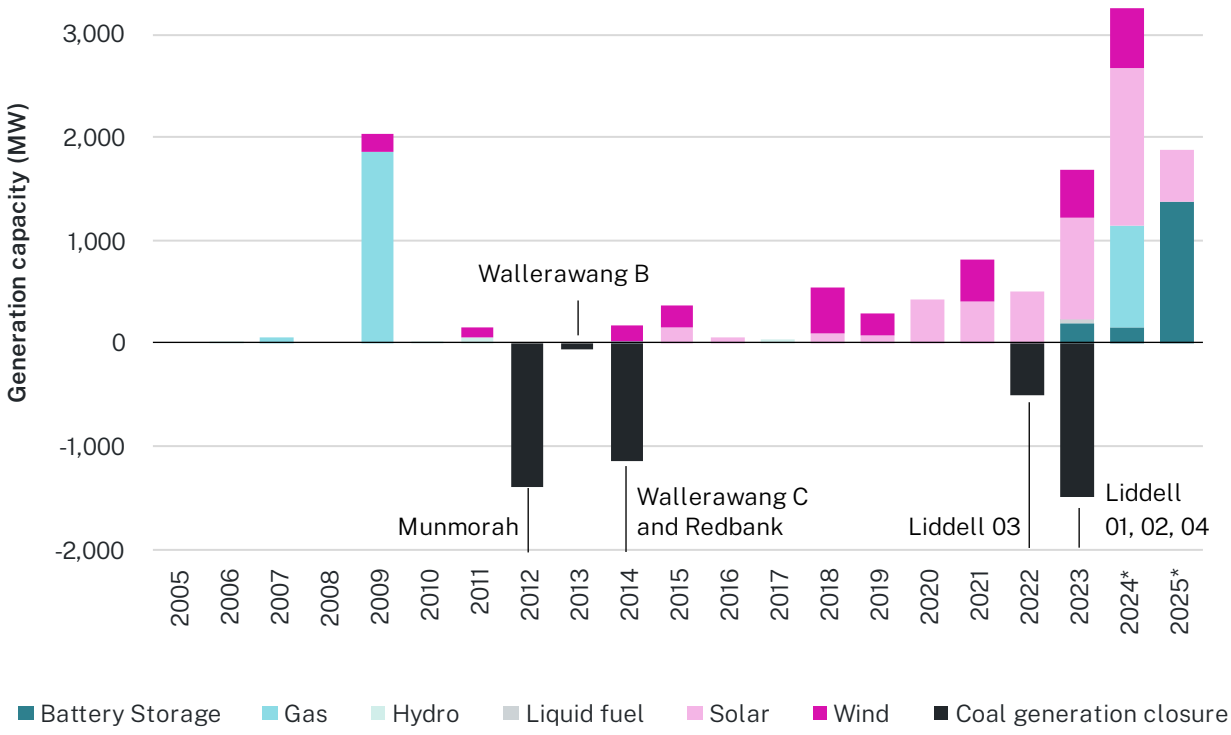


Figure 2.2.D: NSW new and retired utility-scale generation capacity 2005–23, and capacity currently expected to be added in 2024 and 2025. *Only additions currently considered as of high confidence are included [13]

A total of 1,599 MW in new large-scale generation capacity was added to the NSW grid in 2023-24. This was composed of 377 MW of wind, 848 MW of large-scale solar and 374 MW of gas. An additional 160 MW of battery storage was also added in 2023-24. The added total renewable capacity was 778 MW annually on average over the 3 preceding years.[14] Figure 2.2.D shows the changes in utility scale generation capacity in NSW since 2005, showing closures of coal power stations and additions of renewable generation, gas generation, and storage capacity.

In addition to new utility scale generation, rooftop solar capacity in NSW has expanded considerably over the past decade. In 2023–24, it was 11 per cent (8,000 GWh) of NSW's total generation, up from 9.8 per cent (6,775 GWh) the previous year (see Figures 2.2.E and 2.2.F).[15]

[13] Internal analysis by the NSW Department of Climate Change, Energy, Environment and Water.
[14] Internal analysis by the NSW Department of Climate Change, Energy, Environment and Water.
[15] Open Electricity 2024.

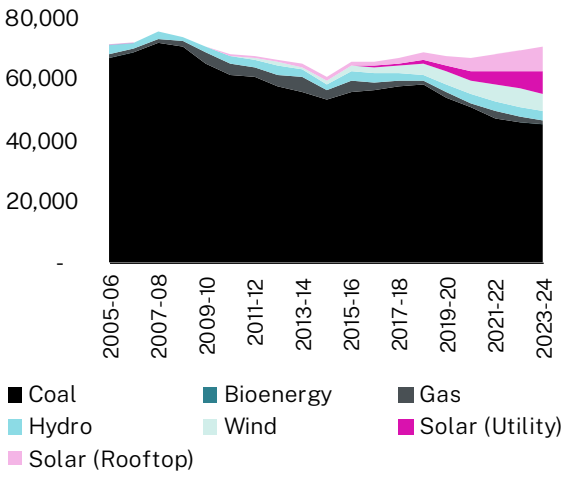


Figure 2.2.E (left): NSW electricity generation mix by source, 2005–06 to 2023–24 (GWh)[16]

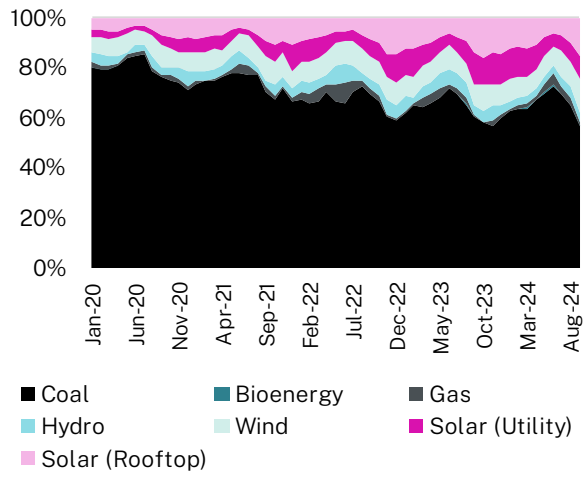


Figure 2.2.F (right): NSW electricity generation mix by source, 2020–24 (%)[17]

State and Australian Government engagement in the sector

Clear NSW and national policies, targets and institutions are in place to drive the decarbonisation of the electricity and energy sector. In 2020, the NSW Government launched the Electricity Infrastructure Roadmap (the Roadmap) to coordinate the transition to a largely decarbonised electricity grid over two decades. The Roadmap includes targets for 12 GW of new renewable generation capacity (33.6 TWh) and 16 GWh of long duration storage capacity. An additional long-duration storage target of 12 GWh by 2034 was added in October 2024. The Roadmap includes regional coordinated planning in the form of Renewable Energy Zones (REZs). The Roadmap also contains an underwriting mechanism which aims to accelerate private sector investment in generation and long-duration storage projects through Long Term Energy Service Agreements (LTESAs). Including 2023-24, only 17 per cent of the Roadmap target capacity (approx. 2 GW) has been commissioned.[18] With 5 years left to deliver the remainder, an additional 2 GW will need to be commissioned each year. This is equivalent to the commissioned capacity over the past three years, highlighting the need for acceleration.

The volume of LTESAs signed under the Roadmap is an indicator of how much emissions could reduce by in coming years. According to the Consumer Trustee of the Roadmap, AEMO Services, underwriting agreements are now in place for around half of the 2030 renewable generation target and around 30 per cent of the storage target.[19] These aim to support developers with reaching a financial investment decision; however, they do not guarantee that projects will progress. AEMO Services expects further progress in early 2025, as tenders for storage and access rights for renewable generation and transmission are awarded in the South-West REZ and the Central-West Orana REZ.

[16] Open Electricity 2024.
[17] Open Electricity 2024.
[18] Internal analysis by the NSW Department of Climate Change, Energy, Environment and Water.
[19] AEMO Services Limited 2024a; AEMO Services Limited 2024b.

The Australian Government's Capacity Investment Scheme (CIS) was launched in May 2023 and expanded in November that year to achieve a target of 32 GW new capacity nationally.[20] The CIS provides further investment support and has been fully integrated within Roadmap processes. In the first tender round in 2023-24, CIS underwriting was awarded for 550 MW of NSW projects.[21] Successful bids for the 2024 generation tender under the CIS are expected to be announced in November 2024, with at least 2.2 GW out of the 6 GW specifically for projects in NSW. A further 4 GW long-duration storage tender round will open late 2024.

Transitioning away from coal power

The output from coal power stations has decreased from 47 TWh in 2021-22 to 45 TWh in 2023-24, in line with the trend over the previous years (see Figure 2.2.E). According to the Electricity Supply and Reliability Check Up Review (the 'Check Up') commissioned by the NSW Government and delivered in August 2023, all of NSW's remaining coal generation capacity will likely need to be replaced in the next 10 to 15 years (see Table 2.2.A).[22] The progressive reduction in output and closure of coal power generation is necessary for NSW to meet the state's emissions targets. The Check Up emphasised the need for coordination as coal power plants close, and recent state government policy interventions have underpinned extensions of operation. The deferral of closure dates for Liddell and Eraring coal power stations (see Table 2.2.A) demonstrates challenges with electricity supply reliability standards and securing firm supply.

Coal generator	Capacity (MW)	Year of closure
Munmorah	600	2012
Redbank	144	2014
Wallerawang C	1,000	2014
Liddell	2,000	2023 (deferred from 2022)
Eraring	2,880	2027–29 (estimated, deferred from 2025)
Vales Point	1,320	2033 (estimated)
Bayswater	2,640	2033 (estimated)
Mount Piper	1,400	2035–40 (estimated)

Table 2.2.A: Historical and estimated coal power station closures in NSW (future closure dates as announced by owners)[23]

Utility-scale batteries are increasingly supporting system security and reliability. The 50 MW Wallgrove battery was one of the first large batteries installed in NSW in 2022-23. A further 160 MW was added in 2023-24 and 150 MW is currently in the commissioning phase. A significant number of batteries are expected to start full operation in 2025, including the

[20] Australian Government Department of Climate Change, Energy, the Environment and Water 2024a.
[21] Marsden Jacob Associates 2023.
[22] Marsden Jacob Associates 2023.
[23] Burke, Best, and Jotzo 2018; Marsden Jacob Associates 2023.

850 MW Waratah Super Battery, most of which have been awarded tenders under the Roadmap framework in 2023 and 2024.[24] The NSW Energy Security Corporation, which is currently in its establishment phase, intends to support investment in short and long-duration storage such as community batteries and pumped hydro.

The replacement of coal power plants with renewable energy has also seen recent investment in gas peaking generators. These facilities have smaller capacities than the coal power plants being retired. They generally operate much less frequently, largely during peak demand and periods of low renewable generation and have higher running costs. The two main developments are the Tallawarra B gas peaking plant that commenced operation in early 2024, and the 750 MW Hunter Power Project, which is expected to commence operation in December 2024. The Australian Energy Market Operator (AEMO) estimates that a small amount of gas power generation will likely be needed to ensure reliability across the electricity grid in 2050, supplementing other dispatchable energy from batteries, pumped hydro and traditional hydroelectricity.[25]

Challenges affecting the speed of building infrastructure and transmission

As noted above, the amount of renewable capacity recently having been commissioned, if sustained, is significantly less than required to meet NSW's Roadmap targets. Prolonged planning assessments, slow investment decisions by developers, and difficulties securing workforces and equipment have been identified as factors delaying the rollout of renewable generation and transmission.[26]

Delays in the delivery of transmission projects directly constrain the pace at which new renewable generation capacity can be connected to the grid. To host the required new generation and storage capacity, EnergyCo expects that at least 1,200 km of new transmission lines will be needed in NSW by 2033[27] and AEMO estimates this to be 10,000 km nationally by 2050.[28] To coordinate such a large electricity infrastructure pipeline, the Roadmap supports development across five designated REZs. The scale and design of the REZs has evolved, with initial operational dates for Central West Orana and New England REZs delayed relative to original expectations (see Table 2.2.B). A shortage of workforce capacity and failure to secure community support are key risks for delivery, especially in relation to large-scale transmission infrastructure. Projects are already facing skills and labour shortages and supply chain constraints for international equipment purchases.[29]

[24] Internal analysis by the NSW Department of Climate Change, Energy, Environment and Water.
[25] Australian Energy Market Operator 2024a.
[26] Marsden Jacob Associates 2023; Australian Energy Market Operator 2024a.
[27] Energy Corporation of NSW 2023.
[28] Australian Energy Market Operator 2024a.
[29] Briggs et al. 2022; Clean Energy Council 2024a; Australian Government and Jobs and Skills Australia 2023; Australian Energy Market Operator 2024a.

Some new renewable generation projects can be accommodated on the existing transmission and distribution networks through network enhancements.[30] In 2023-24, the majority of the generation and most of the storage projects that contribute to Roadmap targets were outside of designated REZ boundaries.[31] EnergyCo has been working jointly with network service providers to initiate further such network enhancements that could be delivered by 2030.

	Intended network capacity	Original announced full capacity date	Current full capacity date	Status of transmission infrastructure critical to unlock full capacity
Central-West Orana	4.5 GW	Late 2025 (for earlier 3 GW option)	4.5 GW by 2028, up to 6 GW in the longer term	
New England	8 GW	2031-2035 (was 2027 in 2022 Integrated System Plan, prior to major redesign)	6 GW by 2033, up to 8 GW in the longer term	Realignment of transmission corridor following public consultation. Planning approvals by 2026.
Hunter-Central Coast	1 GW	2027	2028	
Illawarra	1 GW	No date has been published	No date has been published	
South-West	2.5 GW	2031	2029	Refer to PEC and Hume link below.
Project Energy Connect (PEC)	Stage 1: 150 MW Stage 2: 800 MW	2024-25	Stage 1: December 2024 Stage 2: July 2027	Stage 1 Western section: energised and going through interregional internetwork testing now. Stage 2 Eastern Section: at risk on construction timeline.
Hume link	2.2 GW	2025-26	Northern: July 2026 Southern: December 2026	Delivery timeframe at risk as current EIS approval behind timeline.
Sydney Ring North (Hunter Transmission Project)	5 GW	2027	December 2028	The NSW Government has issued the Planning Secretary's Environmental Assessment Requirements for the project.
Sydney Ring South	4.5 GW	2027	September 2028	AEMO Non network options consultation closed Sep 2024.
Victoria – NSW Interconnector West (VNI West)	1.93 GW Vic to NSW 1.7 GW NSW to Vic	2027-28	December 2029	On track.
Waratah Super Battery Project	0.9 MW	2025	2025	

Table 2.2.B: Progress in construction of Renewable Energy Zones and associated transmission infrastructure in NSW. Compiled from published[32] and unpublished[33] sources

[30] Marsden Jacob Associates 2023.

[31] Internal analysis by the NSW Department of Climate Change, Energy, Environment and Water.

[32] Australian Energy Market Operator 2020; Australian Energy Market Operator 2022; Australian Energy Market Operator 2024a; Energy Corporation of NSW 2023; Energy Corporation of NSW 2024; Infrastructure Partnerships Australia 2024.

