

HOUSE OF ASSEMBLY
LAID ON THE TABLE

20 Mar 2024

Report on the operation of the *Climate Change and Greenhouse Emissions Reduction Act 2007* (South Australia)

Prepared under **Section 7** of the
Climate Change and Greenhouse Emissions Reduction Act 2007 (South Australia)

December 2023



Government of South Australia

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Executive Summary

The *Climate Change and Greenhouse Emissions Reduction Act 2007* (the Act) sets a framework for government to work with business and the community to reduce emissions and build resilience to the impacts of climate change. Under the Act, a Section 7 report is required every two years on progress against emissions reduction and renewable energy targets. This Section 7 report relates to the 2022 and 2023 calendar years.

Net greenhouse gas emissions have reduced by 44% in South Australia between 1989-90 and 2020-21. This is significant progress towards South Australia's legislative target "...to reduce by 31 December 2050 greenhouse gas emissions within the state by at least 60 percent to an amount that is equal to or less than 40 percent of 1990 levels" stated in the Act.

South Australia also has policy targets to reduce greenhouse gas emissions by more than 50% by 2030 (from 2005 levels) by 2030 and to reach net zero emissions by 2050.

Since the previous report, several key policies and practical measures have been developed to progress South Australia's reduction of greenhouse gas emissions, in particular:

- *South Australia – Responding to Climate Change 2022*
- *South Australian Government Climate Change Actions*
- *Hydrogen Jobs Plan*
- Repeal of the Electric Vehicle levy
- *Carbon Farming Roadmap for South Australia 2022*
- *South Australia's Small Business Strategy 2023-2030*
- South Australia's Green Paper on the Energy Transition
- Successful passage of amendments to the *Environment Protection Act 1993* in September 2023, that clarified that climate change matters can be considered when administering the Act. Amendments will commence on 1 March 2024.
- Work on developing a state-wide emissions reduction plan, and modernising the Act
- An Industry Climate Change Conference held in April 2023 to connect industry, business, and governments on building a strong net zero emissions future
- Community Climate Conversations held across the state to understand how South Australian communities consider the state should transition to a clean, green, and net zero greenhouse emissions future.

1 Introduction

The [*Climate Change and Greenhouse Emissions Reduction Act 2007*](#)¹ (the Act) provides for measures to develop and implement strategies to reduce greenhouse gas emissions, foster renewable sources of energy, and facilitate adaptation to climate change.

This report has been prepared in accordance with Section 7 of the Act. This is the eighth report on the operation of the Act and provides information about the reporting period for the 2022 and 2023 calendar years. To meet the requirements of Section 7 (Appendix A), this report:

1. provides information about greenhouse gas emissions and renewable energy in South Australia
2. reports on progress to achieve the renewable electricity targets
3. assesses the effectiveness of South Australia's climate change initiatives in achieving the SA target
4. describes targets and determinations
5. reports on progress against sector based or interim targets
6. describes climate change sector agreements
7. provides an overview of offset programs and the national emission trading scheme
8. describes inter-governmental agreements
9. describes significant national or international commitments
10. describes impacts of climate change.

This report uses the emissions inventory published in the State and Territory Greenhouse Gas Inventories (STGGI) 2021, which was published in April 2023. These are the most recent figures provided by the Australian Government.

The preceding seven progress reports were completed from 2009 to 2021 and are available on the [Department for Environment and Water website](#)².

¹<http://www.legislation.sa.gov.au/LZ/C/A/CLIMATE%20CHANGE%20AND%20GREENHOUSE%20EMISSIONS%20REDUCTION%20ACT%202007.aspx>

²<https://www.environment.sa.gov.au/about-us/our-reports/climate-change-greenhouse-emissions-reduction-reports>

2 Greenhouse gas emissions

This section presents an assessment of the progress being made to achieve the greenhouse gas emissions target.

2.1 2020-21 greenhouse gas emissions and progress towards the SA target

The SA target under the Act is “to reduce by 31 December 2050 greenhouse gas emissions within the state by at least 60 percent to an amount that is equal to or less than 40 percent of 1990 levels”.

Climate change initiatives put in place by government and other public and private sector organisations have contributed to the net greenhouse gas emissions reduction of 44% between 1989-90 and to 2020-21.

In 2020-21, South Australia emitted 21.5 million tonnes of carbon dioxide equivalent (CO₂-e) and South Australian emissions per capita were 12 tonnes of CO₂-e, which is lower than the national average of 18 tonnes of CO₂-e.

The greenhouse gas emissions presented in this report are not comparable to those published in previous Section 7 reports. The Australian Government regularly revises inventory emission factors and methodologies, and subsequently revises figures back to 1990 to ensure time series consistency. See Appendices B and C for more information on emissions sources and technical notes on the inventory, respectively.

2.2 2020-21 greenhouse gas emissions and progress towards non-legislated emissions targets

South Australia’s policy targets are to reduce net greenhouse gas emissions by more than 50% below 2005 levels by 2030, and to achieve net zero emissions by 2050. Between 2004-05 and 2020-21, net emissions decreased by 42%.

2.3 Sources of emissions

Sources of emissions include: transport; agriculture; energy industries; industrial processes; fugitive emissions; manufacturing industries and construction; other energy sectors; waste; and land use, land use change and forestry (LULUCF) (see Figure 1).

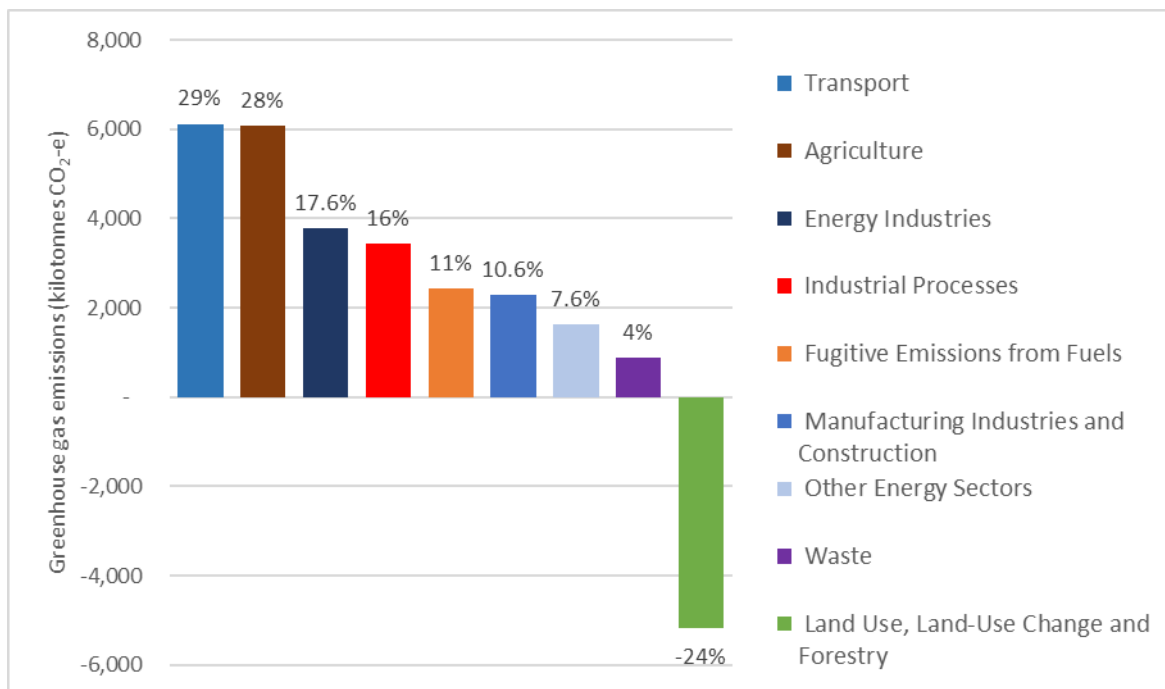


Figure 1: South Australian greenhouse gas emissions percent contribution to total net emissions by sector in 2020-21³

The **Energy sector** contributed the most emissions to total net state emissions (76%). This is comprised of 29% from **Transport** emissions; 17.6% from **Energy industries** (majority from electricity generation); 11% from **Fugitive emissions from fuels** (oil, gas and solid fuels industries); 10.6% from **Manufacturing industries and construction** and 7.6% from **Other energy sectors**.

Agriculture contributed 28% to total net state emissions. This included emissions from livestock industries (enteric fermentation and manure management) and agricultural soils and soil applications, such as fertiliser usage. Emissions from agriculture are impacted by a range of factors, including market conditions and seasonal climatic conditions such as drought.

Industrial processes contributed 16% to total net state emissions. This includes emissions from the food and beverage industry, and the metals, chemicals and minerals (e.g. cement) industries. This emission source also includes emissions from the consumption of halocarbons in refrigeration and sulphur hexafluoride in electricity supply and distribution.

The **Waste sector** contributed 4% to total net state emissions. The majority of emissions from this source are from municipal solid waste disposal and wastewater treatment and discharge. Emissions from solid waste disposal are influenced by methane recovery and recycling rates and alternative waste treatment options. Changes in estimates for wastewater treatment and discharge emissions are

³ <https://www.greenhouseaccounts.climatechange.gov.au/>

largely driven by changes in industry production, population loads on centralised treatment systems and the amount of methane recovered for combustion or flaring.

The **Land use, land use change and forestry (LULUCF) sector** includes both emissions sources and sinks (i.e. sequestration of carbon) and when combined provided a net figure of -24%. The sources of emissions include deforestation activities. Sinks include regrowth on deforested land, plantations and natural regeneration, activities on cropland and grassland and a small amount from harvested wood products. This sector experiences large fluctuations over time in sinks and sources from land management activities. Emissions from this source can also often reduce or increase over the whole time series from year to year due to improvements in methodologies.

