

Technical information supporting the 2023 Greenhouse gas emissions environmental trend and condition report card

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Acknowledgement of Country

We acknowledge and respect the Traditional Custodians whose ancestral lands we live and work upon and we pay our respects to their Elders past and present. We acknowledge and respect their deep spiritual connection and the relationship that Aboriginal and Torres Strait Islanders people have to Country. We also pay our respects to the cultural authority of Aboriginal and Torres Strait Islander people and their nations in South Australia, as well as those across Australia.

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Summary

The 2023 release of South Australia's environmental trend and condition report cards summarises our understanding of the current condition of the South Australian environment, and how it is changing over time.

This document describes the indicators, information sources, analysis methods and results used to develop this report and the associated 2023 Greenhouse gas emissions report card. The reliability of information sources used in the report card is also described.

The Greenhouse gas emissions report card sits within the report card Climate theme. Report cards are published by the Department for Environment and Water and can be accessed at www.environment.sa.gov.au.

This document describes the indicators, data sources, analysis methods and results used to develop this report and the associated report card. The reliability of data sources for their use in this context are also described.

1 Introduction

1.1 Environmental trend and condition reporting in SA

The Minister for Climate, Environment and Water under the *Landscape South Australia Act 2019* is required to 'monitor, evaluate and audit the state and condition of the State's natural resources, coasts and seas; and to report on the state and condition of the State's natural resources, coasts and seas' (9(1(a-b))). Environmental trend and condition report cards are produced as the primary means for the Minister to undertake this reporting. Trend and condition report cards are also a key input into the State of the Environment Report for South Australia, which must be prepared under the *Environment Protection Act 1993*. This Act states that the State of the Environment Report must:

- include an assessment of the condition of the major environmental resources of South Australia (112(3(a))), and
- include a specific assessment of the state of the River Murray, especially taking into account the Objectives for a Healthy River Murray under the *River Murray Act 2003* (112(3(ab))), and
- identify significant trends in environmental quality based on an analysis of indicators of environmental quality (112(3(b))).

1.2 Purpose and benefits of SA's trend and condition report cards

South Australia's environmental trend and condition report cards focus on the state's priority environmental assets and the pressures that impact on these assets. The report cards present information on trend, condition, and information reliability in a succinct visual summary.

The full suite of report cards captures patterns in trend and condition, generally at a state scale, and gives insight to changes in a particular asset over time. They also highlight gaps in our knowledge on priority assets that prevent us from assessing trend and condition and might impede our ability to make evidence-based decisions.

Although both trend and condition are considered important, the report cards give particular emphasis to trend. Trend shows how the environment has responded to past drivers, decisions, and actions, and is what we seek to influence through future decisions and actions.

The benefits of trend and condition report cards include to:

- provide insight into our environment by tracking its change over time
- interpret complex information in a simple and accessible format
- provide a transparent and open evidence base for decision-making
- provide consistent messages on the trend and condition of the environment in South Australia
- highlight critical knowledge gaps in our understanding of South Australia's environment
- support alignment of environmental reporting, ensuring we 'do once, use many times'.

Environmental trend and condition report cards are designed to align with and inform state of the environment reporting at both the South Australian and national level. The format, design and accessibility of the report cards has been reviewed and improved with each release.

1.3 Climate change in Australia

Climate affects almost every part of our lives. Communities, industries, landscapes and ecosystems all develop with a tolerance for a range of climate variation. If the climate changes beyond that range of tolerance, then they must either adapt, migrate, transform or decline.

According to the Australian Academy of Science (2015), "Earth's climate has changed over the past century. The atmosphere and oceans have warmed, sea levels have risen, and glaciers and ice sheets have decreased in size. The best available evidence indicates that greenhouse gas emissions from human activities are the main cause. Continuing increases in greenhouse gases will produce further warming and other changes in Earth's physical environment and ecosystems."

1.4 Greenhouse gas emissions

The Climate: Greenhouse gas emissions report card reports on the change in annual mass of greenhouse gases emitted in South Australia since 2004–05.

This report covers sources of greenhouse gas emissions and removals by sinks resulting from human (anthropogenic) activities for the major greenhouse gases:

- carbon dioxide (CO₂)
- methane (CH₄)
- nitrous oxide (N₂O)
- perfluorocarbons (PFCs)
- hydrofluorocarbons (HFCs)
- sulphur hexafluoride (SF₆).