[33] Discussions with the NSW Department of Climate Change, Energy, the Environment and Water, NSW Department of Planning, Housing and Infrastructure and NSW EnergyCo.

Securing community support

Securing broad community support is critical to the ongoing rollout of utility-scale renewable generation and is an emerging challenge for transmission projects.[34] In the past 5 years, wind, solar and transmission project proposals have been subject to growing numbers of negative community responses.[35] Any failure to ensure strong community engagement and social licence can lead to delays and increase project costs.[36] However, beyond a project focus, it is critical that there is an equitable basis for distributing the benefits and sharing the impacts of the transition. There are economic and social opportunities for regional communities in the expansion of renewable generation, but they need support to take advantage of them.[37] For instance, in the coming decade or longer, communities and local government will need support to be able to respond to and appraise project proposals.[38] A draft NSW energy policy framework was put on public exhibition in early 2024[39] and a national community engagement guideline was released by the Australian Government in July 2024[40] but there is more to do in this area.

Consumer energy resources

The need for large-scale electricity infrastructure can be reduced through smaller-scale technologies that enable consumers to either generate, use, manage time of use or store electricity at their premises and form part of the local distribution system.[41] These consumer energy resources (CER) include demand-side efficient and smart appliances, grid-connected technologies such as heat pump hot water, pool pumps, home batteries, and electric vehicles (EVs), at household, commercial and industrial levels.

CER could reduce demand during evening peaks and help avoid investment in additional peak generation and transmission capacity.[42] AEMO estimates that effective coordination of consumer batteries could save up to $4.1 billion in electricity infrastructure investment nationally by 2050.[43] The initiatives included in the NSW Consumer Energy Strategy released in September 2024 have the potential to make a notable contribution to the sector's decarbonisation, for example the targeted 1 million consumers having access to rooftop solar and battery systems in NSW by 2035.

[34] Legislative Council Standing Committee on State Development 2023.
[35] Internal analysis by the NSW Department of Planning, Housing and Infrastructure; McCrea et al. 2024.
[36] Australian Energy Market Operator 2024b.
[37] Regional Australia Institute 2024.
[38] The Energy Charter 2023.
[39] NSW Department of Planning, Housing and Infrastructure 2024.
[40] Australian Government Department of Climate Change, Energy, the Environment and Water 2024c.
[41] Australian Energy Market Operator 2024a; Blackhall et al. 2020; Australian Government Department of Climate Change, Energy, the Environment and Water 2024b.
[42] Blackhall et al. 2020; Clean Energy Council 2024b.
[43] Australian Energy Market Operator 2024a.

2.3 Transport sector

Summary of the Commission's initial assessment of progress

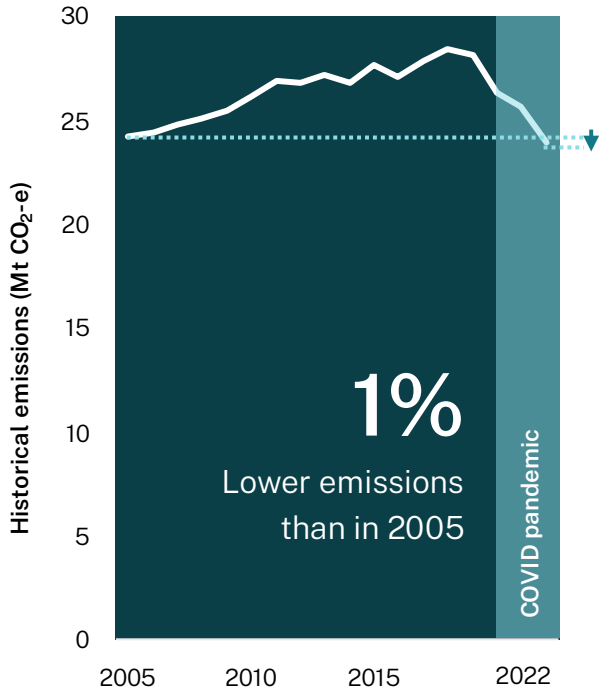


Figure 2.3.A: Annual emissions from the transport sector, 2005–22

The transport sector has been a growing source of emissions in NSW since 2005. Recent data indicates that emissions from the sector are on the rise again after a temporary decline during the COVID-19 pandemic. There were positive steps in 2023-24, such as the announcement of the Australian Government's New Vehicle Efficiency Standard, the continued rollout of electric vehicle initiatives by the NSW Government and the opening of a new Sydney Metro line. Despite this, emissions in this sector are not yet on a consistent reduction trajectory, and further policy action will likely be needed in coming years. This includes taking a holistic approach that accelerates the uptake of zero and low-emissions transport for people and freight.

NSW has made limited progress in reducing emissions from the transport sector, which increased by 3.9 Mt CO_2-e (16.1 per cent) between 2005 and 2019 (Figure 2.3.A). While emissions temporarily dropped during the pandemic, recent national data indicates they are now trending upward again.[44] Transport is the second-highest emitting sector in NSW, with road transport responsible for 87 per cent of these emissions.

Cars are the main source of emissions for this sector and reduced car usage during the pandemic led to a sharp drop in car emissions. This temporary shift masked the fact that emissions from light commercial vehicles and heavy trucking continued to rise between 2019 and 2022, increasing their share of total sector emissions.

Existing policies largely focus on 'improve' actions within transport types – such as replacing internal combustion engine vehicles with EVs. Further effort is required to 'avoid' emissions by improving the overall efficiency of the transport system and encourage a 'shift' to lower-emissions transport modes for passengers and freight. Residential development near transport nodes allowing people to travel shorter distances, and active transport planning and infrastructure to increase walking and cycling are key to avoiding emissions.

[44] Australian Government Department of Climate Change, Energy, the Environment and Water 2024c.

Emissions from cars and light commercial vehicles can be effectively reduced through electrification. Policies at federal and state levels aim to increase the adoption of light EVs, predominantly by improving vehicle emissions standards and co-funding the rollout of charging infrastructure.

The NSW Electric Vehicle Strategy, released in June 2021, set targets for 50 per cent of new car sales to be EVs by the 2030–31 financial year and the vast majority to be EVs by 2035. Under the strategy, the NSW Government launched multiple funding rounds to support EV infrastructure: 3 rounds to rollout fast chargers, 3 for destination chargers, 2 for kerbside chargers, and 1 to make strata buildings EV-ready. It also included 4 fleet electrification funding rounds. There are now 141 charging ports at 18 fast charging sites and 649 charging ports at 257 destination charging sites installed.

EVs account for just over 8 per cent of new car registrations so far in 2024, up from around 1 per cent in 2021.[45] However, growth has recently slowed. The continued growth in sales of SUVs and utility vehicles (utes) poses challenges to decarbonisation as they are more emissions-intensive and there are currently very few EV ute options on the market.

Current solutions for heavy road vehicles – electric or hydrogen – are still being developed, as are alternative fuels for aviation and shipping. The long lifespans of current vehicles and the large capital investments required to find appropriate alternatives complicate the transition.

Transport for NSW's Towards Net Zero Emissions Freight Policy, released in 2023, aims to develop a decarbonisation pathway for freight. The policy focuses on road freight vehicles with a gross vehicle mass of 4.5 tonnes or more and rail freight, recognising that rail freight produces 16 times less greenhouse gas emissions compared to road freight. However, it is only at an early implementation stage, with no significant funding committed. In the short term, the Commission encourages taking opportunities to reduce the distance travelled by each freight vehicle and shift to lower-emissions transport modes wherever possible.

The NSW Government has also committed to electrifying the state's 8,000 buses by 2047. The latest public figures state that in 2023 there were 100 low-emissions buses in Greater Sydney, with further rollouts planned. In 2024, Transport for NSW announced the start of on-road trials for roll outs in regional areas.[46] The 2021 NSW Electric Vehicle Strategy also included targets for electrifying the NSW Government's own vehicle fleet, which was complemented in August 2023 with a requirement for agencies to prioritise EVs when replacing an existing passenger vehicle. Government procurement has a role in decarbonising the sector, and the Commission will seek to understand the impact these policies have had in the Commission's 2024-25 report.

[45] Transport for NSW 2024.
[46] Transport for NSW 2022.

Transport is the second largest source of emissions in NSW, and the sector is not yet on a consistent reductions trajectory. For this reason, the Commission will more closely assess the need for more targeted action to reduce transport emissions in its assessment for 2024-25.

There are opportunities to encourage a shift to lower-emissions transport modes and deploy commercially available technologies at scale, but also challenges in developing some of the technologies needed for the future. Better coordination is required across government, between different levels of government, and between government and industry to ensure a holistic systems approach to decarbonising the sector.

Box 2.3.A: Transport sector emissions profile

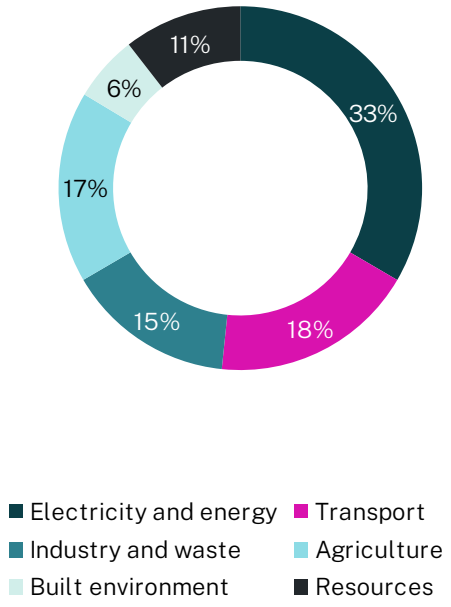


Figure 2.3.B: Transport emissions as a proportion of NSW emissions, excluding the land sector, 2022

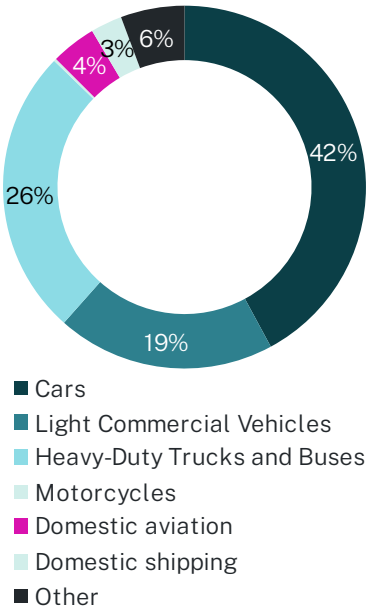


Figure 2.3.C: Breakdown of emissions within NSW transport sector, 2022

In 2022, the transport sector generated 24 Mt CO_2-e, 18 per cent of NSW emissions (Figure 2.3.B) Of these, 62 per cent came from light vehicles (cars and light commercial vehicles) and 26 per cent from heavy vehicles (Figure 2.3.C). The 3 dominant emissions sources were cars (10.1 Mt CO_2-e), heavy trucks and buses (6.7 Mt CO_2-e) and light commercial vehicles (4.7 Mt CO_2-e).

Transport sector emissions come almost exclusively from the combustion of liquid fossil fuels. For the road transport sector, this means diesel and unleaded petrol. Emissions from electricity generation for electrified transport are accounted for in the electricity and energy section.

2.4 Agriculture and land sector

The agriculture and land sectors are intricately linked. The ecosystem services that the land sector provides support agricultural activities, while these activities can also heavily influence the land sector's emissions. Natural events also influence the net total emissions of both sectors.

Landholders, farmers and growers conduct activities on land they own or manage, but depending on greenhouse gas accounting rules, emissions from these activities appear in different parts of the Inventory. Many of the currently available and feasible opportunities for farmers and growers to reduce emissions are through land-based interventions that would appear in the land sector's Inventory. For example, farmers can take action on their properties to store more carbon by planting trees or increasing organic matter in soils, but the carbon storage such actions enable will appear under the land sector in the Inventory, rather than under the agriculture sector.

To align with the Inventory, this report largely discusses emissions and carbon storage in the agriculture and land sectors individually. But it is important to keep in mind how connected they are, and that many opportunities to reduce emissions in the agriculture sector sit within the land sector.

2.4.1 Agriculture sector

Summary of the Commission's initial assessment of progress

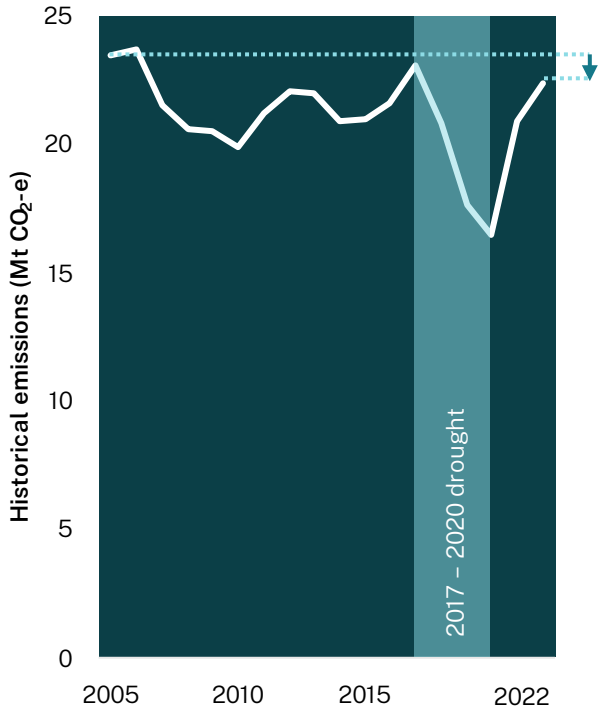


Figure 2.4.1.A: Annual emissions from the agriculture sector, 2005–22

The latest Inventory shows that since 2005, NSW has made limited progress in reducing emissions from the agriculture sector. The decline in agricultural emissions from 2017 to 2020 reflects the drought that affected much of the state, followed by increased emissions during the drought recovery phase from 2020 to 2022 (Figure 2.4.1.A).

NSW and Australian Government emissions reduction initiatives continued to be rolled out in this sector in 2023–24. However, without accelerated efforts from governments and agricultural producers, the sector is unlikely to significantly contribute to the state's primary emissions reduction targets for 2030 and 2035, and it is likely to be the largest source of remaining emissions in 2050.[47]

[47] NSW Department of Climate Change, Energy, the Environment and Water 2024a.