Appendix B provides a detailed breakdown of emissions by sector.

2.4 Change in emissions since the 1989-90 base year to 2020-2021

Progress towards net emissions targets is achieved through a combination of reducing emissions and preventing increases. From the 1989-90 base year to 2020-21, net emissions have decreased by 44%.

Figure 2 shows the change in South Australian net emissions since 1989-90, alongside gross state product (GSP). Since peak emissions in 2006-07, net emissions have reduced while the GSP has continued to increase.

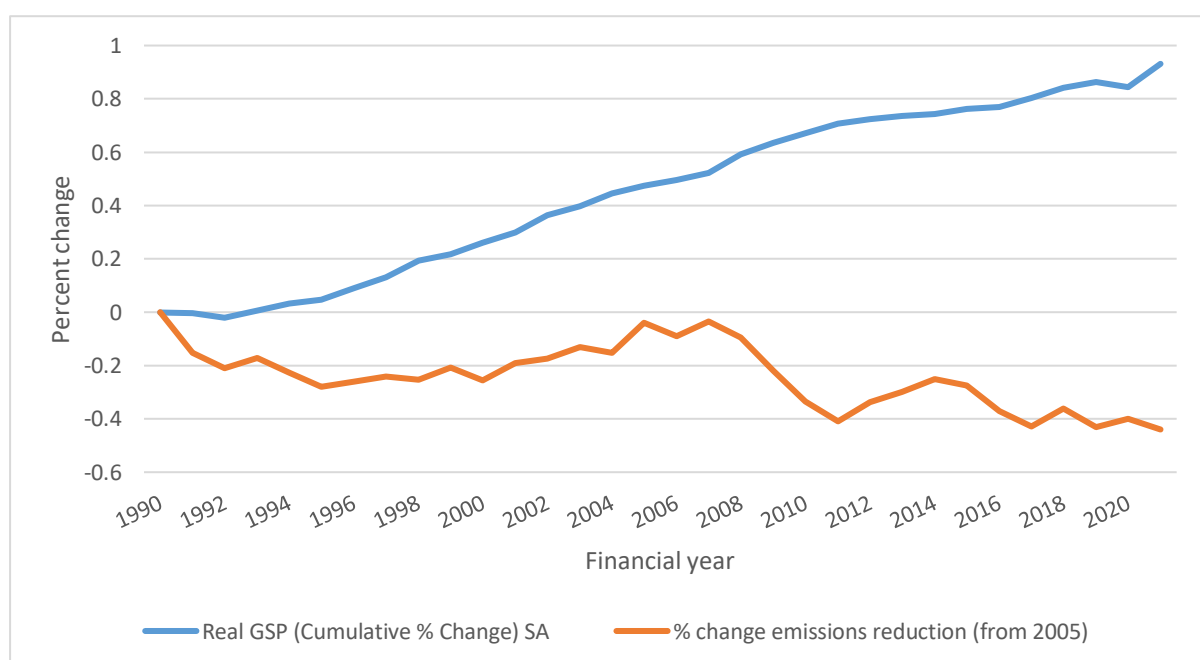


Figure 2: South Australian percent change in GSP and greenhouse gas emissions, since 1989-90 ⁴

2.5 Drivers of change in net emissions from the 1989-90 base year to 2020-21

The changes observed over the measurement period are the net effect of increases and decreases in the different sectors. Greenhouse gas emissions sources that contributed materially to the decrease in

⁴ State and Territory Greenhouse Gas Inventory and Australian Bureau of Statistics State Accounts, 2021-22 financial year

emissions include: Energy industries emissions (driven by an increase in renewable generation); Fugitive emissions from fuels; Agriculture (mainly enteric fermentation); Waste and LULUCF. Sources that increased include Transport, Manufacturing industries and construction, Other energy sectors and Industrial processes.

The change in emissions sources and sinks and their contribution to the increase or decrease in emissions from the 2004-05 to 2020-21 is outlined in Table 1. Appendix B provides a more detailed breakdown of emissions by sector.

Drivers of reduced emissions 1989-90 to 2020-21

The main contributors to overall reductions in net greenhouse gas emissions since 1989-90 are:

1. Land use, land use change and forestry (LULUCF), with an increase in sinks contributing 62% of total net emissions reduction. This is mainly due to plantations and natural regeneration of forest land, regrowth on deforested land, as well as cropland and land being converted to wetland.
2. Fuel combustion in energy industries, contributed 26% of total net emissions reduction. This was mainly due to the increase in renewable energy generation and the reduced emissions intensity of non-renewables.
3. Fugitive emissions from fuels, contributed 12% of total net emission reduction. This is likely to have been driven by a combination of changes in technology as well as the reduction in coal mining and natural gas extraction in South Australia.
4. Enteric Fermentation, contributing 9% of total net emission reduction. This is likely to be driven by the reductions in the numbers of livestock over this period⁵. Reductions in livestock numbers has occurred as a result of drought conditions in South Australia. Stock numbers are expected to recover.
5. Emissions from solid waste disposal and wastewater have also contributed 5% of total net emissions reduction.

Drivers of increased emissions 1989-90 to 2020-21

The main contributors to increases in emissions over this period are:

1. Products used as substitutes for ozone depleting substances (ODS) contributed a 5% increase due to the use of substitutes have increased steadily, causing emissions to rise.
2. Transport contributed a 5% increase due mostly to heavy-duty trucks and buses and light commercial vehicles.
3. Other contributing sources are emissions from fuel combustion in manufacturing industries and construction (2% increase), and agricultural soils and other agriculture (1% increase each).

⁵ <https://www.abs.gov.au/statistics/industry/agriculture/agricultural-commodities-australia/latest-release> ABS Catalogue 7121.0

Table 1: Changes in sources of emissions and sinks and their contribution to change from 1989-90 to 2020-21⁶

Source of greenhouse emissions	Greenhouse emissions (kilotonnes CO ₂ -e)			Contribution to the net decrease		% change in emissions	
	1989-90	2020-21	Change		%	1989-90 to 2020-21	
Energy industries	8,176	3,784 ↓	-4,391	↓	26%	↓	-54%
Manufacturing industries and construction	2,006	2,276 ↑	271	↑	-2%	↑	13%
Transport	5,328	6,114 ↑	788	↑	-5%	↑	15%
Fugitive emissions from fuels	4,385	2,435 ↓	-1,949	↓	12%	↓	-44%
Other energy sectors	1,297	1,629 ↑	333	↑	-2%	↑	26%
ENERGY	21,192	16,238 ↓	-4,953	↓	29%	↓	-23%
Enteric fermentation	5,346	3,831 ↓	-1,514	↓	9%	↓	-28%
Agricultural soils	1,320	1,415 ↑	96	↑	-1%	↑	7%
Manure management	581	567 ↓	-13	↓	0%	↓	-2%
Other agriculture (includes Field burning of agricultural residues, Liming and Urea application)	113	256 ↑	143	↑	-1%	↑	125%
AGRICULTURE	7,360	6,069 ↓	-1,290	↓	8%	↓	-18%
Minerals industry	1,092	928 ↓	-163	↓	1%	↓	-15%
Products used as ODS substitutes	No*	800	800	↑	-5%		n/a
Remaining emissions from industrial processes ⁷	1,667	1,709 ↑	43	↑	0%	↑	3%
INDUSTRIAL PROCESSES	2,759	3,437 ↑	678	↑	-4%	↑	25%
Solid waste disposal	1,150	651 ↓	-498	↓	3%	↓	-43%
Wastewater treatment and discharge	504	215 ↓	-288	↓	2%	↓	-57%
Other waste	4	22 ↑	19	↑	0%	↑	511%
WASTE	1,658	887 ↓	-769	↓	5%	↓	-46%
LULUCF	5,329	-5,179 ↓	-10,507	↓	62%	↓	-197%
Total	38,299	21,452 ↓	-16,845		100%	↓	-44%

Notes: Totals may not sum due to rounding; *Not occurring

⁶ <https://www.greenhouseaccounts.climatechange.gov.au/>

⁷ Some sources contributing to this total are confidential.

3 Renewable electricity targets

This section presents an assessment of the progress being made to achieve renewable electricity targets.

3.1 Renewable energy generation in 2022-23

The Department for Energy and Mining (DEM) reports that South Australia generated 10,452 GWh⁸ of renewable electricity in 2022-23. The amount of renewable energy generation was 73.7% of total energy generation. The Australian Energy Market Operator (AEMO) publicly reports South Australia's energy registered capacity and generation figures for 2022-23 which are provided in Table 2 (See Appendix C for more information).

Table 2: South Australian registered capacity and local generation by energy source in 2022-23

Fuel Type	Registered capacity (MW)	Generation (GWh)	Generation % of total
Gas	2,683	3,598	25.4%
Wind	2,348	6,651	46.9%
Diesel + small non-scheduled generation (SNSG)	482	116	0.8%
Rooftop Photovoltaic (PV)	2,193	2,505	17.7%
PVNSG	251	436	3.1%
Solar	697	804	5.7%
Storage - Battery	471	74	0.5%
Total	9,125	14,185	100%

3.2 Progress against the renewable energy targets under the Act

There are three renewable energy targets under the Act (Table 3). The two generation targets and the consumption target have been achieved.

Table 3: Summary of renewable generation targets.