In accordance with the Intergovernmental Panel on Climate Change (IPCC) guidelines, Australia's emissions of the greenhouse gas nitrogen trifluoride (NF₃) are considered negligible and are not estimated (DCCEE 2023).

Global warming potentials (GWPs) have been used for each of the major greenhouse gases to convert them to carbon dioxide equivalents (CO₂-e). As greenhouse gases vary in their radiative activity and in their atmospheric residence time, converting emissions into CO₂-e allows the integrated effect of emissions of the various gases to be compared (DCCEE 2023).

2 Methods

2.1 Indicator

The indicator used for the Greenhouse gas emissions report card is the annual mass of greenhouse gases emitted in South Australia since 2004–05. This includes both positive and negative greenhouse gas emissions, where negative emissions represent greenhouse gases sequestered through land use and forestry.

2.2 Data sources

The Australian Government prepares the State and Territory Greenhouse Gas Inventory data annually for all states and territories, with a 2 year time lag. The latest State and Territory Greenhouse Gas Inventories report (Australian Government 2022) for the period 1989–90 to 2020–21 was released on 13 April 2022. The inventory supports reporting against Australia's international obligations under the United Nations Framework Convention on Climate Change (UNFCCC), specifically the Paris Agreement (UNFCCC 2023).

The South Australian Greenhouse Gas Inventory within the State and Territory Greenhouse Gas Inventories report is used to track progress against state-level greenhouse gas emissions targets.

The Australian Government regularly revises the inventory emission factors and methodologies when new information or more accurate methodologies and data become available. When this occurs, they are required to revise figures back to 1989–90 to ensure time series consistency. As a result, the estimates presented in the current South Australian inventory supersede all previously published estimates for the whole time series. Results are not comparable with the inventory report published in 2020.

2.3 Data collection

The Australian Government provides the Department for Environment and Water with the South Australian Greenhouse Gas Inventory and the data are also published by the Australian Government in the [State and Territory Greenhouse Gas Inventories](#).

2.4 Data analysis

In the 2020–21 financial year, South Australia emitted 21.5 million tonnes of carbon dioxide equivalent (MtCO₂-e). This represents a 42% reduction in greenhouse gas emissions from the 2004–05 financial year. The reduction in greenhouse gas emissions is measured from a 2004–05 base year. This base year aligns with the Government of South Australia's target to reduce state greenhouse gas emissions by more than 50% from 2005 levels by 2030. The Government of South Australia also aims to achieve net zero by 2050.

Categories of greenhouse gas emissions include:

- transport
- agriculture
- energy industries
- other energy

- industrial processes
- fugitive emissions
- waste
- land use, land use change and forestry.

Figure 2.1 shows the contribution of each emission source to total net greenhouse gas emissions for South Australia 2020–21. The category of 'land use, land use change and forestry' includes both emissions sources and sinks (i.e. sequestration of carbon) which, when combined, resulted in net negative emissions in 2020–21.