Box 2.4.1.A: Agriculture sector emissions profile

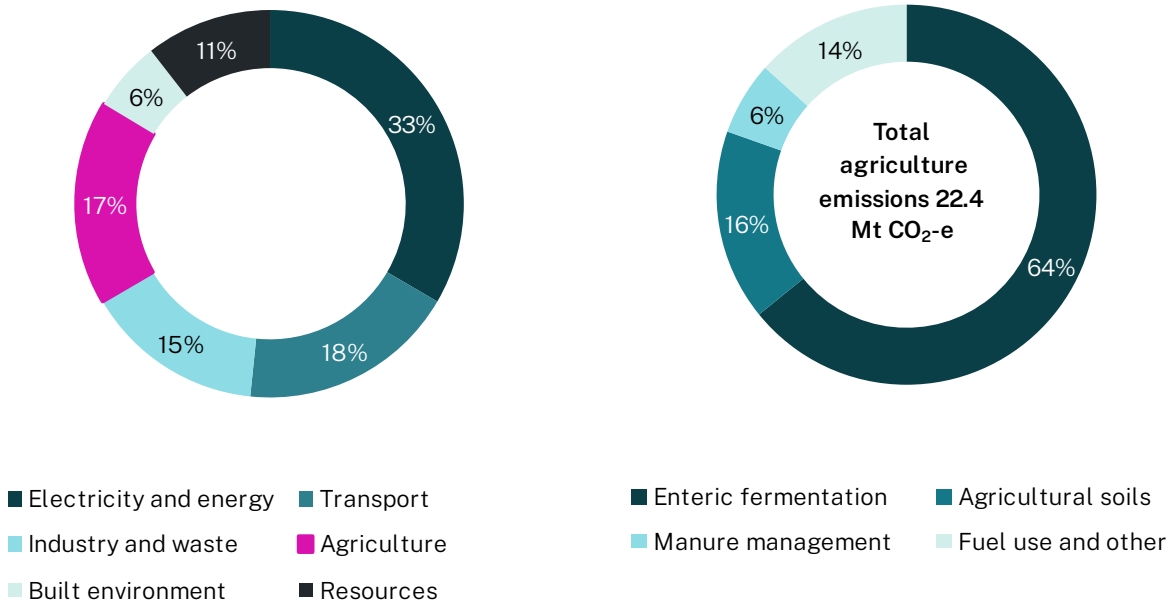


Figure 2.4.1.B: Agriculture emissions as part of NSW emissions, excluding the land sector, 2022

Figure 2.4.1.C: Emissions in the NSW agriculture sector, 2022

The agriculture sector's emissions come from several sources, including enteric fermentation in livestock, which occurs during digestion in ruminants like cattle and sheep and releases methane as a byproduct. Other sources include agricultural soils (including fertiliser and urea application), manure management, fuel use on farms, and various other agricultural activities. Estimated emissions from the agriculture sector were approximately 22.4 Mt CO_2-e in 2021–22, representing around 17 per cent of the state's total emissions (excluding land sector emissions) and the third-largest portion of NSW's emissions profile (Figure 2.4.1.B).

Around 60 per cent of the sector's total emissions are methane (CH4) from livestock enteric fermentation (Figure 2.4.1.C). Methane and nitrous oxide (N2O) together represent about 87 per cent of the sector's estimated total emissions, or approximately 19.5 Mt CO_2-e, while the remaining emissions come from carbon dioxide (CO_2) mainly associated with urea application and fuel use (Figure 2.4.1.D).

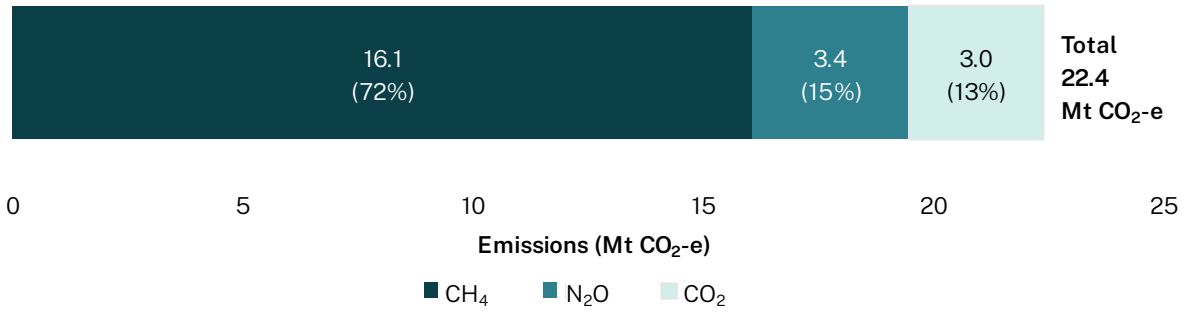


Figure 2.4.1.D: The agriculture sector's emissions volume and share, by gas, 2021–22

Fluctuations in emissions from agriculture since 2005 are primarily due to climatic conditions such as seasonal variances, rainfall patterns and periods of major drought and flooding. Over the past two decades, Australian Government and state initiatives have focused on promoting sustainable farming, enhancing climate resilience and offering financial incentives for emissions reductions. However, the Climate Change Authority's Sector Pathways Review published in 2024 suggested technical, logistical, and financial barriers are hindering the widespread adoption of emissions reduction strategies in this sector.[48]

The NSW Government is actively engaged in efforts to lower agricultural emissions. For example, the NSW Department of Primary Industries and Regional Development (DPIRD) assessed strategies for abating enteric methane in 2021[49] to inform NSW primary producers about strategies to reduce methane emissions while also improving productivity and animal health. Collaborative research projects between DPIRD, industry partners and universities are currently underway to develop decision-making tools to help industry select sheep and cattle breeds that produce low amounts of methane while maintaining productivity.[50]

At the national level, since signing the Global Methane Pledge in October 2022, Australia has committed to reducing agriculture sector methane emissions by 30 per cent by 2030. It has also committed to taking action to seek abatement opportunities in the sector.[51] As part of these efforts, the Australian Government is funding programs such as Methane Emissions Reduction in Livestock (MERiL)[52] to support the development and commercialisation of methane-reducing feed supplements for large-scale grazing systems, such as seaweed-based supplements. The program has developed a Livestock Emissions Framework for Feed Technologies fact sheet in 2023, to provide a consistent approach to estimating emission reductions from feed technologies.[53]

Other initiatives are underway to understand barriers and opportunities for reducing emissions in the agriculture and land sectors, while building capacity to ensure the continued strength and resilience of its industries. For instance, through the Primary Industries Productivity and Abatement Program (PIPAP)[54], launched in 2022, the NSW Department of Climate Change, Energy, the Environment and Water is working to support farmers and land managers to reduce emissions and sequester carbon in soils and vegetation while aiming to deliver other economic, social and environmental outcomes. This initiative launched under the NSW Net Zero Plan Stage 1: 2020–2030, aims to address barriers to participation in carbon markets by building landholder capacity, exploring linkages between carbon and nature markets, and identifying where investment in data, metrics and methods could facilitate greater market participation.

[48] Climate Change Authority 2024a.
[49] Almeida et al. 2021.
[50] NSW Department of Primary Industries and Regional Development 2024b.
[51] Australian Government 2022a.
[52] Australian Government 2022b.
[53] Australian Government Department of Climate Change, Energy, the Environment and Water 2023.
[54] NSW Department of Climate Change, Energy, the Environment and Water 2024c.

The NSW Department of Climate Change, Energy, the Environment and Water's greenhouse gas emissions projections 2023 Methods paper[55] notes that because of changes to funding, co-investment and carbon price assumptions in 2023, there is less abatement projected under PIPAP than in the previous year's projection. The PIPAP efforts highlight the link between the agriculture and land sectors, with the Program working with farmers, Aboriginal landholders, and public land managers. The High Impact Partnership projects and Living Carbon grants the PIPAP has funded to date aim at helping landholders scale up carbon storage on their land through registered Australian Carbon Credit Unit Scheme (ACCU) projects.

PIPAP is also funding the creation of the NSW Land and Primary Industries Emissions Reduction Roadmap[56] with DPIRD and the NSW Decarbonisation Innovation Hub. The project aims to guide NSW's agricultural and land sectors in reducing greenhouse gas emissions and increasing carbon storage while ensuring productivity and sustainability. It is expected to identify and evaluate viable emissions reduction strategies, address knowledge gaps, and assess barriers to adoption. The Commission understands that the project has undertaken an extensive review of industry and government climate strategies and roadmaps, while also engaging with key stakeholders to gather feedback on prioritised subsector abatement strategies. The findings are currently being compiled into an interim report. Marginal abatement cost and adoption analyses will be conducted next, followed by consultations with the government. The final roadmap is expected to be published in early 2025. Outputs from this Roadmap will be used to target further PIPAP investments.

Meanwhile, the Australian Government is developing an Agriculture and Land Sectoral Plan[57] as part of its broader Net Zero Plan. This is aimed at guiding the sector to reduce emissions while maintaining profitability and sustainability. In May 2024, it announced a $63.8 million investment over the next decade to drive emissions reduction, enhance greenhouse gas accounting in the agriculture and land sector, and support research into carbon storage.[58] These initiatives are likely to influence NSW's agriculture sector and could inform future planning and developments within the state.

The agriculture sector is expected to be the largest source of residual emissions in 2050 in the absence of technology breakthroughs or significant shifts in production, assuming emission reductions occur as projected in other sectors.[59] There are significant challenges to reducing emissions in the sector due to its diversity. The sector's geographic, production and climatic diversity makes it difficult to apply uniform emissions reduction strategies across all farming operations.

[55] NSW Department of Climate Change, Energy, the Environment and Water 2024a.
[56] ClimateKIC Australia 2024.
[57] Australian Government Department of Agriculture, Fisheries and Forestry 2024.
[58] Australian Government Department of Climate Change, Energy, the Environment and Water 2024a.
[59] NSW Department of Climate Change, Energy, the Environment and Water 2024a.

Additionally, the emissions sources in the sector present distinct technological and financial barriers. High costs of emerging technologies, such as methane-reducing feed additives, have been subject to limited adoption to date.[60] Further work is required to ensure the scalability and long-term effectiveness of these emerging technologies. Knowledge gaps also persist, especially regarding how these innovations will perform across different environmental and economic contexts. Targeted policies and funding will likely be required to support farmers in adopting proven methods and scaling up new innovations to commercial scale.
The Commission intends to consider these matters more deeply in the preparation of its annual assessment for 2024-25.

2.4.2 Land sector

Summary of the Commission's initial assessment of progress

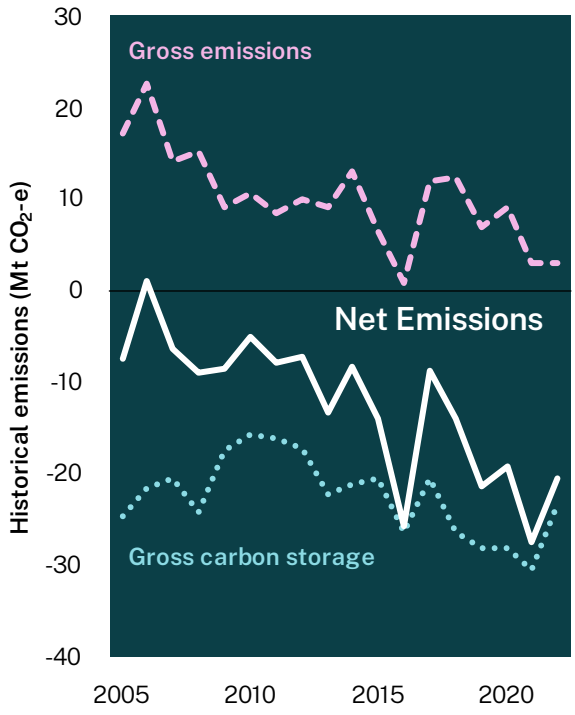


Figure 2.4.2.A: Annual emissions from the land sector, 2005–22

Reductions in net emissions from the land sector since 2005 could make major contributions to the state's 2030 and 2035 emissions reduction targets (Figure 2.4.2.A). However, these reported emissions reductions and their potential to continue over time is subject to significant uncertainty. This is partly because advances in estimation methods have frequently produced major recalculations of historical emissions in recent years, complicating predictions about future changes in land sector emissions. Further, the scale and degree of permanence of the land sector's contribution will continue to be subject to uncertainty, including in light of an evolving understanding of the impact of climate change on the land sector.

The land sector encompasses the emissions, carbon uptake and storage changes from forestlands, grasslands, croplands, wetlands, coastal areas, harvested wood products, and urban areas with vegetation. Unlike other sectors, the land sector has the capacity to absorb emissions and store carbon, and release carbon at considerable scales.

However, net emissions estimates for the land sector are subject to considerable uncertainty — estimates of how much carbon can be stored in the land and how much carbon is released from the land, especially with a changing climate.

[60] Climate Change Authority 2024a.

This introduces complexity in reporting temporal trends and progress towards meeting emissions targets. In particular, reported trends can change significantly as new data become available, scientific understanding advances, and measurement methodologies improve.

According to the Inventory, land sector net emissions have steadily declined since 2005 due to:

- **a reduction in gross annual emissions**, primarily from reduced deforestation and, less significantly, a reduction in the rate of soil carbon stock loss
- **a steady increase in stored carbon** through reforestation, afforestation, and increasing soil carbon stock.

The land sector's estimated levels of emissions and carbon storage change over time, as shown in Figure 2.4.2.B. Estimated emissions from deforestation have reduced by 78 per cent from 2005 to 2022, while net carbon storage has increased by 11 per cent. Despite a noticeable decreasing trend in deforestation, it remains a large source of emissions in the land sector. In 2022, deforestation (largely land clearing by primary producers) produced 2.9 Mt CO_2-e of emissions, down from 13.6 Mt CO_2-e in 2005. The annual area of forest converted to non-forest use is estimated to have reduced by 65 per cent, from 12.2 Mt CO_2-e in 2005 to 5.4 Mt CO_2-e in 2022.[61]

The total annual area of sustained forest regrowth is estimated to have increased by 76 per cent from 2005 to 2022, resulting in a 65 per cent increase in total carbon stored, from -3.0 Mt CO_2-e to -6.8 Mt CO_2-e.[62]

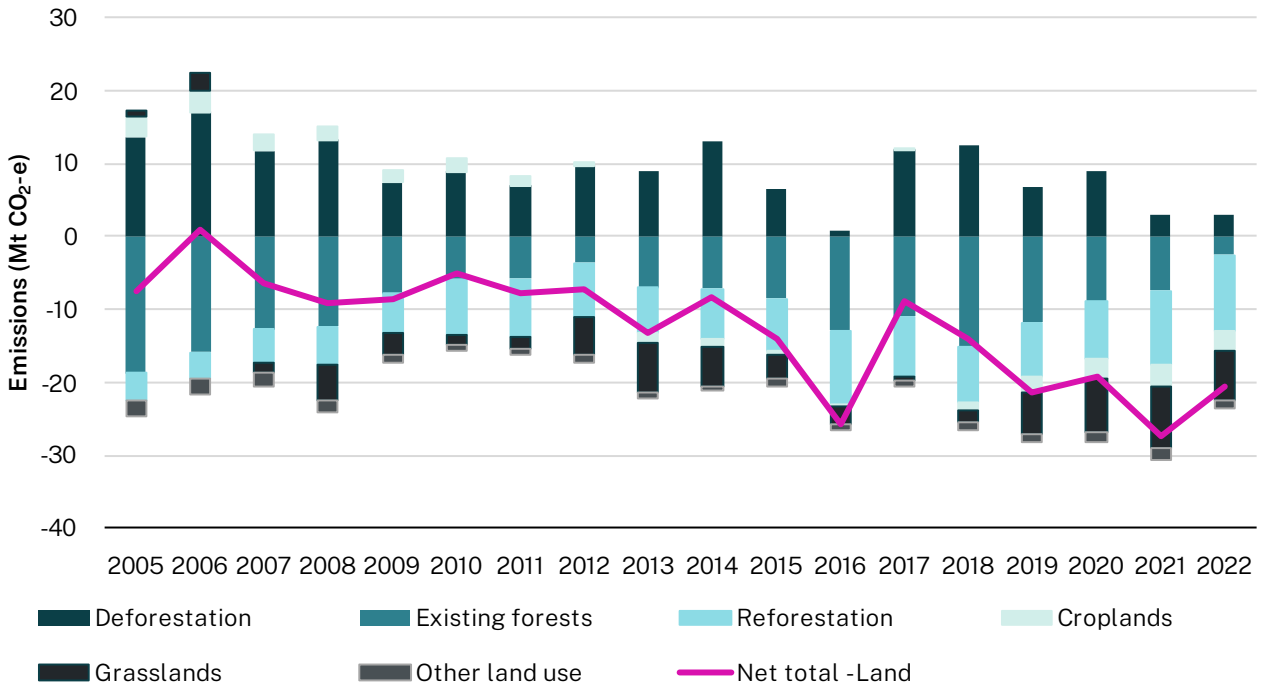


Figure 2.4.2.B: Historical total land sector emissions and carbon storage by subsector category, 2005–22[63]

[61] Australian Government Department of Climate Change, Energy, the Environment and Water 2024a.
[62] Australian Government Department of Climate Change, Energy, the Environment and Water 2024a.
[63] Australian Government Department of Climate Change, Energy, the Environment and Water 2024.