Target	Status
To increase the proportion of renewable electricity generated so that it comprises at least 20% of electricity generated in the State by 31 December 2014.	This target was achieved in 2010-11 when the result was 22% of electricity generated in the State. In 2013, the CSIRO concluded that this target had been met. Source: 2013 Section 7 report
To increase the proportion of renewable electricity consumed so that it comprises at least 20% of electricity consumed in the State by 31 December 2014.	This target was achieved in 2010-11 when the result was 24.1% of the electricity consumed in the State. In 2013, the CSIRO concluded that this target had been met. Source: 2013 Section 7 report
An additional target of achieving 33% of South Australia's electricity generation to come from renewable energy by 2020 was tabled under Section 5 of the Act in 2009.	The electricity generation target was exceeded in 2013-14 when the result was 39%. In 2018, the CSIRO concluded that this target had been met. Source: 2018 Section 7 report

⁸ Department for Energy and Mining uses adjusted data from the Australian Energy Market Operator (AEMO) South Australian Electricity Report (SAER) to calculate renewable energy generation. Numbers may not match exactly due to rounding.

The South Australian government has a policy target of achieving 100% net renewable energy generation by 2030 (as generated in the state). The proportion of South Australia's electricity generation that is renewables, is provided in Figure 3, with renewables comprising 73.7% of total energy generation in 2022-23.

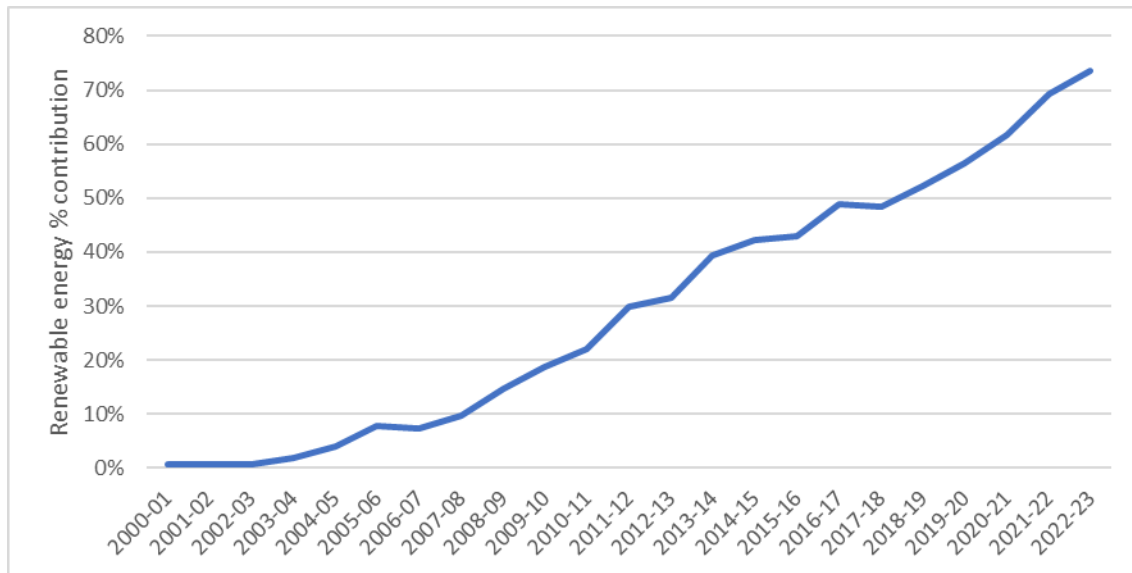


Figure 3: South Australian proportion of electricity generated using renewables, 2000-01 to 2022-23 (Data provided by Department for Energy and Mining)

3.3 Factors that contribute to progress in renewable energy generation

Two types of factors have contributed to progress in renewable energy generation: structural drivers of progress, and the sensitivity of these drivers to changes in context (contextual drivers).

Structural drivers are the mechanics of change, not the cause, and include:

- increased renewable energy generation
- decreasing electricity generation from non-renewables
- reduced South Australian electricity demand
- increasing capacity of residential and utility scale batteries
- reduced electricity imports
- South Australia is a net exporter of electricity.

Contextual drivers include:

- relative market prices of electricity
- commercial decisions to invest in gas and renewable power plants and battery storage
- national schemes (for example, Renewable Energy Target scheme)
- increased capacity of interconnectors
- incentives provided by the Government of South Australia (for example, solar feed-in tariff legislation)
- providing greater certainty of process and supportive policy for windfarm developments in rural areas
- changes in costs of technology.

4 Effectiveness of South Australia's climate change initiatives in achieving the SA target

This section presents an assessment of the effectiveness of the initiatives that are being adopted in order to achieve the SA target.

4.1 Effectiveness and overview of key initiatives

Climate change initiatives put in place by government and other public sector and private sector organisations have contributed to the net greenhouse gas emissions reduction of 44% from the 1989-90 base year to 2020-21. As outlined in section 3.2, a significant portion of emission reductions within South Australia are attributable to the land use, land use change and forestry (LULUCF) and energy industries sectors.

The LULUCF sector has contributed 62% of total emission reductions from the 1989-90 base year to 2020-21. Government and private sector initiatives in the area of afforestation and reforestation have contributed to the amount of carbon stored in sinks. A reduction in deforestation rates has also contributed towards a reduction in emission sources from this sector.

Energy industries have contributed 26% of total emission reductions from the 1989-90 base year to 2020-21. A range of incentives and actions by the South Australian government have contributed to this reduction including: the introduction of market drivers to influence residential and commercial decisions to invest in renewable power and battery storage; improvements in energy efficiency; and technical developments that have reduced the emission intensity of non-renewables. The closure of Port Stanvac, the state's last oil refinery in 2003, and the Northern Power Station, the state's last coal fired power plant in 2016, has also contributed to the reduction.

Key past and present state government initiatives include:

- The Renewable Technology Fund provided grants and loans to support private companies to deliver large scale renewable energy projects, including the Hornsdale Power Reserve.
- Demand management trials to support integration of distributed generation, demand response and demand aggregation assets to increase grid efficiency and incentivise consumers to manage their own electricity demand.
- The Grid Scale Storage Fund and the Home Battery Scheme both support the development of energy storage infrastructure. South Australia's Virtual Power Plant (VPP) is one of the fund's most successful projects. Once complete, it will have 20MW/54MWh of storage capacity.
- SA Water's Zero Cost Energy Future Project is increasing renewable energy generation and energy storage capacity and adopting energy efficiency measures at water utility sites. This includes the installation of 154MW of solar PV and 34MWh of energy storage at 33 water utility sites.
- South Australian Retailer Energy Productivity Scheme supports households and businesses to reduce their energy costs while also maximising the benefits to the power system.

- Review of the Environment Protection (Waste to Resources) Policy 2010 (EPP) with a greater focus on circular economy and decarbonisation.
- Modernisation of the SA Container Deposit Scheme.
- Development of a climate change environment protection policy under the *Environment Protection Act 1993*.

Australian Government policy, for example the Renewable Energy Target and the Emissions Reduction Fund have also helped generate financial incentives for investment in renewable energy generation and other emissions reduction projects.

The agriculture sector has contributed to emission reductions from the 1989-90 base year to 2020-21. This is mainly due to a reduction in emissions from enteric fermentation due to reduced livestock numbers. A reduction in livestock numbers has occurred as a result of drought conditions in South Australia. Stock numbers are expected to recover.

A number of recent initiatives are expected to influence emission reductions into future reporting periods, including:

- The government has allocated \$593 million to build a world-leading hydrogen power plant, electrolyser and storage facility, and accelerate the growth of the state's hydrogen economy under the *Hydrogen Jobs Plan*.
- *South Australia – Responding to Climate Change* outlines the priority actions that the South Australian Government will be focussing on in the near term to build a strong, net zero emissions future and adapt to climate change.
- The government has repealed the Electric Vehicle levy, making it easier for South Australians to shift to electric vehicles.
- Implementing the *Carbon Farming Roadmap for South Australia* will help address barriers and increase participation in carbon farming in South Australia.
- The Growing Carbon Farming Demonstration Pilot, which is supporting trials to encourage carbon farming adoption in South Australia.
- *South Australia's Manufacturing Strategy* includes a focus on lower emissions and environmental sustainability.
- Development of a comprehensive energy transition policy for the next three decades to support the transition to a net-zero emissions future.
- The *Hydrogen and Renewable Energy Act 2023* to enable sustainable large-scale hydrogen and renewable energy projects.
- Development of a state emissions reduction plan that builds on existing initiatives and identifies new policies and actions to reduce emissions in line with state emissions targets.
- Review and amendment of the *Climate Change and Greenhouse Emissions Reduction Act 2007* to update greenhouse gas emissions targets and strengthen climate action.

5 Targets and determinations

This section reports on any target or determination made or set under section 5 during the reporting period.

There were no targets or determinations made or set under section 5 of the Act during the reporting period.

6 Sector based or interim targets

This section presents an assessment of the progress being made to achieve any sector based or interim target under this Act, including a target set for the State Government, or any government agency or instrumentality.

There were no sector based or interim targets under the Act, in place during the reporting period.

South Australia has set a policy target of achieving more than a 50 percent reduction of net emissions by 2030 from 2005 levels. With the 42 percent decrease from 2004-05 levels recorded in 2020-21, at least a further 8 percent net emissions reduction would be needed to meet the interim 2030 target.

While emissions from the energy generation sector are reducing, more effort will be needed to address major sources of emissions across a range of sectors including transport, manufacturing industries and construction, agriculture and industrial processes. This will require additional action by government, business, industry and community.

7 Climate change sector agreements

This section reports on any climate change sector agreements between the Minister and any other person or entity entered into under this Act during the reporting period.

7.1 Climate Change Sector Agreements

The Act provides for the government to enter into climate change sector agreements with people, organisations, and industry or business groups to further any strategies to meet targets set under the Act.

Climate change sector agreements operate under guiding principles and seek to formalise the joint aspiration of the signatories to achieve the aims of the agreement in a non-legally binding way. Typically, the agreements commit the parties to collaborate and work in partnership with a range of stakeholders to deliver the objectives of the agreement.