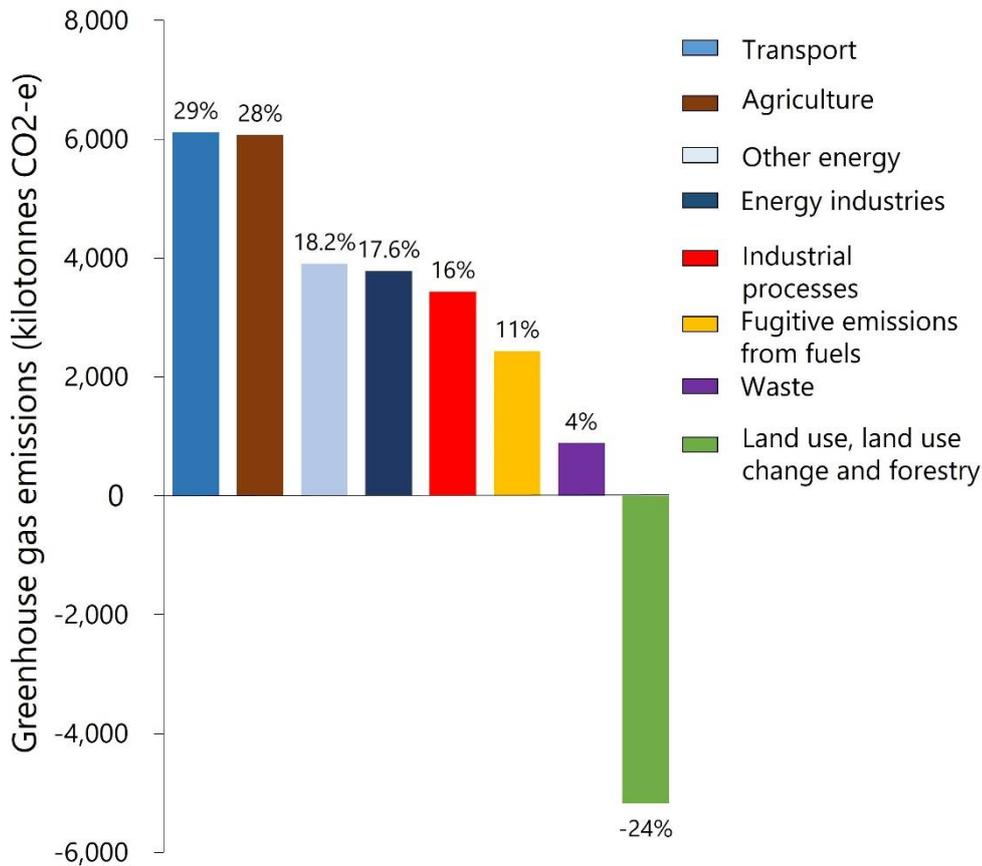


Figure 2.1. South Australia's greenhouse gas emissions by sector in 2020–21

2.5 Methods to assign trend, condition and reliability

2.5.1 Trend

Table 2.1. Definition of trend classes used

| Trend | Description |
|----------------|---|
| Getting better | Over a scale relevant to tracking change in the indicator it is improving in status with good confidence |
| Stable | Over a scale relevant to tracking change in the indicator it is neither improving nor declining in status |
| Getting worse | Over a scale relevant to tracking change in the indicator it is declining in status with good confidence |
| Unknown | Data are not available, or are not available at relevant temporal scales, to determine any trend in the status of this resource |
| Not applicable | This indicator of the natural resource does not lend itself to being classified into one of the above trend classes |

2.5.2 Condition

Table 2.2. Definition of condition classes used

| Condition | Description |
|------------------|--|
| Very good | The natural resource is in a state that meets all environmental, economic and social expectations, based on this indicator. Thus, desirable function can be expected for all processes/services expected of this resource, now and into the future, even during times of stress (e.g. prolonged drought) |
| Good | The natural resource is in a state that meets most environmental, economic and social expectations, based on this indicator. Thus, desirable function can be expected for only some processes/services expected of this resource, now and into the future, even during times of stress (e.g. prolonged drought) |
| Fair | The natural resource is in a state that does not meet some environmental, economic and social expectations, based on this indicator. Thus, desirable function cannot be expected from many processes/services expected of this resource, now and into the future, particularly during times of stress (e.g. prolonged drought) |
| Poor | The natural resource is in a state that does not meet most environmental, economic and social expectations, based on this indicator. Thus, desirable function cannot be expected from most processes/services expected of this resource, now and into the future, particularly during times of stress (e.g. prolonged drought) |
| Unknown | Data are not available to determine the state of this natural resource, based on this indicator |
| Not applicable | This indicator of the natural resource does not lend itself to being classified into one of the above condition classes |

2.5.3 Reliability

Information is scored for reliability based on the minimum of subjective scores (1 [worst] to 5 [best]) given for information currency, applicability, level of spatial representation and accuracy. Definitions guiding the application of these scores are provided in Table 2.3 for currency, Table 2.4 for applicability, Table 2.5 for spatial representation and Table 2.6 for accuracy.

Table 2.3. Guides for applying information currency

| Currency score | Criteria |
|----------------|--|
| 1 | Most recent information > 10 years old |
| 2 | Most recent information up to 10 years old |
| 3 | Most recent information up to 7 years old |
| 4 | Most recent information up to 5 years old |
| 5 | Most recent information up to 3 years old |

Table 2.4. Guides for applying information applicability

| Applicability score | Criteria |
|---------------------|---|
| 1 | Data are based on expert opinion of the measure |
| 2 | All data based on indirect indicators of the measure |
| 3 | Most data based on indirect indicators of the measure |
| 4 | Most data based on direct indicators of the measure |
| 5 | All data based on direct indicators of the measure |