The 2024 National Inventory Report attributes the annual changes to natural phenomena like droughts or periods of heavy rainfall, or to new economic opportunities. These natural changes result in fluctuations in emissions and carbon storage in the sector year on year.

Despite an overall decreasing trend in net emissions, annual fluctuations suggest there is very high uncertainty in how the land sector's emissions might change in the future.

The legislative and regulatory landscape governing deforestation, or land clearing, has a long history. Since 2005, one of the most significant legislative changes affecting NSW land clearing was the enactment of the *Biodiversity Conservation Act 2016* (BC Act) and the *Local Land Services Amendment Act 2016*.[64]

Last year, the BC Act was reviewed to assess whether its policy objectives are still valid and if the approaches to achieving them are appropriate. The review's findings indicated that the BC Act was not fulfilling its primary purpose and required significant reform. It recommended that the BC Act be realigned with global and national reform agendas to reach 'nature positivity'.[65]

In addition to regulation, recent NSW Government grant initiatives seek to promote the use of market-based mechanisms, particularly the national ACCU Scheme, to create economic opportunities that support landholders to undertake activities that enhance biological carbon storage and make it easier to participate in carbon markets. These include components of the PIPAP[66] (discussed in greater detail in the 'Agriculture' section) and the NSW Blue Carbon Strategy's coastal demonstration site,[67] which are helping to fund ACCU projects that aim to scale up carbon storage in land and coastal ecosystems, respectively. The NSW National Parks and Wildlife Service (NSW NPWS) is also using the ACCU Scheme's vegetation methods to contribute to its commitment to be carbon positive by 2028.

Building climate resilience in the land sector

Climate change poses a severe threat to the sustainable management of land, water and biodiversity in NSW. Adept land policy and management practices informed by a long-term view can increase the land sector's ability to withstand and recover from natural and human-induced disturbances. When tailored to the unique features of local ecosystems, land management strategies such as increasing organic matter in soils, diversifying forest tree species and increasing genetic variation, maintaining forest connectivity, and reducing non-climate stressors can strengthen the land sector's resilience to climate change impacts.[68] Healthy, resilient ecosystems have been shown to reduce the severity and frequency of hazards such as floods, wildfires, tree diseases and pests, and windstorms.[69]

[64] Watson and Williams 2024.
[65] NSW Government 2023a.
[66] NSW Department of Climate Change, Energy, the Environment and Water 2024c.
[67] NSW Department of Climate Change, Energy, the Environment and Water 2022.
[68] Thompson et al. 2014.
[69] Baumber et al. 2020.

Traditional knowledge should be considered alongside the best available science for informing how and when hazard reduction burning is an appropriate mitigation measure. Understanding how and when fire should be used as a mitigation or adaptation measure in forest ecosystems could benefit from close collaboration with traditional knowledge-holders and fire practitioners.[70] The Commission looks forward to consulting with NSW's diverse First Nations communities to inform future recommendations in all sectors, with a particular focus on the land sector.

Careful land management should aim to conserve current carbon storage

The degree to which the land sector will act as a carbon source or sink in the future will require ongoing analysis as scientific knowledge advances and the long-term impacts of climate change are better understood. Future risks of wildfires, droughts, prevalence and frequency of pests as a result of temperature changes, coastal erosion and other biophysical effects will likely have a negative impact on the land sector's ability to remove and store carbon, as well as on how long the carbon remains stored. Additionally, research indicates that a warming of soils may accelerate the turnover of soil carbon, leading to a net loss of stored carbon in soils and further weakening the land sector's role as a carbon sink. Land management strategies that maintain forest and soil carbon stocks will help retain today's levels of land-based carbon storage and position the land sector to maximise its contribution to the achievement of the state's emission reduction targets.

The implications of uncertainty in the land sector's emissions accounting

Methods for estimating emissions in the National Inventory Report are constantly advancing. When method advancements cause large changes in the land sector's emissions estimates, NSW's total emissions estimates can also change significantly. This impacts assessments of how the state is progressing towards achieving the primary emissions reduction targets, as demonstrated in Figure 2.4.2.C.

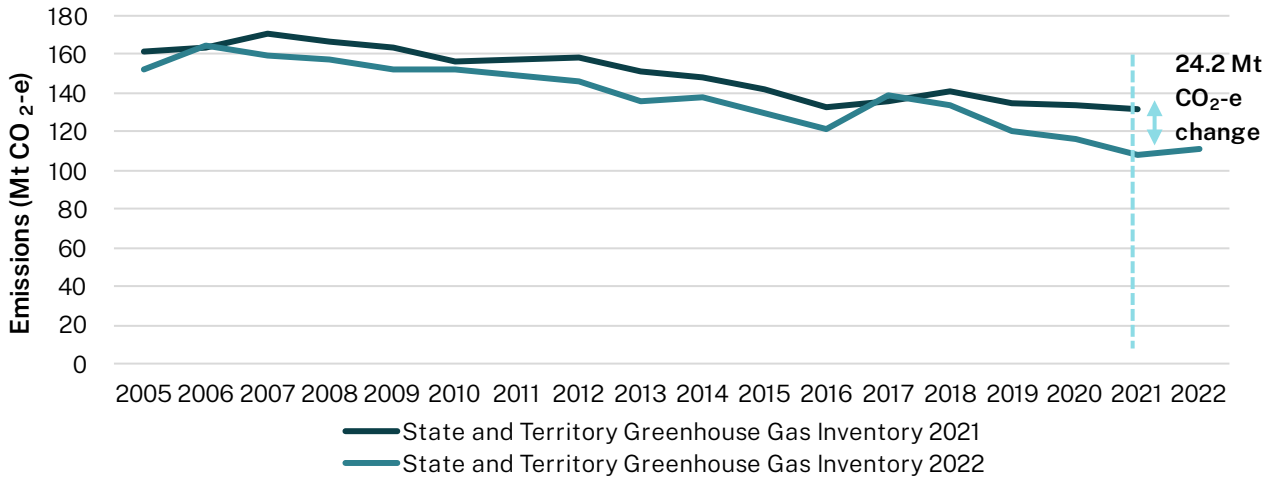


Figure 2.4.2.C: Recalculated economy-wide emissions for 2021 and 2022 Inventories

[70] Steffensen 2020.

While the 2021 Inventory reported that NSW's total emissions in 2021 were 132 Mt CO_2-e, the 2022 Inventory recalculated the emissions in 2021 to be 107.8 Mt CO_2-e. This produced a 24.2 Mt CO_2-e difference, driven largely by advancements in the method used to calculate emissions in the land sector. Potential emissions recalculations as future Inventories are published makes the overall emissions picture uncertain and complicates how best to communicate the state's progress towards its targets.

Other jurisdictions around the world, such as Germany, have addressed this uncertainty by reporting land sector emissions and carbon storage separately from those for the rest of the economy[71], as well as setting separate land-specific emissions targets. More work is needed to inform how the Commission should treat and communicate its contribution to meeting emissions reduction targets.

Box 2.4.2.A: Land sector emissions profile

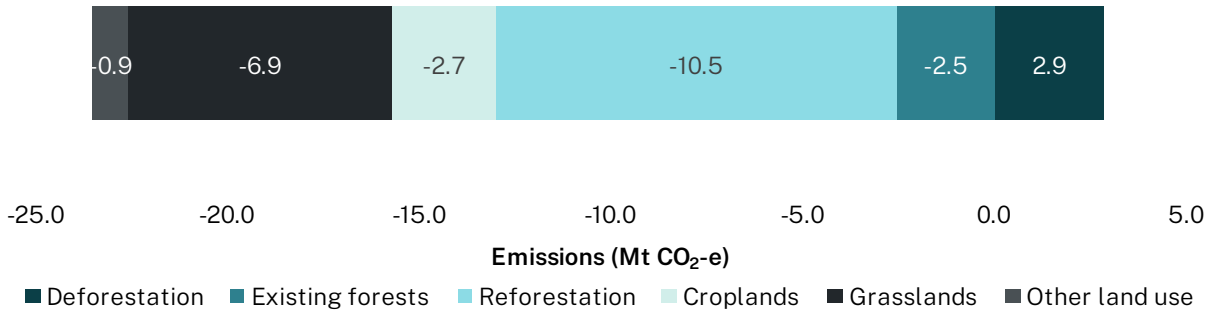


Figure 2.4.2.D: Land sector emissions by subsector, 2022

In 2022, sources of emissions in the land sector come from deforestation activities and loss of carbon from soils. Carbon storage in the sector stems predominantly from reforestation activity and carbon stock change in existing forests, with lesser contributions from increases in soil carbon stock in grasslands and croplands.

According to the Inventory, in 1990, the land sector in NSW was a source of emissions, releasing a net total of 14.7 Mt CO_2-e, likely driven largely by high deforestation rates. By 2005, the land sector functioned as a net sink for emissions, storing a net total of - 7.6 Mt CO_2-e, a 152 per cent decrease from the 1990 level. In 2022, the land sector's net emissions totalled -20.6 Mt CO_2-e, a 240 per cent decrease from 1990.

[71] Deutsche Gesellschaft für Internationale Zusammenarbeit (German Society for International Cooperation) 2018.

2.5 Industry and waste sector

Summary of the Commission's initial assessment of progress

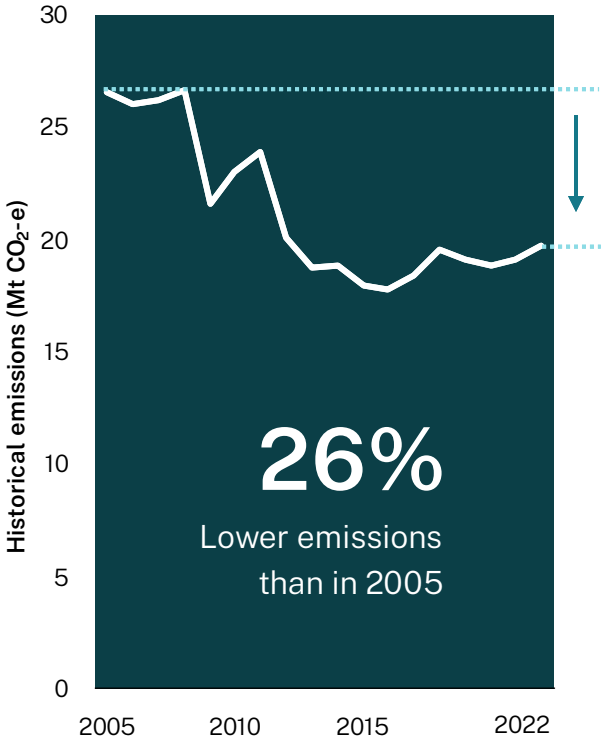


Figure 2.5.A: Annual emissions from the industry and waste sector, 2005–22

Reductions in industry emissions since 2005 are largely due to a decline in industrial production. While there are opportunities to reduce emissions this decade, many industrial processes currently lack viable short-term abatement options. Investment and planning are required now to enable significant parts of the sector to reduce their emissions in the 2030s and 2040s.

Reductions in waste emissions have largely been driven by landfill gas capture. There is an opportunity to achieve further reductions this decade by increasing the landfill gas capture rate. Complementary actions such as diverting organics from landfill and avoidance of waste will be important for long-term decarbonisation.

Industry sector emissions

Industry emissions declined from 21 Mt CO_2-e in 2005 to 15.4 Mt CO_2-e in 2022, a reduction of approximately 25 per cent (Figure 2.5.A). Emissions from industry saw a sharp decline in 2009, largely due to a slowdown in production as a result of global economic conditions,[72] with emissions rebounding as the economy recovered.[73] The significant drop in emissions in 2012 was driven by a large reduction in iron and steel production following the closure of a blast furnace at BlueScope Steel in Port Kembla in 2011.[74]

For policymakers, decarbonising industry involves weighing a complex set of issues. These include considerations around sovereign manufacturing capabilities, the sector's contribution to the economy, and preserving commercial viability when the investment required to reduce emissions at a single facility can be tens of millions of dollars.

Decarbonisation of existing heavy industries such as steel or cement production are proving challenging to abate globally. Key challenges include the long timescales for new

[72] Australian Government Department of Climate Change 2009.
[73] Australian Government Department of Climate Change and Energy Efficiency 2010.
[74] Australian Government Department of Climate Change and Energy Efficiency 2012.

technologies to become commercially available, the high cost of investment for process equipment, long payback periods and the complexities and scale of established global supply chains and commodity trade.

While emissions reductions this decade are achievable through electrification and energy efficiency at some facilities, some industrial processes currently lack available abatement options.[75] Decarbonisation options for these hard-to-abate processes will depend on an available supply of affordable clean electricity and fuels, decarbonised supply chains, and the establishment of shared enabling infrastructure before they can be implemented.

Significant investment, along with greater policy certainty and coordination, is needed to make future decarbonisation options viable by the 2030s and 2040s. Other jurisdictions, such as the UK, have tackled this challenge by implementing industry sector decarbonisation plans or a whole-of-economy plan that considers cross-sectoral issues.[76]

In recent years, the Australian and NSW governments have introduced policies aimed at reducing emissions in the industry and waste sector.