The climate change sector agreements are published on the [website](#) of the Department of Environment and Water.

Climate change sector agreements entered into during 2022-23

No climate change sector agreements were entered into during 2022-23.

Climate change sector agreements concluded during 2022-23

No climate change sector agreements were concluded in 2022-23.

8 Offset programs and national emission trading scheme

This section reports on any emissions offset programs established or recognised under the Act during the reporting period, and on progress in establishing a national emissions trading scheme.

There were no offset programs or emissions trading established or recognised under the Act in place during the reporting period.

9 Intergovernmental agreements

This section presents a report on any intergovernmental agreements relevant to climate change entered into by the Government of South Australia during the reporting period.

National Energy Transformation Partnership

On 12 August 2022, Commonwealth, State and Territory Energy Ministers agreed to establish a new National Energy Transformation Partnership. The Partnership is a framework for national alignment and cooperative action by governments to support the smooth transformation of Australia's energy sector. Through the Partnership, Commonwealth, State and Territory governments will work together on priority actions to support the energy transformation.

10 International commitments

This section presents a report on any significant national or international commitments or agreements relevant to climate change made or entered into during the reporting period.

10.1 New international commitments and agreements

Net Zero Futures Policy Forum

During the reporting period, the South Australian Government committed to become a member of the Net Zero Futures Policy Forum. The Forum is an international partnership of governments committed to addressing the practical challenges of achieving net zero emissions. The Forum is supported by the Under2 Coalition and is open to state/sub-regional governments at the forefront of global decarbonisation efforts including transition to net zero.

10.2 Existing international commitments

Under2 Coalition / Under2MOU

The Government of South Australia is an Under2 Coalition Steering Group Member.

The coalition is made up of more than 220 governments who represent over 1.3 billion people and 43 percent of the global economy. Governments share expertise on innovative policy, report on measurable climate actions, and drive emission reduction initiatives.

South Australia is a signatory to the Global Climate Leadership Memorandum of Understanding (the Under2MOU) which aims for sub-national governments to reduce their greenhouse gas emissions towards net zero by 2050.

South Australia contributes to the Under2 Ambition Tracker, which is an annual survey to assist in tracking progress of net zero emissions.

States and Regions Compact

South Australia participates in the Climate Group States and Regions Alliance; Network of Regional Governments for Sustainable Development (nrg4SD); R20-Regions of Climate Action (R20); and the CDP (formerly the Carbon Disclosure Project).

South Australia contributes to the Annual Disclosure Report which provides a transparent, global picture of the impact, progress and climate action driven by state and regional governments.

RegionsAdapt

In 2015, South Australia joined RegionsAdapt, a forum to exchange experiences and best practices on adapting to climate change. Regional governments collaborate, exchange knowledge and share best practice on adaptation and resilience to climate change. In line with its commitments, South Australia has taken action on adaptation and reports on progress annually through the CDP's states and regions platform.

11 Impacts of climate change

This section presents information on any relevant rates, trends or impacts associated with climate change, with particular reference to any identified or assessed impacts of climate change on South Australia or any expected future impacts of climate change that have emerged or become increasingly relevant during the reporting period.

11.1 Climate projections in South Australia

The [Guide to Climate Projections for Risk Assessment and Planning in South Australia 2022](#)⁹ provides a summary of the changes in climate that are projected to occur in South Australia over the coming 80 years. They use NARClIM1.5 data at grid resolutions of 10 km and 50 km.

Based on the *Guide to Climate Projections for Risk Assessment and Planning in South Australia 2022*, projections for South Australia indicate that:

- maximum, minimum and average temperatures will increase
- the frequency of very hot days will continue to increase, and heatwaves will get longer and hotter
- warming conditions will reduce the frequency of frost events
- average annual rainfall will decline
- the amount of rain falling, and the frequency of extreme rainfall events will increase
- the time spent in drought will increase
- sea level will continue to rise
- sea surface temperatures will continue to rise, and acidity will continue to increase
- harsher fire weather will be experienced, and fuels will be drier and more ready to burn.

The national [Climate Change in Australia](#) website is another source of information which provides three levels of regional detail in South Australia.

The Goyder Institute for Water Research has developed projections for individual weather stations across the state's natural resources management regions that extend to 2100, for 'intermediate' and 'high' emissions pathways. This information can be accessed through the [Goyder Institute for Water Research website](#)¹⁰ and the Government of South Australia's [Enviro Data SA website](#)¹¹.

11.2 Impacts of Climate Change in South Australia

South Australians are faced with challenges from climate change, including sea level rise, reduced average rainfall, intensification of storm events, and more frequent and severe heatwaves, bushfires and droughts.

⁹<https://data.environment.sa.gov.au/Content/Publications/Guide%20to%20climate%20projections%20for%20risk%20assessment%20and%20planning%20in%20South%20Australia%202022.pdf>

¹⁰[Goyder Institute for Water Research website](#)

¹¹ <https://data.environment.sa.gov.au/>

These changes are likely to impact on agricultural production, public health, community wellbeing, natural landscapes and wildlife habitats, and public and private infrastructure, particularly in coastal areas.

In 2023, the Department for Environment and Water prepared [trend and condition report cards](#)¹² that include information on the condition of rainfall, temperatures and sea levels and projected trends under a changing climate.

In 2023, the Department for Environment and Water launched a new [online](#) mapping tool that provides information on the likely future changes in South Australia's climate to help councils, regions, industry, and climate adaptation leaders to plan for our future.

The [Climate Change Science and Knowledge Plan for South Australia 2022](#)¹³ identifies critical science and information that is needed to inform climate change risk assessment, mitigation, planning and adaptation responses in South Australia. It provides a comprehensive plan to prioritise, coordinate, translate and deliver this climate science and information.

¹² <https://www.environment.sa.gov.au/about-us/our-progress/state-report-cards>

¹³

<https://data.environment.sa.gov.au/Content/Publications/Climate%20change%20science%20and%20knowledge%20plan%20for%20South%20Australia%202022.pdf>

Appendix A : Section 7 of the Climate Change and Greenhouse Emissions Reduction Act 2007 (SA)

7—Two-yearly reports

- (1) The Minister must, on a two-yearly basis, prepare a report on the operation of this Act.
- (2) The report must include—
 - (a) an assessment of the effectiveness of the initiatives that are being adopted in order to achieve the SA target; and
 - (b) a report on any determination or target made or set under section 5 during the reporting period; and
 - (c) an assessment of the progress being made to achieve the renewable electricity target; and
 - (d) an assessment of the progress being made to achieve any sector-based or interim target under this Act, including a target set for the State Government, or any government agency or instrumentality; and
 - (e) a report on any sector agreement between the Minister and any other person or entity entered into under this Act during the reporting period; and
 - (f) a summary of—
 - (i) the levels of greenhouse gas emissions, and of the use of renewable energy, within the State (as determined or estimated at the time of reporting); and
 - (ii) the development of technologies to reduce greenhouse gas emissions or to remove greenhouse gases from the atmosphere; and
 - (g) a report on any emissions offset programs established or recognised under this Act during the reporting period, and on progress in establishing a national emissions trading scheme; and
 - (h) a report on any inter-governmental agreements relevant to climate change entered into by the South Australian Government during the reporting period; and
 - (i) a report on any significant national or international commitments or agreements relevant to climate change made or entered into during the reporting periods; and
 - (j) information on any relevant rates, trends or impacts associated with climate change, with particular reference to any identified or assessed impacts of climate change on South Australia or any expected future impacts of climate change that have emerged or become increasingly relevant during the reporting period.
- (3) The Minister must cause a copy of the report to be laid before both Houses of Parliament within 6 sitting days after the report is prepared.
- (4) The first report under this section must be completed and tabled in Parliament by the end of 2009.
- (5) The first report under this section, and thereafter every alternate report, must incorporate a report from—
 - (a) the CSIRO; or
 - (b) if the CSIRO is unwilling or unable to provide a report—an independent entity designated by the Minister by notice in the Gazette,that assesses the extent to which any determination or target made or set under section 5 is being achieved and, if it appears relevant, should be revised.
- (6) In this section—

CSIRO means the Commonwealth Scientific and Industrial Research Organisation.

Appendix B : Review of sources of greenhouse gas emissions by sector

This Appendix presents the 2020-21 South Australian greenhouse gas inventory by sector. It presents the 1989-90 to 2020-21 inventory, the changes during this period, and graphics, data and summary statistics for each of the sectoral categories.

B.1 All emissions

The South Australian inventory from 1989-90 to 2020-21 is presented in Figure 4, by sectoral source, including:

- Energy (including Energy industries; Manufacturing industries and construction; Transport; Fugitive emissions from fuels; and Other energy sectors)
- Industrial processes
- Agriculture
- Waste
- Land use, land use change and forestry (LULUCF) which is a net calculation of both sources of emissions and greenhouse gas sinks.

The black line in Figure 4 shows total net greenhouse gas emissions.