At the national level, the Safeguard Mechanism regulates facilities (excluding emissions from waste deposited before the mechanism began on 1 July 2016)[77] emitting over 100,000 t CO_2-e emissions annually, imposing a declining cap (known as a 'baseline') on their emissions. If a facility exceeds its baseline, the excess emissions must be managed. This policy commenced in 2016 and was significantly reformed in 2023, and the mechanism now provides a financial incentive for covered facilities to reduce emissions. The specific effect on emissions from NSW based facilities is not yet known. The Australian Carbon Credit Unit (ACCU) Scheme also has methods targeting emissions from industry facilities.[78]

In NSW, the Net Zero Industry and Innovation Program (NZIIP) commits over $1 billion to help industries reduce their emissions, develop new technologies, and establish low-emissions industries. In July 2023, Orica, a major provider of explosives and blasting systems for the mining industry, announced the completion of Kooragang Island Decarbonisation Project, with the successful commissioning of an Australian first technology across three nitric acid manufacturing plants. This project will eliminate 567,000t CO_2-e from the site each year. NZIIP co-invested $13.06 million into the project, together with $25 million financed by the Clean Energy Finance Corporation.[79]

The 2023 NSW Department of Climate Change, Energy, Environment and Water emissions projections methods paper notes that the department indicated that the NZIIP will not achieve the level of abatement previously expected, and that the program is undergoing review and redesign in 2024.[80] Given this, the Commission intends to consider NZIIP and other industry sector initiatives more deeply in 2024-25.

[75] Climate Change Authority 2024a.
[76] UK Department of Business Energy and Industrial Strategy 2021.
[77] Australian Clean Energy Regulator 2024b.
[78] Australian Clean Energy Regulator 2024a.
[79] Orica 2023.
[80] NSW Department of Climate Change, Energy, the Environment and Water 2024a.

The NSW Government is developing Industry Decarbonisation Pathways (IDPs) for mining and manufacturing facilities in the Hunter and Illawarra regions to achieve shared emissions reduction goals. The IDPs aim to help address coordination gaps across different industries and supply chains. However, plans that encompass the entire sector and economy are also likely to be required. The Australian Government is also developing an Industrial Sector Plan for reducing emissions in this sector nationally, which will identify key emissions reduction priorities. The Commission also intends to consider this Plan and its impact in NSW as part of its assessment of progress for this sector in 2024-25.

Both the Australian and NSW governments have introduced policies to support the establishment of a domestic supply of low-emissions fuels. Recent initiatives include the Federal Hydrogen Headstart[81] program, the NSW Hydrogen Strategy[82] and the NSW Renewable Fuels Scheme.[83]

These policies were introduced in part because many options to reduce emissions from hard to abate processes will require a future supply of affordable, reliable, low-emissions fuels to be viable. Uncertainty about the future supply of low-emissions fuels is currently inhibiting investment in these abatement options, which further amplifies uncertainty about future demand. The recent withdrawal by Origin Energy from the Hunter Valley Hydrogen Hub in October 2024, citing uncertainty about the pace of development of the hydrogen market, is an example of the challenge at hand.[84]

Waste sector emissions

Waste emissions declined from 5.5 Mt CO_2-e in 2005 to 4.3 Mt CO_2-e in 2022, a drop of approximately 22 per cent. The reduction in waste emissions was primarily due to increased rates of gas capture at landfill sites, consistent with the national trend.[85] Some reductions since 2005 can be linked to lower per capita waste generation and a greater diversion of waste from landfills.

The rate of landfill gas capture in NSW was 39 per cent in 2022.[86] Increasing the landfill gas capture rate by implementing proven technologies will be essential to decarbonise the waste sector. While other abatement options such as the diversion of organic waste away from landfill are also key for the sector's long-term decarbonisation, the diversion of organics does not address legacy emissions.

At the national level, the ACCU Scheme has five methods targeting emissions from industry and waste.[87] In NSW, Section 12 of the Waste Avoidance and Resource Recovery Act 2001 (NSW) requires the NSW Environment Protection Authority to develop a waste strategy for NSW and review the strategy every 5 years. The latest strategy, the Waste and Sustainable

[81] Australian Government Department of Climate Change, Energy, the Environment and Water 2024b.
[82] NSW Department of Planning, Industry and Environment 2021b.
[83] NSW Department of Climate Change, Energy, the Environment and Water 2024b.
[84] Origin Energy 2024.
[85] Australian Government Department of Climate Change, Energy, the Environment and Water 2024.
[86] *Waste Avoidance and Resource Recovery Act (NSW)* 2001.
[87] Australian Clean Energy Regulator 2024a.

Materials Strategy 2041: Stage 1 2021–2027 (WASM),[88] was released in 2021. The WASM commits the NSW Government to require gas capture for landfills over a certain size and all expanded or new landfills, with exemptions for certain circumstances.

At the time of writing, no regulatory requirement for landfill gas capture had been implemented. Implementing requirements face challenges including their potential impact on commercial viability. Implementing gas capture technology is not currently viable for some landfills due to cost, capability or the characteristics of the waste, issues that are particularly relevant for smaller or council-run landfills. The WASM commits $7.5 million to support the installation of landfill gas capture infrastructure to complement regulatory measures. Regulatory requirements may also impact the ability of landfills to generate revenue through the ACCU Scheme, due to additionality requirements.

Box 2.5.A: Industry and waste sector emissions profile

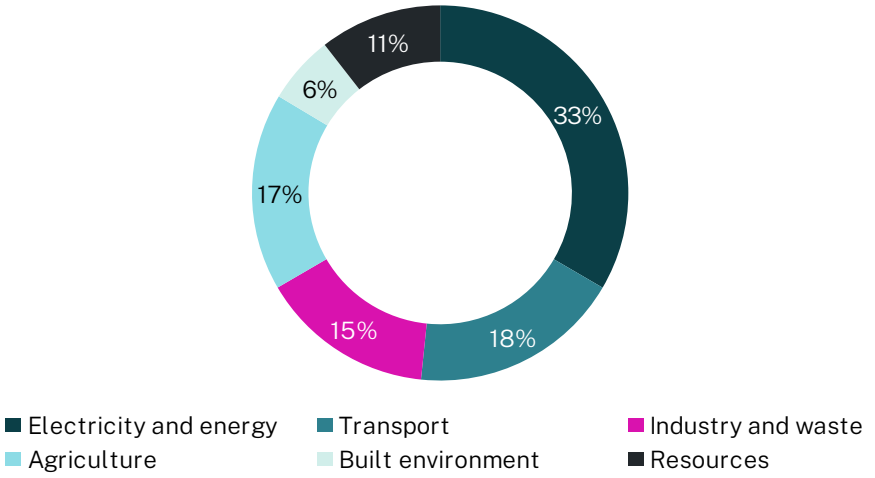


Figure 2.5.B: Industry and waste emissions as a percentage of NSW emissions, excluding the land sector, 2022

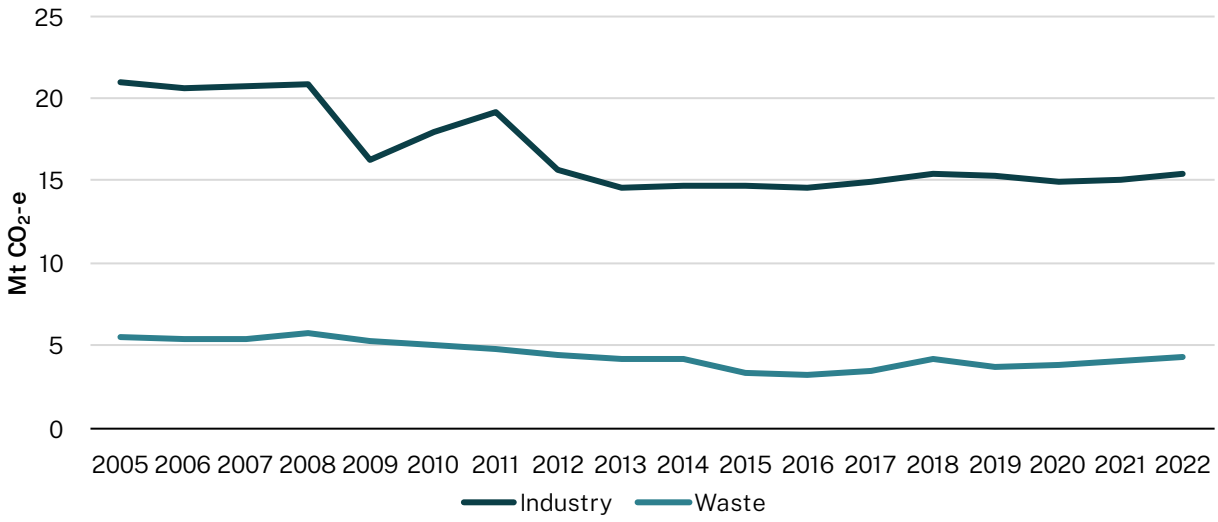


Figure 2.5.C: Annual emissions from industry and waste, 2005-2022

[88] NSW Department of Planning, Industry and Environment 2021a.

Box 2.5.A: Industry and waste sector emissions profile

The industry and waste sector processes, manufactures and produces goods, and disposes of materials that have reached their end of life.[89]

In 2022, the industry and waste sector accounted for 15 per cent (19.7 Mt CO_2-e) of NSW emissions (Figure 2.5.B), made up of 15.4 Mt CO_2-e from industry emissions and 4.3 Mt CO_2-e from waste emissions (Figure 2.5.C).

The largest sources of NSW emissions in 2022 from industry were facilities producing aluminium, iron and steel, lime and cement, and ammonia. These facilities accounted for 8.4 Mt CO_2-e or approximately 55 per cent of NSW industry emissions, with iron and steel production contributing the largest share. Many of these facilities undertake processes with limited decarbonisation options currently available. The remaining 45 per cent of NSW industry emissions in 2022 were largely from manufacturing, the bulk of which were from the manufacture of chemicals and non-metallic minerals.

The largest source of NSW emissions from waste in 2022 was from organic waste disposed at landfill sites, followed by the treatment of domestic, commercial and industrial wastewater.

[89] Climate Change Authority 2024a.

2.6 Resources sector

Summary of the Commission's initial assessment of progress

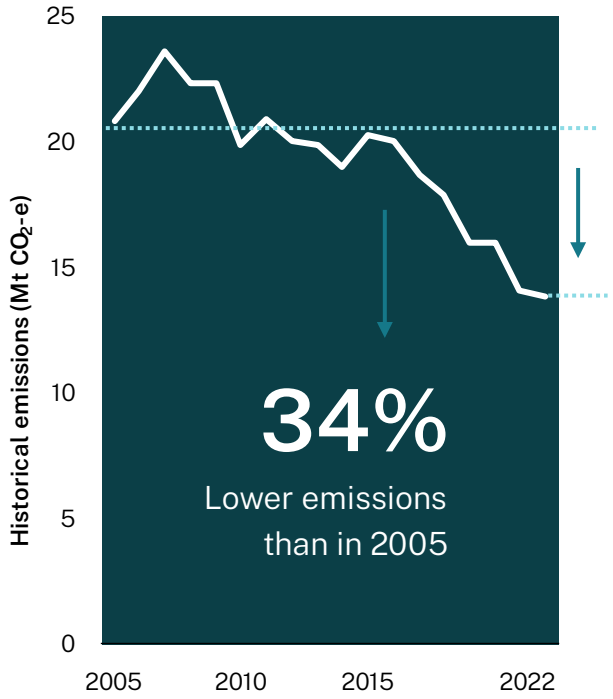


Figure 2.6.A: Annual emissions from the resources sector, 2005–22

Direct emissions from the resources sector have declined since 2005, primarily due to coal mine closures, yet still account for 11 per cent of NSW emissions. However, there is a risk of increased emissions associated with a sizeable pipeline of coal mine extension and expansion projects that are currently awaiting determination through the planning process. Any emissions increases associated with extended or expanded coal projects would require other sectors to make greater emissions reductions if the state is to meet its emissions reduction targets. The potential emissions increases from projects seeking planning determination pose a major challenge for the state's regulatory arrangements.

Given the criticality of this sector for achievement of NSW existing and future net zero emissions targets, the Commission will place priority on a deep consideration of these issues in its assessment for 2024-25, recognising the need to address the broader social and economic implications for NSW communities in making this transition to a net zero economy.

Ninety-nine per cent of the direct emissions from the resources sector are fugitive emissions from coal mining and fuel combustion emissions associated with mining machinery and equipment (see box 2.6.A).

Direct emissions from the sector declined by one-third between 2005 and 2022, from approximately 20.8 Mt CO_2-e to 13.8 Mt CO_2-e[90], or 11 per cent of NSW emissions in 2022. This was largely due to the closure of several 'gassy' underground coal mines. Emissions reduction solutions of varying technological and commercial readiness exist for both underground and open cut mines. The barriers to their uptake include supply chain and technical constraints, safety constraints, the high cost of implementing most emissions reduction levers, regulatory inconsistencies and gaps, and workforce and skills shortages.[91]

[90] Australian Government Department of Climate Change, Energy, the Environment and Water 2024.
[91] Climate Change Authority 2024a.

Several federal and state-led initiatives target emissions reduction in this sector. The Australian Government's Safeguard Mechanism[92] applies to 27 coal mines in NSW out of the 59 coal licensees regulated by the NSW Environmental Protection Authority (EPA). The mechanism applies to facilities with direct emissions exceeding 100 kt CO_2-e per annum. The Safeguard Mechanism aims to incentivise the most cost-effective abatement activities by requiring facilities to keep emissions below their baseline, while facilities that remain below their baseline can sell credits to others. Facilities that do not meet requirements can purchase offsets in the form of Australian Carbon Credit Units or Safeguard Mechanism Credits. The Safeguard Mechanism sets a baseline decline rate of 4.9 per cent per year until 2030. However, prevailing and expected price levels in credit markets may not be sufficient to incentivise some options to reduce emissions, and some emitting mines are not covered in the Safeguard Mechanism because their emissions are below the inclusion threshold.

In NSW, the Net Zero Industry and Innovation Program[93] provides grants and facilitation support for a range of abatement projects, including coal mine emissions. To date, including in 2023-24, no coal abatement projects have been funded. The Commission has been advised the program is continuing to engage with coal operators regarding abatement opportunities. As discussed in the industry and waste section, the program is currently undergoing review and redesign in 2024.

Separately, the Coal Innovation NSW Fund[94], which supports research on and demonstration of low-emissions coal technologies, has funded a project to demonstrate commercial uptake of emissions abatement technology, targeting emissions reduction at an active coal mine. The Ventilation Air Methane Abatement Demonstration Project, co-funded by Coal Innovation NSW and project owner South32, at Appin Colliery (now owned by GM3), is currently subject to a feasibility assessment. If it progresses, a full-scale methane reactor will be installed to demonstrate the improved safety and commercial viability of the technology.

[92] Australian Clean Energy Regulator 2024b.

[93] NSW Department of Climate Change, Energy, the Environment and Water 2021.

[94] NSW Department of Primary Industries and Regional Development 2024a.

Fugitive emissions from coal mining will continue to be significant in the medium term, with several recent approvals of coal mine extension applications and more projects seeking planning approval. Recent approvals include:

- Modification 4 for the Moolarben Coal Complex Underground[95] by the NSW Department of Planning, Housing and Infrastructure in December 2023, allowing an increase in the total run-of-mine coal extraction from UG2 of 9.4 Mt to 13.9 Mt
- Modification 8 for the Boggabri Open Cut Coal Mine[96] by the NSW Department of Planning, Housing and Infrastructure in January 2024, allowing an increase of the approved mining depth to recover an additional 61.6 Mt of run-of-mine coal
- Modification 5 for the Glendell Open Cut Coal Mine[97] by the NSW Department of Planning, Housing and Infrastructure in July 2024, allowing continued mining operations until June 2026, with an additional 1.8 Mt of run-of-mine coal forecast to be produced
- the Narrabri Underground Mine Stage 3 Extension Project[98], the Ashton Coal Operations Ravensworth Underground Mine[99] and the Mount Pleasant Optimisation Project[100] by the NSW Government in 2022, with final approval by the Australian Government given in September 2024.