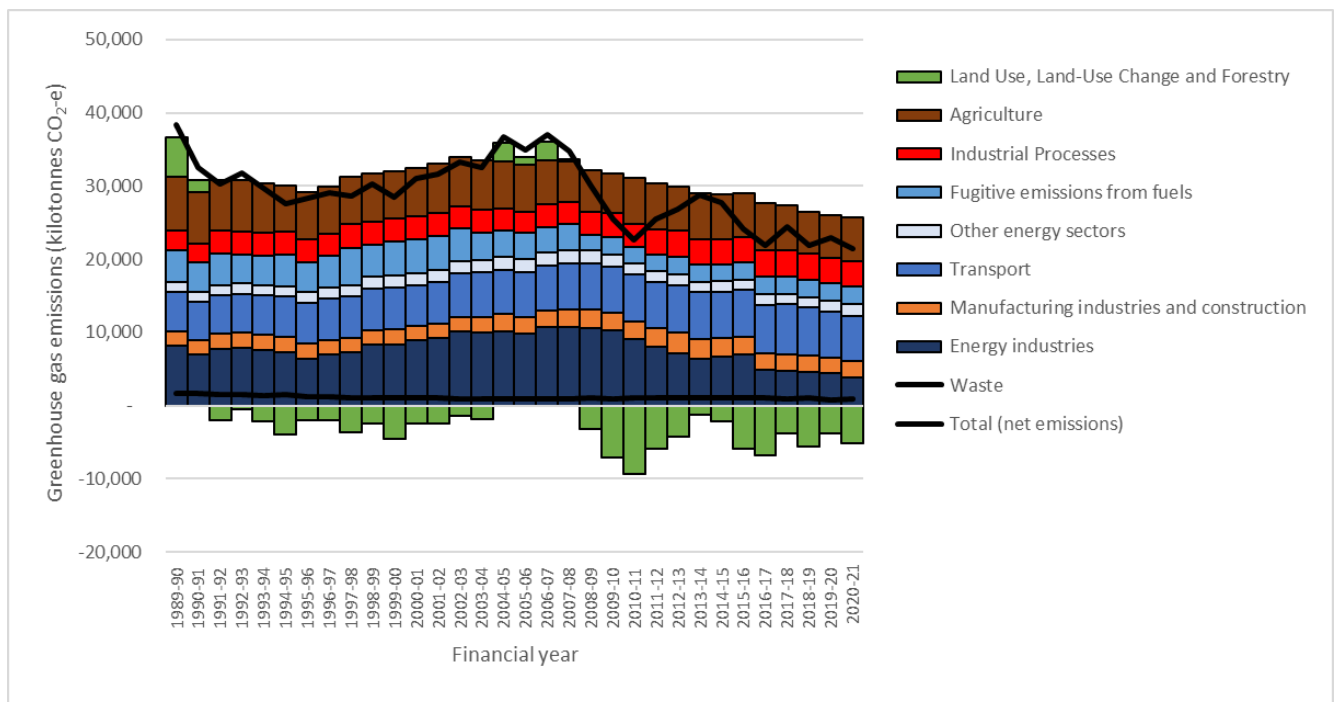


Figure 4: South Australian greenhouse gas inventory, 1989-90 to 2020-21, by source of emissions¹⁴

¹⁴ <https://www.greenhouseaccounts.climatechange.gov.au/>

Table 4: South Australian greenhouse gas inventory by source of emissions, percent change from 1989-90 base year to 2020-21¹⁵

Source of greenhouse emissions	Greenhouse emissions (kt CO ₂ -e)		% Change to 2020-21
	1989-90	2020-21	2004-05 to 2020-21
Energy (including Energy industries; Manufacturing industries and construction; Transport; Fugitive emissions from fuels and Other energy sectors)	21,192	16,238	-23%
Industrial processes	2,759	3,437	25%
Agriculture	7,360	6,069	-18%
Waste	1,658	887	-46%
LULUCF (net)	5,329	-5,179	-197%
Net emissions	38,299	21,452	-44%

Note: Totals may not sum due to rounding

The following sections in this appendix provide detailed graphics, data and summary statistics about each of the categories. All data is sourced from the South Australian Greenhouse Gas Inventory 2021¹⁶.

B.2 Energy

Energy sector emissions are presented in Figure 5 and Figure 6 and are broken down into the following components:

- *Energy industries* – the combustion of fuel in electricity generation, petroleum refining, gas production and solid fuel manufacture.
- *Transport* – road transportation (passenger cars, trucks, and buses), domestic aviation, domestic navigation and pipeline transport.
- *Manufacturing industries and construction* – direct emissions from fuel combustion in manufacturing industries, ferrous and non-ferrous metals production, plastics production, construction and non-energy mining.
- *Other energy sectors* – direct fuel combustion in the residential, commercial and institutional sectors, including energy used in mobile equipment in agriculture, forestry, fishing and military sectors.
- *Fugitive emissions from fuels* – emissions other than energy use including in mining activities and oil and gas sector operations (including venting, flaring, exploration, extraction, production, processing and transmission).

¹⁵ <https://www.greenhouseaccounts.climatechange.gov.au/>

¹⁶ <https://www.greenhouseaccounts.climatechange.gov.au/>

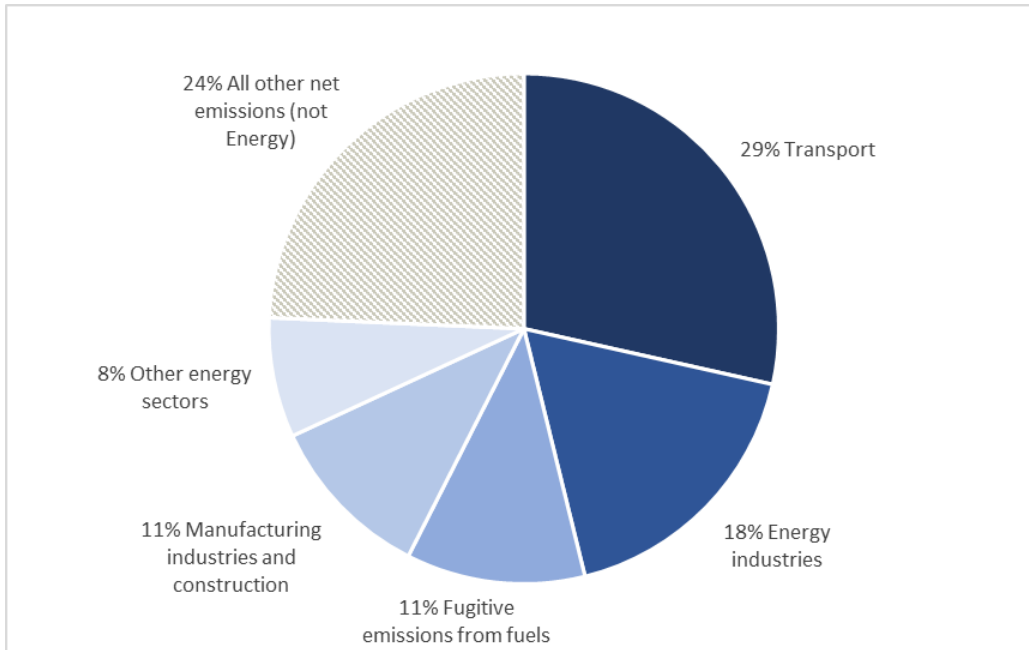


Figure 5: South Australian greenhouse gas emissions energy sector relative to all other net emissions, 2020-21

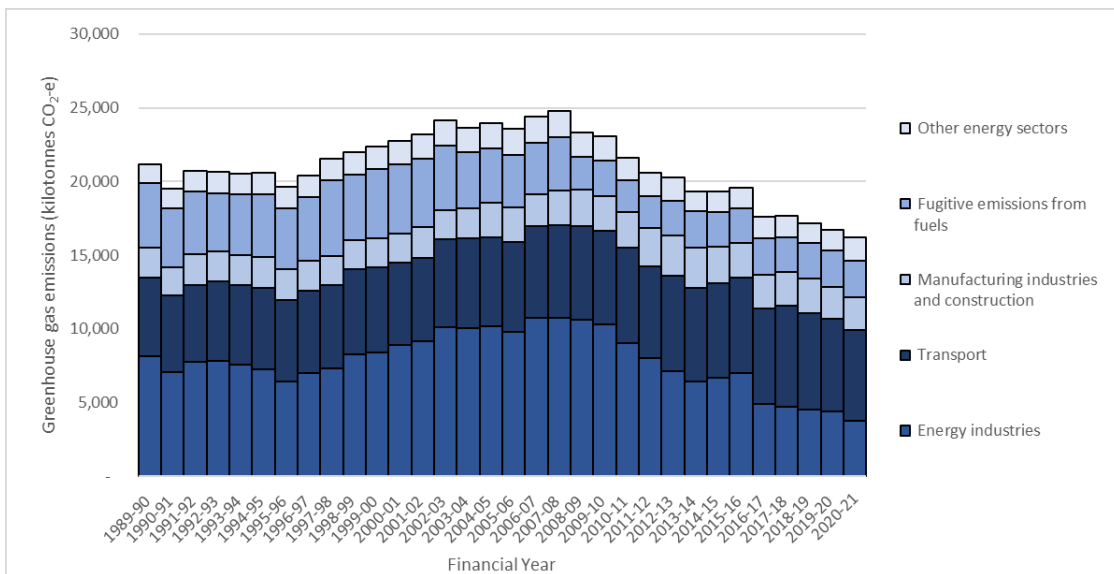


Figure 6: South Australian greenhouse gas emissions energy sector kilotonnes CO₂.e by selected subcategory 1989-90 to 2020-21

Table 5: South Australian greenhouse gas emissions energy sector percent change from 1989-90 base year to 2020-21

Source of greenhouse emissions	Greenhouse emissions (kt CO ₂ -e)		% Change to 2020-21
	1989-90	2020-21	1989-90 to 2020-21
Energy industries	8,176	3,784	-54%
Manufacturing industries and construction	2,006	2,276	13%
Transport	5,328	6,114	15%
Fugitive emissions from fuel	4,385	2,435	-44%
Other energy sectors	1,297	1,629	26%
Energy	21,192	16,238	-23%

B.3 Agriculture

Agriculture sector emissions are presented in Figure 7 and Figure 8, broken down into the following components:

- *Enteric fermentation* – emissions associated with microbial fermentation during digestion of feed by ruminant (mostly cattle and sheep) and some non-ruminant domestic livestock.
- *Manure management* – emissions are produced from the decomposition of the organic matter remaining in manure under anaerobic conditions. These conditions occur when large numbers of animals are managed in a confined area where manure is typically stored in large piles or lagoons.
- *Agricultural soils* – emissions associated with the application of fertilisers, crop residues and animal wastes to agricultural lands and the use of biological nitrogen fixing crops and pastures.
- *Other Agriculture* – emissions from Field burning of agricultural, Liming (emissions associated with the use of limestone and dolomite) and Urea application (emissions associated with adding urea to soils for fertilisation).