In addition, at the time of preparing this report, 33 planning applications[101] for existing coal operations were being considered by the NSW Department of Planning, Housing and Infrastructure. Of these, the Commission has been advised that 22 would have potential impacts on the state's emissions (advice received from the NSW Department of Climate Change, Energy, the Environment and Water in consultation with the NSW Department of Planning, Housing and Infrastructure).

Of these projects, the proposal for the Hunter Valley Operations Continuation Project[102] was recently withdrawn from the Australian Government's approval process under the *Environment Protection and Biodiversity Conservation Act 1999*.[103] The EPA advice of 22 May 2024 to the NSW Department of Planning, Housing and Infrastructure raised concerns about the project's significant unabated emissions. The EPA noted that these emissions may result in the rest of the economy having to achieve greater emissions savings for NSW to reach its emissions reduction targets. The Commission has been advised that an amendment to the existing development application is expected to be lodged with the NSW Department of Planning, Housing and Infrastructure in 2025.

[95] NSW Department of Planning, Housing and Infrastructure 2024.
[96] NSW Department of Planning, Housing and Infrastructure 2024.
[97] NSW Department of Planning, Housing and Infrastructure 2024.
[98] NSW Department of Planning 2022b.
[99] NSW Department of Planning 2022c.
[100] NSW Department of Planning 2022a.
[101] NSW Department of Planning, Housing and Infrastructure 2024.
[102] NSW Department of Planning, Housing and Infrastructure 2024.
[103] Hunter Valley Operations 2024.

The EPA is the key regulator of emissions in NSW. The EPA released its draft Climate Change Assessment Requirements and draft Greenhouse Gas Assessment Guide for Large Emitters[104] for public consultation in May 2024. These would apply to all planning applications for new large emitting facilities or modifications (at or above 25,000 t CO_2-e direct and electricity emissions) including modifications and extensions to existing mines. The finalised requirements and guide are expected to be published in late 2024 and will support more robust consideration of future planning applications.

The Commission recognises that addressing the social and economic dimensions of emissions reduction is also critical to the sector's transition. Coal production in NSW is concentrated in just a few locations: the Hunter, Illawarra, Central West and North West regions. The NSW Government has committed to establish Future Jobs and Investment Authorities to support regional communities, including work with the Australian Government Net Zero Economy Authority to support transitional employment planning in these regions.[105] Sustained, respectful and inclusive engagement with these communities and local leaders – including First Nations peoples – will be critical as the energy transition progresses.

In line with the Commission's statutory responsibility under the *Climate Change (Net Zero Future) Act 2023,* the Commission intends to closely examine developments in the resources sector because of the impact the sector has on the NSW's primary emissions reduction targets, recognising the broader social and economic implications for NSW communities.

The major emissions sources in the resources sector may change in the future, with several state and national strategies supporting the expansion of the mining of critical minerals and other metals. These include the NSW critical minerals and high-tech metals strategy 2024–35[106] and the Australian Government's Critical Minerals Strategy 2023–2030[107] and Australia's Global Resources Strategy.[108] Emissions in these forms of mining will mainly come from fuel combustion and electricity use. The latter could be addressed through the use of renewable electricity and batteries. The uptake of alternatives to diesel fuel has been hampered by constrained supply and cost,[109] although low-emissions alternatives for mining equipment are being commercialised and several trials are underway in Australia.[110] This suggests that non-coal mining operations in the sector have a potential pathway to low emissions.

[104] NSW Environment Protection Authority 2024.
[105] NSW Government 2023b.
[106] NSW Department of Regional NSW 2021.
[107] Australian Government Department of Industry, Science and Resources 2023.
[108] Australian Government Department of Industry 2020.
[109] Climate Change Authority 2024a.
[110] Akhand 2024.

Box 2.6.A: Resources sector emissions profile

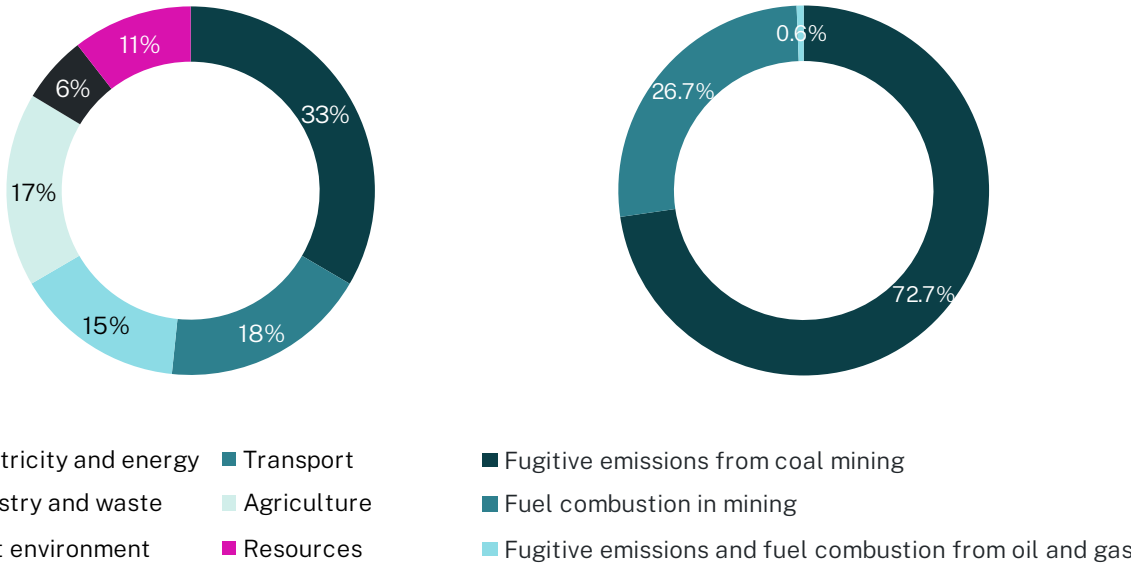


Figure 2.6.B: Resources emissions as part of NSW emissions, excluding the land sector, 2022

Figure 2.6.C: Direct emissions from the NSW resources sector, 2022

The resources sector contributed an estimated 13.8 Mt CO_2-e to the state's direct emissions in 2022, making up 11 per cent of the state's total emissions (Figure 2.6.B). Value chain emissions from the domestic and international use of thermal and metallurgical coal produced in NSW were estimated to be approximately 56.5 Mt CO_2-e (domestic) and 379.5 Mt CO_2-e (export) in 2022*.

As shown in Figure 2.6.C, fugitive emissions are almost entirely from coal mining and primarily relate to the geological conditions prevalent at an operation, which vary significantly between sites.[111] Most emissions are from fugitive methane, with contributions from carbon dioxide escaping during the extraction of coal. In 2022, fugitive emissions from underground coal mines were estimated at 8.1 Mt CO_2-e, while open cut coal mining contributed 2 Mt CO_2-e.

Emissions from fuel combustion are primarily associated with heavy machinery operation in resources extraction, and approximately 90 per cent of these emissions are from coal mines. These emissions have steadily increased since the early 2000s, mainly due to increases in surface coal mining.[112] Surface coal extraction operations have been expanding and accessing deeper reserves, and machinery is hauling loads over greater distances.[113]

As NSW currently only has minimal oil and gas extraction industries, emissions from these activities have generally been low. Between 2005 and 2022, emissions varied between approximately 0.02 Mt CO_2-e and 0.32 Mt CO_2-e.

*Note: *These are estimates based on domestic and export coal consumption data reported by Coal Services for NSW in 2022; the Australian National Greenhouse Accounts Factors (2024); the UK Department for Environment, Food & Rural Affairs' and UK Department for Energy Security and Net Zero's greenhouse gas conversion factors for company reporting (2023); and assumptions for shipping and rail distances.*

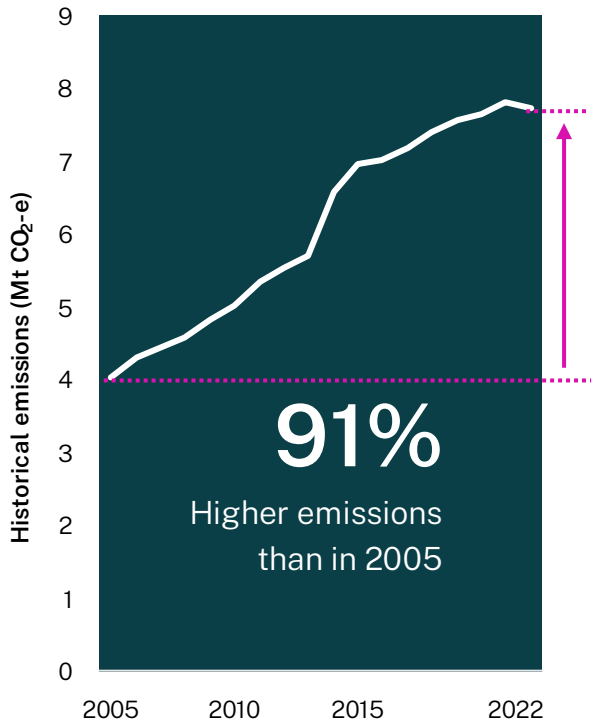
[111] Boreham, Golding, and Glikson 1998; Saghafi et al. 2008.

[112] Australian Government Department of Climate Change, Energy, the Environment and Water 2024.

[113] Climate Change Authority 2024a.

2.7 Built environment sector

Summary of the Commission's initial assessment of progress



Emissions in the built environment sector have grown substantially, nearly doubling since 2005. While growth in emissions has slowed in recent years, the sector is currently not on a clear emissions reduction trajectory. That said, most of the technologies needed to reduce and even eliminate emissions in this sector are already commercially available, with scope for significant policy action by governments and greater action by industry and households. The release of the NSW Consumer Energy Strategy in September 2024, committing the government to setting electrification targets for homes and small businesses is a positive step.

Figure 2.7.A: Annual emissions from the built environment sector, 2005–22

While there has been a slowing in the rate of growth over the past 5 years, emissions from the built environment sector grew by 91 per cent from 2005 to 2022. Even with some positive initiatives introduced by the NSW Government in recent years, more decisive action is required from governments, real estate businesses and households before the sector is positioned to make a meaningful contribution to meeting the state's primary emissions reduction targets in 2030 and 2035.

This is a sector where significant abatement is possible and the technologies to decarbonise the sector are already commercially available. The largest source of direct emissions in this sector (53 per cent) is the use of onsite fossil fuels in homes and buildings in operation. Most of the emissions are from the use of gas and diesel fuel. Homes account for about 60 per cent of gas use in buildings, with the remaining 40 per cent estimated to come from other buildings.[114] Just under half of the homes of NSW are connected to the gas network.[115]

[114] Northmore Gordon 2021.
[115] NSW Independent Pricing and Regulatory Tribunal 2023.

The Climate Change Authority has identified that replacing gas appliances with all-electric technologies is the lowest-cost path to reduce emissions from onsite fuel use in homes and buildings. It recommends that federal and state governments develop strategies for the complete, efficient and equitable electrification of all buildings.[116] This aligns with the recommendations of recent academic studies,[117] as well as with advocacy from a range of industry bodies in the built environment.[118]

Several jurisdictions comparable to NSW are now pursuing ambitious electrification policies. This includes the European Union, whose member countries installed 3 million heat pumps in buildings in 2023 alone, and who have set a joint target to install 60 million heat pumps between 2020 and 2030. Domestically, Victoria announced all-electric requirements for all new homes and public buildings, while the Australian Capital Territory (ACT) has done so for all new buildings. Both jurisdictions are actively promoting electrification in existing buildings.

In contrast, the NSW Government currently has neither regulations nor targets to drive building electrification. Unlike Victoria and the ACT, NSW has not placed restrictions on gas connections to new homes or developments. The Commission considers that this is an area for policy attention in NSW and intends progressing further work in this area as part of its 2024-25 annual assessment and forward work program.

Current policy initiatives in place include requirements introduced by the NSW Government in 2022 to encourage (but not mandate) large new buildings to be all-electric.[119] Subsidies for replacing gas boilers with heat pumps were introduced in the NSW Energy Savings Scheme in 2023.[120] While there was little substantive policy progress in 2023–24 to address onsite fossil fuel emissions, the release of the NSW Consumer Energy Strategy in September 2024 has committed the NSW Government to introducing electrification targets for homes and small businesses in 2026. This policy also commits the government to develop a NSW Gas Decarbonisation Roadmap by 2026, which aims to clarify its future use in buildings.

Refrigerants have been the second-largest and fastest-growing source of emissions in the built environment since 2005. Refrigerants leak during the charging and the use of refrigeration, heating and air-conditioning equipment. Most of the gases that are used in equipment in Australia today, particularly hydrofluorocarbons (HFCs), are gases with significant global warming potential (GWP).

Tackling the impact of refrigerants on the environment has been historically addressed through the Montreal Protocol. Under the 2017 Kigali Amendment of the Montreal Protocol, Australia must reduce its use of HFCs by 85 per cent by 2036. This is expected to be achieved by switching to refrigerants with low (<10) GWP, such as natural refrigerants. The EU, for example, has placed a market ban on several categories of products and equipment containing HFCs.

[116] Climate Change Authority 2024b.
[117] Williams et al. 2023; Li et al. 2024.
[118] Australian Sustainable Built Environment Council 2022; Green Building Council of Australia and Property Council of Australia 2023; Clean Energy Finance Corporation 2022.
[119] NSW legislation 2022.
[120] NSW legislation 2024.

Emissions reduction in NSW is managed through a progressive phase-down of HFC imports by the Australian Government. This phase-down will require retiring and replacing equipment because the choice of refrigerant influences the selection of plant and equipment. This is particularly relevant as the typical lifespan of equipment is 15 to 25 years. Addressing refrigerants appears to be an area where government action can help ensure that industry has access to the capital equipment and the skills needed to prevent the installation of new HFC-charged equipment.

Decarbonisation of the built environment sector has direct implications for the emissions of several other sectors of the NSW and Australian economies. Buildings are the largest source of demand for electricity in NSW. They are also currently the largest source of photovoltaic generation and where most EVs are expected to be charged. For this reason, the amount of electricity used in buildings, as well as the timing of demand each day, will have a major influence on the cost and speed at which the electricity and energy sector decarbonises.

Over the past 2 decades, government policy action has largely focused on energy-efficiency measures in buildings. These are a good foundation for mechanisms that can be expanded and strengthened to save more energy. Although energy efficiency measures do not address the built environment sector's direct emissions, they are fundamental to reduce the demand for electricity and in turn reduce the new generation and transmission needed to decarbonise the electricity grid. The work of building industry bodies suggests much greater energy savings can be realised in existing buildings through more ambitious government policies, such as mandating the disclosure of building energy performance ratings at the point of sale or lease.[121]

In addition, the construction of new buildings and infrastructure creates significant demand for industrial products such as steel, cement, glass and aluminium, the production of which can account for a large portion of industrial emissions. These emissions are typically termed 'embodied carbon' of buildings and infrastructure. Accordingly, the built environment has a central role to play in creating demand for low-carbon industrial products to drive decarbonisation in the industry and waste sector.