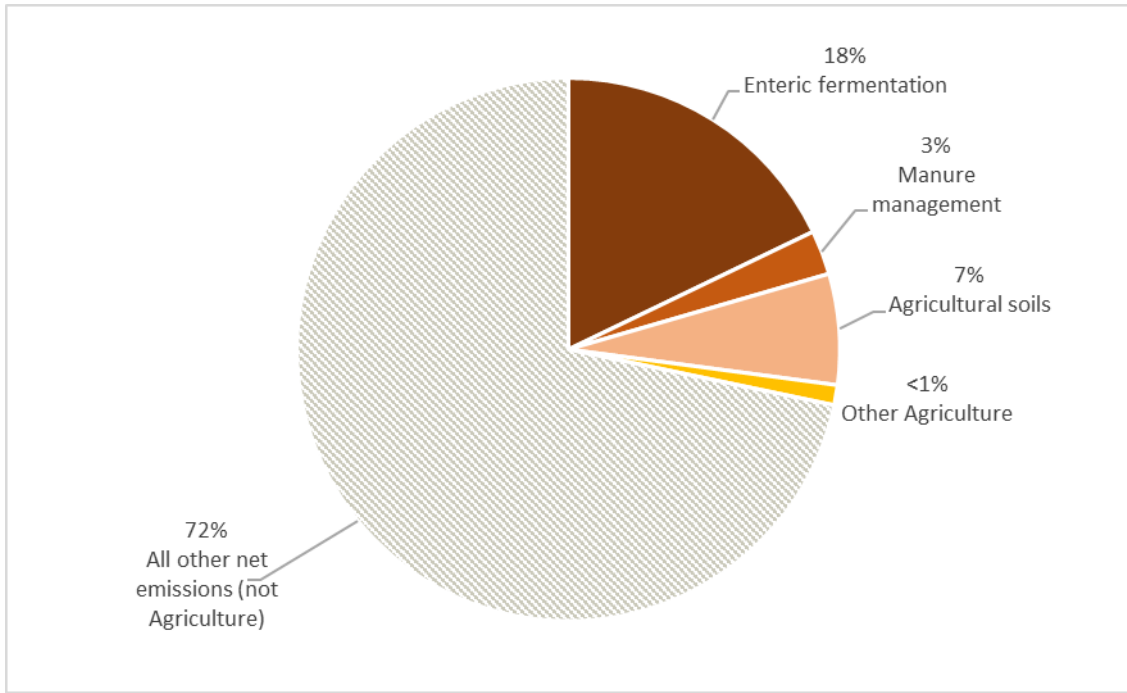


Figure 7: South Australian agriculture sector greenhouse gas emissions relative to all other net emissions, 2020-21

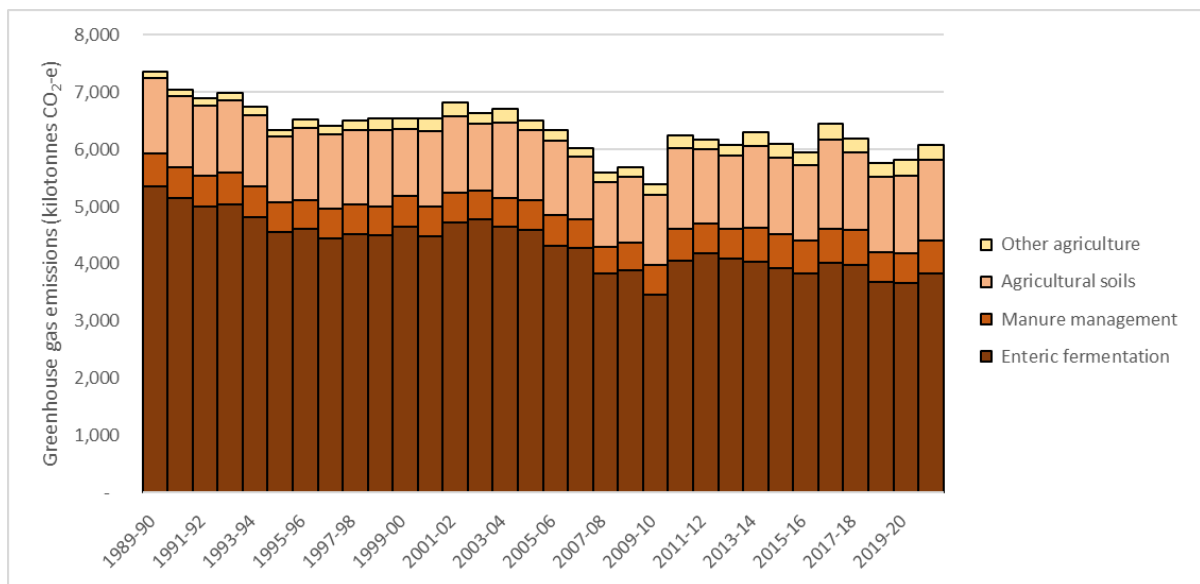


Figure 8: South Australian agriculture greenhouse gas emissions kilotonnes CO₂e, by selected subcategory, 1989-90 to 2020-21

Table 6: South Australian greenhouse gas emissions agriculture sector by source of emissions, percent change from 1989-90 base year to 2020-21

Source of greenhouse emissions	Greenhouse emissions (kt CO ₂ -e)		% Change to 2020-21
	1989-90	2020-21	1989-90 to 2020-21
Enteric fermentation	5,346	3,831	-28%
Manure management	581	567	-2%
Agricultural soils	1,320	1,415	7%
Other Agriculture: (Field burning of agricultural residues, Liming, and Urea application)	113	256	125%
Agriculture	7,360	6,069	-18%

B.4 Industrial processes

Emissions from industrial processes are presented in Figure 9 and Figure 10 and are broken down into the following components:

- *Mineral industry* – carbon dioxide (CO₂) from cement clinker and lime production, the use of limestone, dolomite and other carbonates in industrial smelting and other processes, soda ash production and use and magnesia production.
- *Product uses as ODS (ozone depleting substances) substitutes* – This sub-sector comprises emissions of synthetic gases from the use of hydrofluorocarbons (HFCs) in refrigeration and air conditioning, foam blowing, fire extinguishers, aerosols/metered dose inhalers and solvents.
- Remaining emissions from industrial processes:
 - *Non-energy products from fuels and solvent use* - CO₂ emissions arising from the oxidation of lubricants, as well as emissions from solvent use, road paving and other activities.
 - *Other product manufacture and use* - emissions from the consumption of SF₆ in use in electricity supply and distribution and miscellaneous uses including eye surgery, tracer gas studies, magnesium casting, plumbing services, tyre manufacture and industrial machinery equipment. Emissions of N₂O from aerosol products and anaesthesia are estimated but are confidential and are included in the Nitric acid production emissions.
 - *Emissions from chemical and metals industry (confidential data)*. Key categories in the Australian metals sector are iron and steel and aluminium production. Key categories for Australia in the chemicals sector are CO₂ from ammonia production, N₂O from nitric acid production, and HFCs from fluorochemical production. Emissions estimates are not disclosed for these sources due to confidentiality provisions and cannot be confirmed to apply to South Australia.
 - *Other industrial processes* – CO₂ from the consumption of CO₂ in the food and beverage industry, and the use of sodium bicarbonate.

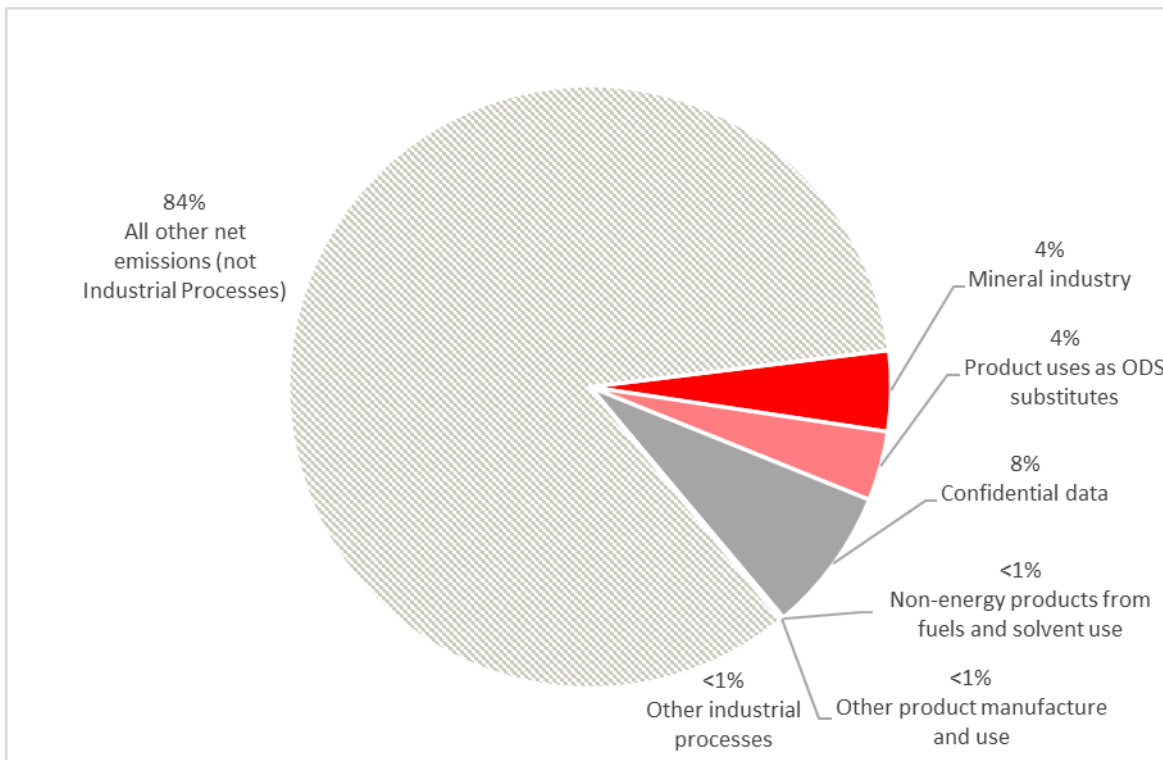


Figure 9: South Australian greenhouse gas emissions industrial processes sector relative to all other net emissions, 2020-21

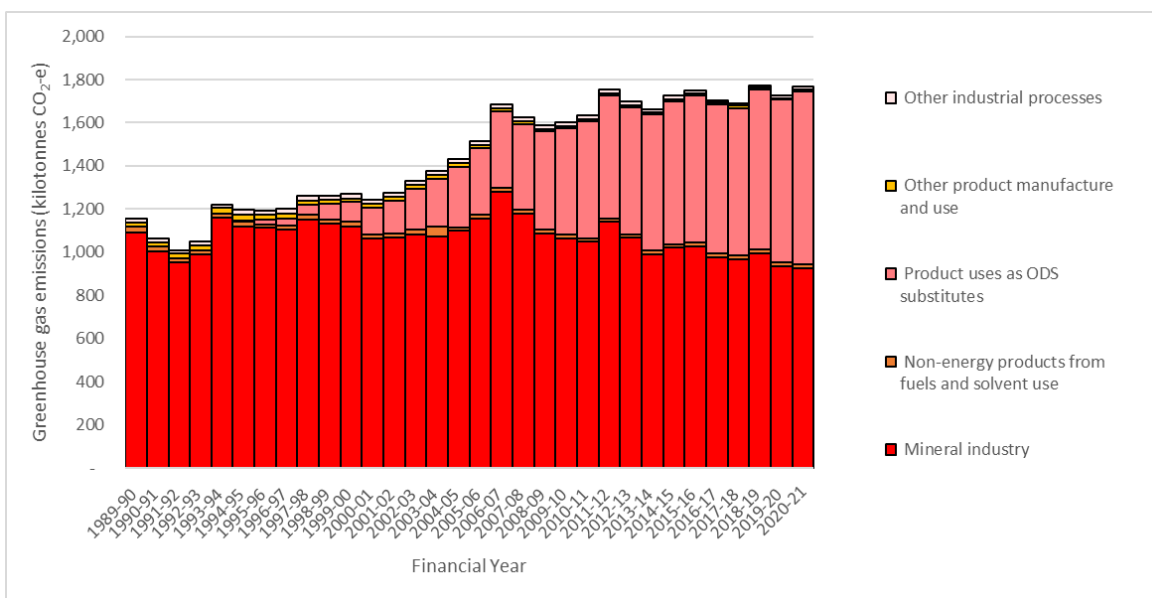


Figure 10: South Australian greenhouse gas emissions industrial processes kilotonnes CO₂-e, by selected subcategory, 1989-90 to 2020-21.

Notes: Emissions estimates are not available for some sources due to confidentiality provisions and are not included in this graph. The graph is not representative of a total for the sector.

Table 7: South Australian greenhouse gas emissions industrial processes sector by source of emissions, percent change from 1989-90 base year to 2020-21

Source of greenhouse emissions	Greenhouse emissions (kt CO ₂ -e)		% Change to 2020-21
	1989-90	2020-21	1989-90 to 2020-21
Mineral industry	1,092	928	-15%
Product uses as ODS substitutes	No*	800	NA
Remaining emissions from industrial processes:	C	C	NA
Chemical Industry	C	C	NA
Metals industry	C	C	NA
Non-energy products from fuels and solvent use	26	17	-35%
Other product manufacture and use	19	11	-42%
Other industrial processes	17	12	-29%
Industrial processes	2,759	3,437	25%

Notes: *Not occurring; C refers to emissions estimates not available due to confidentiality provisions.

B.5 Land Use, Land Use Change and Forestry (LULUCF)

Emissions and sinks from land use, land use change and forestry (LULUCF) are presented in Figure 11 including each of the subcategories separated by sinks and sources. The principal drivers of change in carbon fluxes across the landscape relate to losses and gains of woody vegetation. *Land converted to forest land* and *harvested wood products* are always sinks while *land converted to cropland* and *grassland* are always sources (deforestation). However, all of the remaining categories can have both sinks and sources contributing in any one year. For example, *forest land remaining forest land* was primarily a sink until 2005, only featuring as a source in 1998 and 2000, however since then it has been both a source and a sink.

The LULUCF subcategories are as follows:

- *Forest land* includes all lands with a tree height of at least 2 metres and crown canopy cover of 20 percent or more, and lands with systems with a woody biomass vegetation structure that currently falls below but which, in situ, could reach the threshold values of the definition of forest land. *Forest land remaining forest land* includes plantations, harvested native forests and other native forests (regeneration after harvest). Emissions from fuelwood consumption and biomass burning in forests (controlled burning and wildfire) are also included as well as the removals associated with post-fire recovery. *Land converted to forest land* includes grassland, croplands, settlements and wetlands (tidal marsh) on which forest is identified to emerge. These changes include plantations and forest regrowth on land previously cleared for other uses, environmental plantings and the regeneration of forest from natural seed sources. Permanent losses of woody vegetation that have been classed as *forest land* are reported under *forest conversion to other land use* classifications.
- *Cropland* includes all land that is used for continuous cropping and those lands managed as crop-pasture (grassland) rotations. Non-CO₂ emissions from cropland remaining cropland are reported in the Agriculture sector. This sector comprises emissions and removals from *cropland remaining*

cropland and *forest land converted to cropland* and *wetlands converted to cropland*. Since 1990, there has been no significant consistent trend in emissions, with transient variations driven by fluctuations in climatic conditions and shifts in management practices.

- The *grassland* category represents a diverse range of climate, management and vegetation cover. It also includes increases and decreases in sub-forest forms of woody vegetation (shrubs). This sector comprises emissions and removals from *grassland remaining grassland* and *forest land and wetlands converted to grassland*. Changes in carbon stocks in *grassland remaining grassland* are largely affected by changes in land management practice and climatic factors.
- For the sub-sectors *forest land converted to cropland* and *forest land converted to grassland*, the total emissions associated with the transition from forest to non-forest land use include the immediate loss of carbon as trees are cleared and burned, as well as an ongoing loss of soil carbon as it decays to a new equilibrium stock level and other ongoing emissions and removals associated with the new land use.
- *Settlements* are areas of residential and industrial infrastructure, including cities and towns, and transport networks. This sector comprises emissions and removals from *settlements remaining settlements* and *forest land and wetlands converted to settlements*. The *land converted to settlements* subcategory comprises mangrove and other forest land converted to settlements and wetlands (tidal marsh) converted to settlements. Conversion of tidal marsh is assumed to occur along with any clearing of mangroves for settlements – as such the trends are identical. The key drivers of variation over the time period have been urbanisation and population growth.
- *Wetlands* include areas of perennial lakes, reservoirs, swamps and major water course areas. Land areas that meet the definition of forest land, such as mangroves, are reported under the forest land category. *Wetlands remaining wetlands* include tidal marshes and seagrass meadows. Estimates include net changes in sparse vegetation, loss of seagrass beds due to capital dredging and nitrous oxide emissions from aquaculture operations.

The subcategories *wetland remaining wetland*, *land converted to wetland* and *settlements remaining settlements* have been omitted from Figure 11 due to insignificant contributions from 1989-90 to 2020-21.

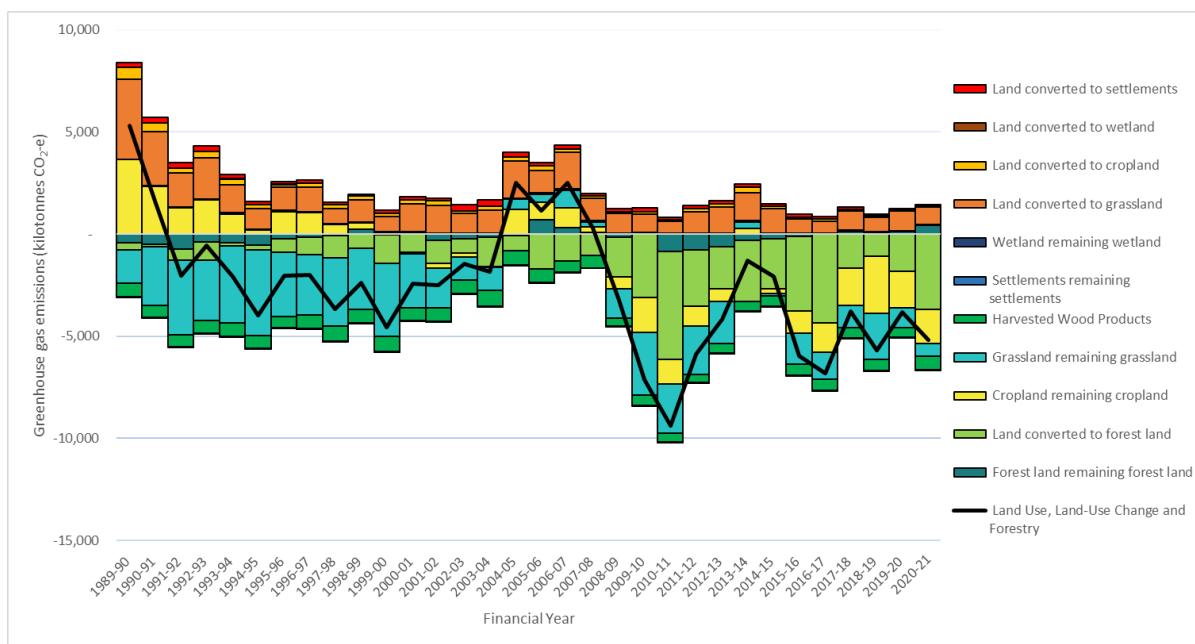


Figure 11: South Australian land use, land use change and forestry by sources and sinks for subcategories 1989-90 to 2020-21