NSW has been the most active Australian jurisdiction in driving embodied carbon initiatives to date. It is the first Australian state to introduce embodied carbon reporting requirements for new building developments under the NSW Sustainable Buildings State Environmental Planning Policy (2022), which commenced in late 2023. The NSW government is also aiming to use its purchasing power to drive the decarbonisation of construction supply chain through the NSW Decarbonising Infrastructure Delivery Policy. Launched in 2024, this policy requires government infrastructure delivery agencies to report and manage embodied carbon in construction projects over $50 million for buildings and over $100 million for other infrastructure.

[121] Australian Sustainable Built Environment Council 2022; Green Building Council of Australia and Property Council of Australia 2023; Climateworks Centre 2023; Climate Change Authority 2024b.

This is a positive start, and the Commission is interested in future uplifts to these policies and initiatives, in particular the opportunities to limit embodied carbon and to strengthen reporting frameworks.

Box 2.7.A: Built environment sector emissions profile

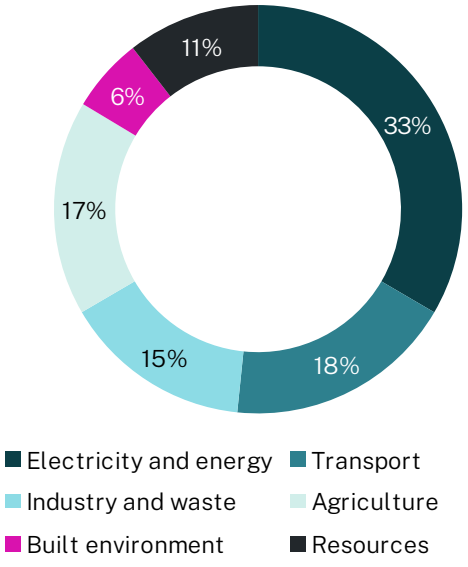


Figure 2.7.B: Built environment emissions as part of NSW emissions, excluding the land sector, 2022

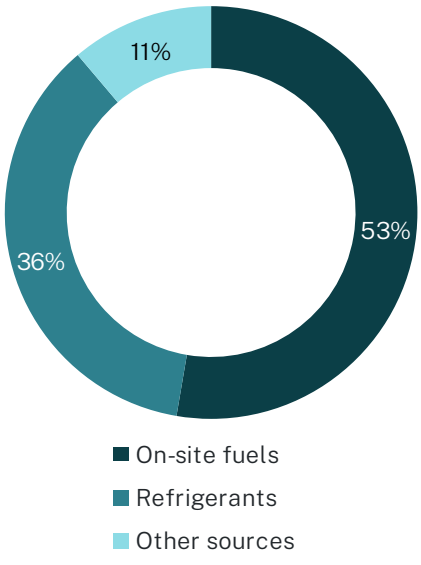


Figure 2.7.C: Direct emissions in the NSW built environment sector, 2022

The built environment sector incorporates all infrastructure, homes and buildings. In 2022, the direct emissions of the built environment accounted for 7.7 Mt CO_2-e or 6 per cent of NSW emissions (Figure 2.7.B).

The largest source of direct emissions is the onsite use of fossil fuels (53 per cent) (Figure 2.7.C). This includes using gas for hot water, heating and cooking in homes, commercial and public buildings. It also includes using diesel to power equipment and generators in commercial and public buildings, and in the construction of buildings and infrastructure.

Another major source of emissions is the use of refrigerants (36 per cent) (Figure 2.7.C). Refrigerant gases used in many current heat pumps for hot water, air-conditioning and refrigeration systems have high global warming potential (GWP), and result in a potent greenhouse effect as these gases leak into the atmosphere.

The balance of emissions is largely due to fuel usage in construction activity.

Chapter 3: Climate change adaptation

3.1 Our climate is changing

NSW has already experienced significant consequences of climate change, including an increase in some extremes such as heatwaves and increased short-duration rainfall intensity. NSW is projected to see increases in these and other extremes in all future climate scenarios. Adaptation plays a key role in reducing exposure and vulnerability to climate change. It can be proactive, reactive, incremental or transformational.

Temperature is the most robust indicator of climate change. NSW has already warmed by 1.4 degrees since national records began in 1910. All parts of the state are projected to experience average temperature increases, with the greatest increases inland. Coastal regions are expected to experience smaller but still noticeable increases. Extreme temperatures, including heatwaves, can have more pronounced impacts on human health, infrastructure and the environment than changes to average temperatures.[122]

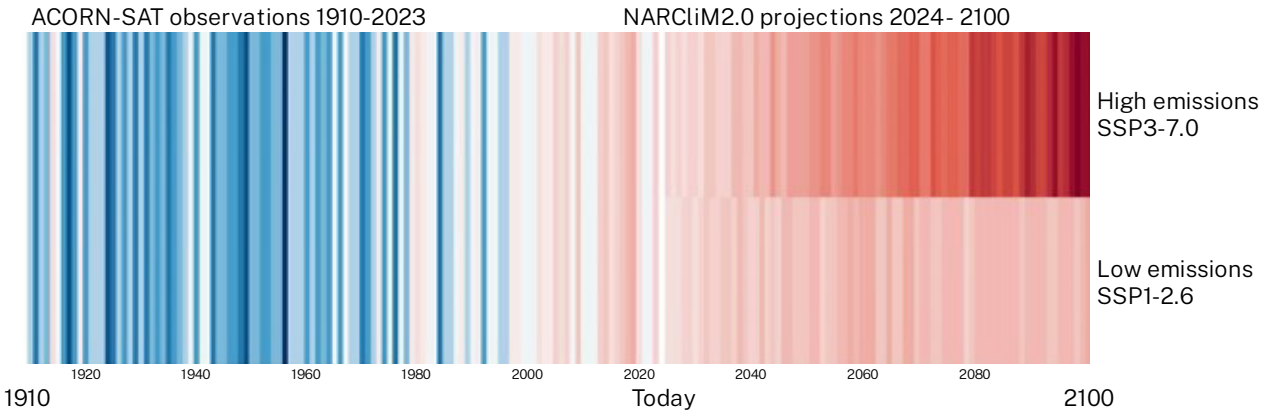


Figure 3.1.A: Climate Stripes average temperature 1910-2100; Credit: NSW Department of Climate Change, Energy, the Environment and Water, 2024 Source: ACORN-SAT observations 1910–2023; NARCliM 2.0 projections 2024–2100

[122] NSW Government 2024.

3.2 Adaptation

Climate change adaptation means adjusting to the actual or expected effects of climate change. Adaptation plays a key role in reducing exposure and vulnerability to climate change. It can be proactive, reactive, incremental or transformational.[123]

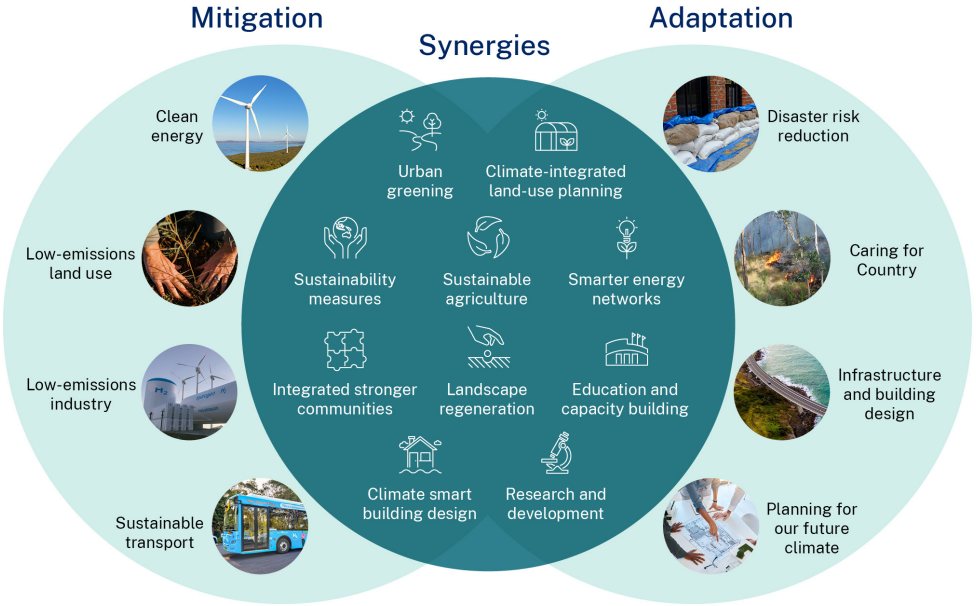


Figure 3.2.A: An outline of the synergies between mitigation and adaptation, highlighting that adaptation encompasses many activities, including disaster risk reduction. Source: NSW Department of Climate Change, Energy, the Environment and Water. Caring for Country image: Oliver Costello.

Box 3.2.A: Adaptation in the Paris Agreement

The Paris Agreement set the global goal on adaptation (Article 7(1)) and a high-level framework for adapting to climate change (Article 7(9)). The inclusion of adaptation in the Paris Agreement was significant as it emphasised the equal importance of adapting to climate change alongside mitigation efforts.[124]

Article 7(9) outlines processes to develop adaptation policies, programs and actions, where appropriate. The Paris Agreement is high-level and allows for flexibility in implementing the framework. The United Arab Emirates Framework for Global Climate Resilience was adopted at the 2023 Conference of the Parties of the United Nations Framework Convention on Climate Change. It included targets for countries for each of the steps in the framework, now commonly called the adaptation cycle.

Australia is party to the Paris Agreement. NSW endorsed the Paris Agreement in the 2016 NSW Climate Change Policy Framework, and part of the purpose of the *Climate Change (Net Zero Future) Act 2023* (NSW) is to give effect to Article 2 of the Paris Agreement. The Paris Agreement recognises the importance of subnational action in reaching the global goal on adaptation.

[123] Intergovernmental Panel on Climate Change 2022.
[124] United Nations Development Program 2024.

3.3 Climate change adaptation approaches

The adaptation cycle includes identifying climate risks, formulating adaptation policies or plans, implementing actions, and then monitoring and evaluating the results. The cycle has been adopted widely. For example, all Organisation for Economic Co-operation and Development countries have developed at least one national strategy or plan for climate adaptation, with more than half having already updated it at least once.[125]

Figure 3.3.A: The iterative climate adaptation cycle

The Commission considered how the adaptation cycle recommended by the Paris Agreement has been adopted in 6 jurisdictions, including NSW. The United Kingdom (UK), European Union (EU), and New Zealand (NZ) are informative as they have had one or more adaptation cycles. Victoria and the Australian Government were analysed as they are commonly compared with NSW. Jurisdictions' adaptation cycles commonly included the steps outlined in Article 7(9) of the Paris Agreement.

The UK, Victoria, NZ and the EU legislated their adaptation cycles, including setting maximum timeframes between different parts of the adaptation cycle. Legislated timeframes for adaptation planning provides continuity and has effectively ensured ongoing progress in several jurisdictions.

[125] Organisation for Economic Co-operation and Development 2023.

The public release of information on climate risks is a requirement in UK and NZ legislation. The publication of reports, including risk assessments, during the adaptation cycle builds community understanding and engagement, which encourages accountability and good decision making.

Box 3.3.A: The Australian context

The national approach to climate change adaptation is outlined in a 2012 Council of Australian Government's agreement entitled 'Roles and responsibilities for climate change adaptation in Australia'. Underpinning this agreement is the principle that climate-related risks should be assigned to those best able to manage them. The result is that states and territories are largely responsible for climate change adaptation. A 2024 independent review of the Australian Climate Service recommends that the Australian Government review this agreement. Given the considerable evolution of the climate policy landscape since 2012, a review of the agreement may support climate adaptation in NSW.

The Australian Government has committed to deliver a National Climate Risk Assessment (NCRA) and National Adaptation Plan (NAP). The NCRA is intended to deliver a shared understanding of national climate change risks and inform the NAP. The first pass of the NCRA, released in March 2024, provides a high-level risk assessment at a national scale and was designed to inform national-level adaptation responses.

3.4 Adaptation in NSW

The NSW Climate Change Policy Framework, released in 2016, set an aspirational objective of making NSW more resilient to a changing climate.

The NSW Climate Change Adaptation Strategy was released in 2022. It sets out the NSW Government's long-term approach to adaptation across four priority areas:

1. develop robust and trusted metrics and information on climate change risk
2. complete climate change risk and opportunity assessments
3. develop and deliver adaptation action plans
4. embed climate change adaptation in NSW Government decision making.

It includes 20 actions supported by $93.7 million in funding from 2022 to 2030. The strategy is the first state-wide attempt to coordinate ongoing adaptation planning in NSW.

Several ongoing NSW Government programs that focus on state-wide climate change adaptation pre-date the strategy. For example, the AdaptNSW website has been a source of information on climate change adaptation for over 10 years. A dedicated climate science team has been operating since 2007, releasing the state's first climate change projections in 2014.

Most recently, the NSW Government enacted the *Climate Change (Net Zero Future) Act 2023* (the Act). Part of the Act's purpose is to give effect to the Paris Agreement's adaptation aim – to increase the ability to adapt to the adverse impacts of climate change. The Cabinet Office subsequently established a Climate Change Network to oversee the whole-of-government implementation of climate change objectives.

Under section 15(1)(b) of the Act, *the* Commission's role is to monitor and review, and provide advice and recommendations on, progress in relation to the broad adaptation objective: 'NSW is more resilient to a changing climate'. Section 10(2) of the Act enables the creation of regulations that may advance the implementation of the adaptation objective.

Many other activities play an important role in helping NSW adapt to the impacts of climate change. These include:

- planning and disaster risk reduction initiatives
- the activities of NSW Government agencies, local councils, businesses and communities
- individual actions.

The Commission acknowledges the important role of the knowledge and practices of Aboriginal peoples in informing and guiding adaptation policy and programs in NSW. For millennia, Aboriginal peoples have been adapting to changing environments by learning from Country and responding with cultural practices to protect and care for Country. Listening to the voices of Aboriginal people and enabling their cultural knowledge and practices can help NSW adapt and respond to a changing climate. The Commission will seek to actively consider how Aboriginal cultural knowledge and practices can support adaptation and inform its future advice and recommendations.

Box 3.4.A: Connecting to Jagun (Country) for healing and community resilience

The Connecting to Jagun for healing and community resilience project is an example of an Aboriginal-led caring for Country project that has been supporting social, cultural, environmental and economic outcomes. In response to the extreme 2019-20 bushfires, the project has been improving landscape and community climate adaptation through caring for and connecting to Country. The project focused on healing community and caring for Country through cultural fire as a learning pathway to improve community and landscape resilience to bushfires and natural hazards. The project, led by Jagun Alliance Aboriginal Corporation, was a collaboration between local Aboriginal rightsholders, regional stakeholders and local landholders in the Northern Rivers of NSW. It delivered over 20 community fire planning workshops and 45 cultural burns in 2023. Many of the project activities supported intergenerational and cross-cultural climate adaptation knowledge exchanges between local landholders, Bundjalung, Githabul, Gumbayngirr and Yaegl peoples. The project is enabling ongoing climate adaptation by teaching and practicing cultural knowledge that has been reducing bushfire risk and improving environmental outcomes for thousands of years.