Table 8: Land use, land use change and forestry sector by source of emissions, change from 1989-90 base year to 2020-21

Source of greenhouse emissions	Greenhouse emissions (kt CO ₂ -e)		% Change to 2020-21
	1989-90	2020-21	
Net LULUCF	5,329	-5,179	-197%

B.6 Waste

Waste sector emissions are presented in Figure 12 and Figure 13, and are broken down into the following components:

- *Solid waste disposal* – emissions resulting from anaerobic decomposition of organic matter in landfills.
- *Wastewater treatment and discharge* – emissions resulting from anaerobic decomposition of organic matter in sewerage facilities (including on-site systems such as septic tanks) during treatment and disposal of wastewater.
- *Biological treatment of solid waste (confidential data)* - the anaerobic decomposition of organic material in composting and anaerobic digester facilities.
- *Incineration and open burning of waste (confidential data)* – emissions resulting from incineration of solvents and clinical waste.

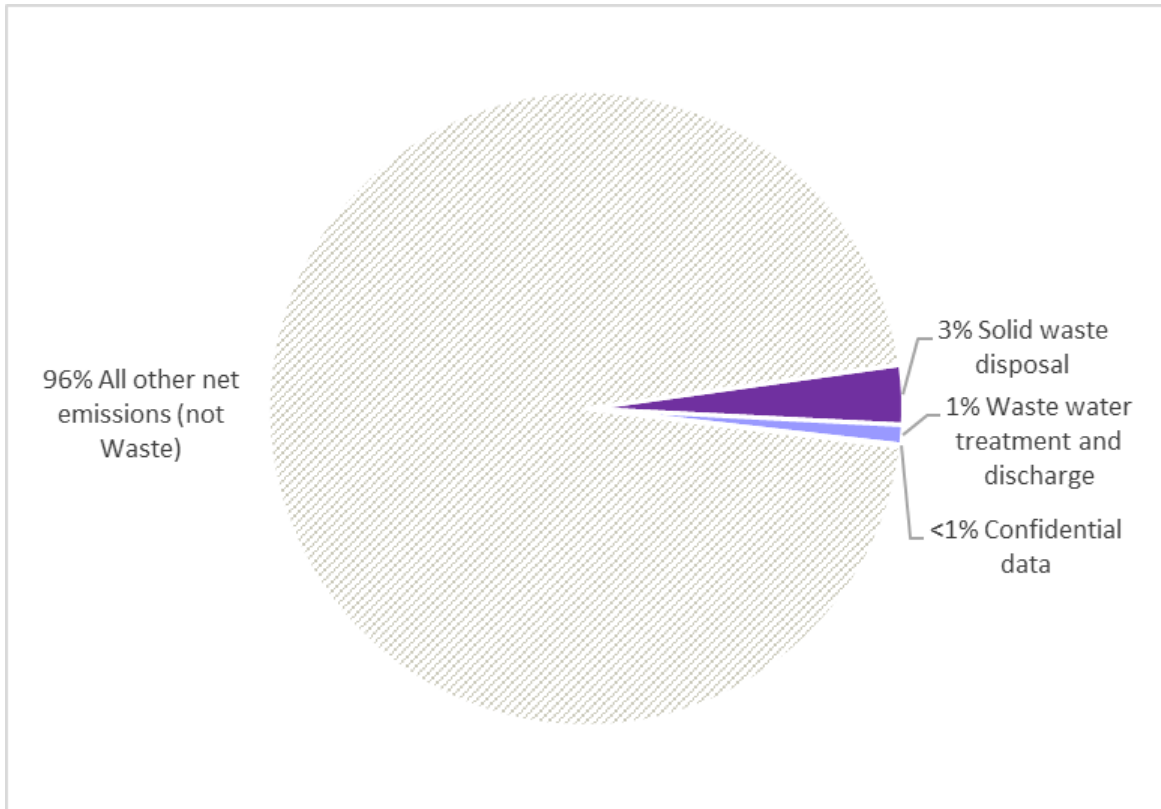


Figure 12: South Australian waste sector greenhouse gas emissions relative to all other net emissions, 2020-21

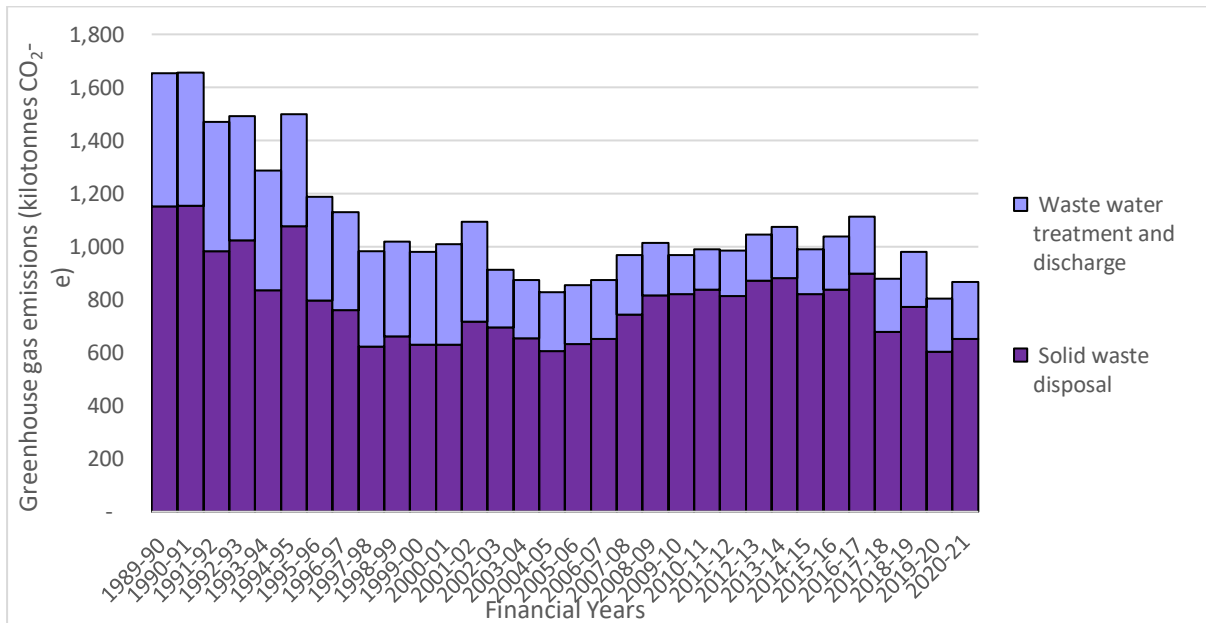


Figure 13: South Australian waste greenhouse gas emissions kilotonnes CO₂-e, by selected subcategory, 1989-90 to 2020-21.

Note: Emissions estimates are not available for some sources due to confidentiality provisions and are not included in this graph. The graph is not representative of a total for the sector.

Table 9: South Australian greenhouse gas emissions waste sector by source of emissions, percent change from 1989-90 base year to 2020-21

Source of emissions	Greenhouse gas emissions (kt CO ₂ -e)		% Change to 2020-21
	1989-90	2020-21	
Solid waste disposal	1,150	651	-43%
Wastewater treatment and discharge	504	215	-57%
Biological treatment of solid waste	C	C	NA
Incineration and open burning of waste	C	C	NA
Waste	1,658	887	-46%

Note: C refers to emissions estimates not available due to confidentiality provisions.

Appendix C : Technical notes

A review of the progress towards the emissions target includes technical issues such as those related to methods and data sources. The technical points that influenced the interpretation and comparability of the estimates of progress are outlined below.

- This is the eighth Section 7 report on the operation of the Act. The first was prepared in 2009.
- The Australian Government produces all states' and territories' greenhouse gas inventories and publishes them with a two-year delay.
- States' and territories' greenhouse gas inventories are developed by the Australian Government in accordance with international guidelines and protocols. The estimates are derived from multiple data sources most of which are collected for other purposes, such as agriculture surveys. Data is collected specifically for greenhouse gas monitoring from Australia's large emitters, excluding governments, under the *National Greenhouse and Energy Reporting Act 2007*.
- The Australian Government regularly revises inventory emission factors and methodologies when new information or more accurate methodologies become available. Under the United Nations Framework Convention on Climate Change rules, the government is required to revise figures back to 1990 to ensure time series consistency. The estimates in the current South Australian inventory supersede all previously published estimates. These revisions can lead to changes in annual emissions reduction due to methodology change. Consequently, the greenhouse gas emissions presented in this report are not comparable to those published in previous Section 7 reports.
- The Department for Energy and Mining (DEM) calculates progress towards renewable energy generation targets based on the amount of renewable energy generated in South Australia as a proportion of total electricity generation. DEM uses adjusted data from the Australian Energy Market Operator (AEMO) South Australian Electricity Report (SAER) to calculate renewable energy generation from wind, solar, and small non-scheduled renewable generation. The renewable component of the small non-scheduled generation figure is not published by AEMO in the SAER.