Credit: Jagun Alliance

The project was funded by the Australian Government's Black Summer Bushfire Recovery Grant. Jagun Alliance provided this case study to the Commission for use in this report.

Disaster risk reduction in NSW

Disaster risk reduction is one element of climate change adaptation. The Sendai Framework for Disaster Risk Reduction 2015-2030 emphasises the importance of coherence between the two separate disciplines. The *NSW Reconstruction Authority Act 2022* established the NSW Reconstruction Authority, a state government agency responsible for disaster recovery and building community resilience to disasters. Two independent inquiries on disasters influenced the authority's establishment: the 2020 NSW Bushfire Inquiry and 2022 NSW Flood Inquiry.

The authority released the first State Disaster Mitigation Plan in 2024, and the second plan will be delivered in 2026. The authority is also responsible for guiding the development of local or regional Disaster Adaptation Plans (DAPs). These plans must consider the impact of climate change and will outline actions designed to prevent or minimise the impact of disasters. The authority is developing the DAPs for the Northern Rivers and Hawkesbury–Nepean Valley.

3.5 How NSW compares with other jurisdictions

The adaptation cycle set out in the NSW Climate Change Adaptation Strategy aligns with the Paris Agreement and approaches in other jurisdictions. The strategy's actions set out an ongoing adaptation cycle with a maximum timeframe of 5 years, allowing for shorter or more frequent planning cycles to consider emerging climate risks and information. While NSW climate change legislation includes a high-level adaptation objective, it does not legislate an adaptation cycle.

Jurisdiction	Legislation	Adaptation cycle	Risk assessment	Adaptation plan	Monitoring and evaluation
United Kingdom	Climate Change Act 2008	✓ Legislated	✓ Independent	✓	✓ Independent
European Union	European Climate Law 2021	✓ Legislated	✓	✓	✓ EU Commission
New Zealand	Climate Change Response Act 2002[126]	✓ Legislated	✓ Independent	✓	✓ Independent
Australia[127]	Climate Change Act 2022	✗ Not legislated	✓ Not completed	✓ Not completed	✓ Not completed
Victoria	Climate Change Act 2017	✓ Legislated	✗	✓	✓ Not legislated
NSW	Climate Change (Net Zero Future) Act 2023	✗[128] Not legislated	✓ Not completed	✓	✓ Not completed

Table 3.5.A: Overview of approaches to the adaptation cycle across Australian and international jurisdictions

[126] Adaptation was included in a 2019 amendment to New Zealand's Climate Change Response Act 2002.
[127] The Australian Government has not committed to an ongoing adaptation cycle.
[128] The *Climate Change (Net Zero Future) Act 2023* includes an adaptation objective but does not legislate an adaptation cycle.

3.6 Measuring progress on adaptation

For this initial report, the Commission focused on the progress NSW has made towards delivering the public adaptation commitments in the NSW Climate Change Adaptation Strategy, using qualitative evidence, including a self-assessment of progress provided by the NSW Department of Climate Change, Energy, the Environment and Water. This was informed by international frameworks and the adaptation approaches of other jurisdictions.

Measuring progress on climate change adaptation is extremely challenging. While it is possible to prepare quantitative projections for climate change mitigation, it is much more difficult to measure adaptation progress quantitatively. Greater emphasis needs to be placed on qualitative assessments, which are common in other jurisdictions. For future annual reports, the Commission will endeavour to articulate a clear approach to measuring progress, including quantitative measures where possible. The department has reported information on the status and expected completion dates of 20 strategy actions (see table 3.6.A), noting that:

- 2 out of 9 actions due in 2023 were completed (actions 12 and 13)
- the delivery of six actions due in 2023 was delayed (actions 1, 9, 10, 11, 14 and 18)
- one action due in 2023 was yet to start (action 15).

Eleven actions are due later or are ongoing. Of these, 9 are underway (actions 3, 4, 5, 6, 7, 8, 16, 17 and 19) and 2 are yet to start (actions 2 and 20).

Table 3.6.A summarises the status of each action as reported by the department. The Commission has not commented on every action in the strategy. Instead, its assessment of progress has focused on activities that enable adaptation planning and NSW's adaptation cycle.

Completed | Underway | Underway (delayed) | On track | Yet to commence

Status		Strategy	Due date
	12	Clearly define responsibilities for NSW public sector senior executive leadership to improve oversight around climate change risks, opportunities and adaptation.	2023
	13	Appoint a climate change risk officer in each NSW Government cluster to embed climate change risk and adaptation across Government actions and decisions.	End of 2023
	4	Undertake the first climate change scenario analysis for NSW and update it periodically to align with the latest evidence.	End of 2024
	5	Engage in ongoing research on priority climate change risks, opportunities and adaptation options.	No due date
	6	Engage in ongoing research and modelling to translate climate change projections into real-world socio-economic impacts and address priority knowledge gaps.	No due date
	7	Translate climate science into accessible information and resources for people with exposure to climate change risks and all NSW stakeholders.	No due date
	8	Continue to develop practical information, advice and decision tools on the best way to adapt and prepare for climate change.	No due date
	17	The Office of Energy and Climate Change in NSW Treasury will be responsible for monitoring the actions under this strategy and adaptation action plans. The Office will track progress and will coordinate and develop governance for monitoring and reporting by other agencies.	2028
	1	Establish a set of specific, measurable and timebound metrics to measure progress toward climate change resilience and adaptation for all of NSW.	End of 2023
	9	Publish NSW climate change risk and opportunity assessments at least every 5 years, with the first assessment to be published in 2023.	2023
	10	Publish a NSW adaptation action plan at least every 5 years based on the latest climate change risk and opportunity assessment, with the first plan to be published in 2023.	2023
	11	Update or develop policies, guidance, processes and standards (such as NSW Government Business Case Guidelines, Guide to Cost-Benefit Analysis, the NSW Gateway Policy and the Asset Management Policy) so that NSW Government decisions rigorously consider climate change risks, opportunities and adaptation.	End of 2023
	14	Require all NSW Government agencies to identify their own climate change risks in alignment with the Climate Risk Ready NSW Guide and climate change projections.	End of 2023
	18	Publish whole of government climate change disclosures consistent with the Taskforce on Climate-related Financial Disclosures recommendations and other leading international and national standards and guidance as they evolve.	2023
	3	Publish regularly updated and improved local level climate change projections.	No due date
	16	Engage with international bodies and groups of subnational governments to make climate change resilience and adaptation part of all key decisions internationally, move the adaptation agenda forward and maximise opportunities for NSW, including exploring options to share NSW programs and expertise with other jurisdictions and vice versa.	No due date
	19	Publish data and projections on climate change risks, including the financial impacts of those risks, in the NSW Treasury Intergenerational Report released every 5 years.	No due date
	2	Require all NSW Government agencies to report regularly against the metrics (for example annually, or every 2 or 3 years as appropriate for the metric).	End of 2025
	15	Develop climate change risk thresholds and a prioritisation framework to guide the development of adaptation action plans.	End of 2023
	20	At least every 5 years, a panel comprised of representatives from Infrastructure NSW, the Office of the NSW Chief Scientist and Engineer, the NSW Chief Economist and other representatives with suitable expertise will publish an evaluation report on the effectiveness of the actions set out in this strategy and adaptation action plans.	2028

Table 3.6.A: Status of actions from the NSW Climate Change Adaptation Strategy, provided to the Commission by the NSW Department of Climate Change, Energy, the Environment and Water

3.7 Summary

The NSW Climate Change Adaptation Strategy aligns with the Paris Agreement and approaches in other jurisdictions. The strategy sets out a 5-year cycle for adaptation planning. This includes assessing risks, developing plans or programs, and monitoring and evaluation. Many jurisdictions have embedded adaptation planning in legislation. While NSW climate change legislation includes an adaptation objective, it does not legislate an adaptation cycle recommended by the Paris Agreement.

Since the strategy was launched, the NSW Government has made significant progress in certain areas, including:

- developing the first state-wide adaptation action plan
- publishing revised climate change projections
- supporting revised climate change projections with communication products
- offering climate risk training to NSW Government senior executives and appointing climate change risk officers to support risk management for government agencies.

A key strategy action, the NSW Climate Change Risk and Opportunity Assessment, has been delayed from 2023 to early 2025. As this risk assessment is a critical part of the evidence base to inform state-wide adaptation action, its completion should be prioritised. Flow-on impacts from this delay include the deferral of three strategy actions.

Close to halfway through the 5-year implementation period, vital elements of the adaptation cycle have not progressed. In some other jurisdictions, the inclusion of adaptation cycles in legislative instruments have ensured their ongoing application and this approach may help ensure an adequate state-wide adaptation response for NSW.

3.8 Enabling adaptation planning

Updated climate change projections

Climate change information is a critical foundation to enable adaptation planning. In August 2024, the NSW Government released updated NSW and Australian Regional Climate Modelling (NARCliM) projections for two future greenhouse gas emission scenarios. The release of these projections - known as NARCliM2.0 - was a major milestone and one that places NSW at the forefront of climate change information internationally. The resolution of the data is the highest available for south-east Australia, making the information particularly useful for decision making at regional scales.

Improved communication of projections

Following a recommendation of the Audit Office of NSW,[129] the release of NARCliM2.0 (action 3) was supported by communication products including 12 regional snapshots and updates to the AdaptNSW website (action 7).

Future use of climate change projections

NARCliM currently offers very valuable climate change projections for NSW. It should be used, where appropriate, as a source of advice to inform adaptation planning. NSW Government agencies should engage and make greater use of the latest projections to ensure that decisions address the future vulnerability of NSW communities to climate change.

The Commission understands that there may be ongoing barriers to the appropriate use of NARCliM2.0 projections. These barriers include a lack of:

- capability in accessing and applying the data across state and local governments
- capacity to support the use of the data to create actionable information.

The NSW Department of Climate Change, Energy, the Environment and Water has reported that:

- Some NSW Government senior executives received training to help them understand climate change risks and responsibilities (action 12).
- Climate change risk officers have been appointed across the NSW Government to embed climate risk management (action 13).
- Some NSW Government agencies have identified their climate change risks with the support of climate change risk officers (action 14).

While these actions target the capability challenge, the Commission intends to consider whether capacity within government is a barrier to the effective use of NARCliM2.0.

[129] NSW Audit Office 2021.

Investment in adaptation

The NSW Treasury previously estimated that more frequent and severe natural disasters triggered by extreme weather events could cost NSW up to $17.2 billion per year, on average, by 2060–61.[130] This estimate does not include the likely costs of rising sea levels and heatwaves, or the impact of changing weather and climate on agricultural production.

The NSW Climate Change Adaptation Strategy committed $93.7 million from 2022 to 2030 to deliver its actions. The NSW Department of Climate Change, Energy, the Environment and Water reported that the adaptation action plan is not supported by additional funding. The Commission has requested more information on investment in adaptation and related programs across the NSW Government.

Every dollar appropriately invested in climate change adaptation and disaster risk reduction saves between $2 and $10 dollars in recovery.[131] Access to adequate financial resources is an enabling condition for adaptation.[132] There is an opportunity for the NSW Government to optimise adaptation investment and ensure that any adaptation action is adequately resourced.

[130] NSW Treasury 2021.

[131] Global Commission on Adaptation 2019.

[132] Intergovernmental Panel on Climate Change 2022.

3.9 NSW's adaptation cycle

NSW Climate Change Risk and Opportunity Assessment

Risk assessments are the foundation of effective adaptation planning and the development of programs and policies to ensure that NSW is more resilient to a changing climate. The NSW Government committed to publishing a risk assessment at least every 5 years (action 9). The first risk assessment was due in 2023. Once completed, it should identify the highest-priority climate change risks and inform the development of targeted actions.

The NSW Department of Climate Change, Energy, the Environment and Water has reported to the Commission that it expects the risk assessment to be completed in early 2025 and that because it has not been done, actions 1, 2 and 15 have been delayed. The Commission encourages the department to consider prioritising resources in the short term to complete and publish the results of the risk assessment as soon as possible.

Assessing climate change risk is challenging. Many adaptation plans acknowledge the importance of future exposure and vulnerability trends, but the evidence base underpinning these often lacks a balanced and comprehensive risk assessment.[133] While almost all EU member states have conducted climate risk assessments, robust and comprehensive assessments are rare.[134]

The department has provided information on a method initially considered in 2022, and an academic paper by Simpson *et al.* entitled 'A framework for complex climate change risk assessment'. However, the department found that the initial method did not sufficiently capture complex risk or incorporate a systems approach. A review of international evidence indicates that other risk assessments at national or state scales have also not achieved these.

Acknowledging that climate risk assessments are challenging and that an agreed approach is lacking, the Commission suggests the department adopts a method that delivers a fit-for-purpose risk assessment as soon as possible.

Release of the NSW Climate Change Adaptation Action Plan 2025-2029

The NSW Government initially committed to developing an action plan in 2016 for release in 2017. The Government published the NSW Climate Change Adaptation Action Plan 2025-2029 in October 2024 (action 10) - a significant milestone for climate change adaptation in NSW. The plan assigns actions to a range of government agencies, including Destination NSW; the NSW Department of Planning, Housing and Infrastructure; NSW Health; NSW Rural Fire Service; Transport for NSW; the NSW Department of Primary Industries and Regional Development; NSW Treasury and the NSW Department of Climate Change, Energy, the

[133] Garschagen et al. 2021.
[134] European Commission 2023.

Environment and Water. The Commission understands that the whole-of-government Climate Change Network, convened by The Cabinet Office, will oversee the plan's implementation.

The Commission supports the NSW Government's commitment to reviewing the adaptation action plan in 2026 to enable an update that considers the completed risk assessment.

While the Commission has not yet had the opportunity to review the adaptation action plan, the NSW Department of Climate Change, Energy, the Environment and Water reported that a risk assessment would have enabled the plan to:

- better focus resources on the most important risks and opportunities
- more fully meet the criteria for adaptation action plans, as specified in the strategy.

Monitoring and evaluation

The department has developed a draft monitoring and evaluation framework (action 17) for the NSW Climate Change Adaptation Strategy. The strategy commits to publish an evaluation report on the effectiveness the strategy and any adaptation action plans in 2028 (action 20). Monitoring and evaluation processes are important for tracking implementation of adaptation initiatives. These actions are a key part of the adaptation cycle and promote continuous improvement.

The strategy commits to establishing a set of specific, measurable and timebound metrics (action 1) and requiring all NSW Government agencies to report against them (action 2). These metrics, due in 2023, were intended to measure progress towards climate change resilience and adaptation for all of NSW.

Progress on this action includes the development of a framework to guide the selection of metrics. The NSW Department of Climate Change, Energy, the Environment and Water is piloting this framework for biodiversity and the water sector. Further development of state-wide metrics outside these pilots has been delayed until the completion of the risk assessment. As noted in section 3.6, the Commission intends to consider metrics as part of its approach to assessing adaptation progress for future annual reports.

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