Table 2.5. Guides for applying spatial representation of information (sampling design)

| Spatial score | Criteria |
|---------------|--|
| 1 | From an area that represents less than 5% the spatial distribution of the asset within the region/state or spatial representation unknown |
| 2 | From an area that represents less than 25% the spatial distribution of the asset within the region/state |
| 3 | From an area that represents less than half the spatial distribution of the asset within the region/state |
| 4 | From across the whole region/state (or whole distribution of asset within the region/state) using a sampling design that is not stratified |
| 5 | From across the whole region/state (or whole distribution of asset within the region/state) using a stratified sampling design |

Table 2.6. Guides for applying accuracy information

| Reliability | Criteria |
|--------------------|---|
| 1 | Better than could be expected by chance |
| 2 | > 60% better than could be expected by chance |
| 3 | > 70% better than could be expected by chance |
| 4 | > 80% better than could be expected by chance |
| 5 | > 90% better than could be expected by chance |

2.6 Data transparency

Data transparency for this report card is represented in Appendix A.

3 Results

3.1 Trend

The trend for South Australia's greenhouse gas emissions is assessed to be getting better. Total net emissions have decreased by 42% since 2005. The emissions reduction trend is presented in Figure 3.1.

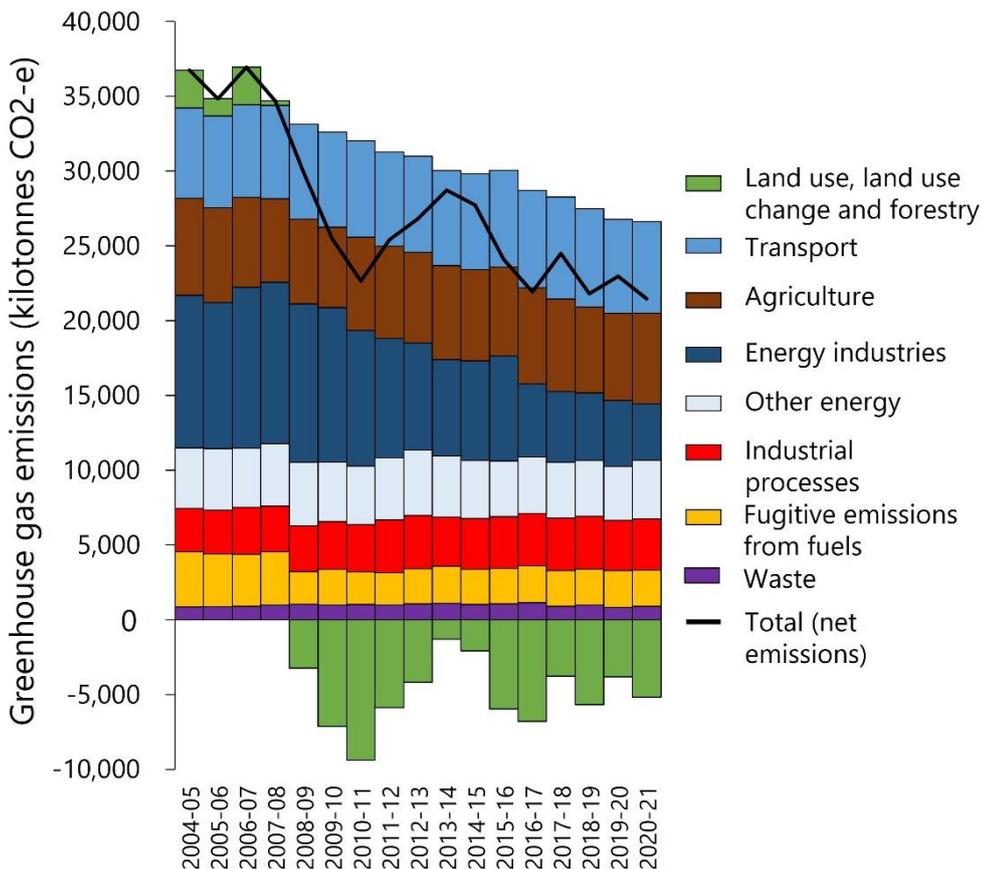


Figure 3.1. South Australia's greenhouse gas emissions trend from 2004-05 to 2020-21

3.2 Condition

The condition of South Australia's greenhouse gas emissions is considered good. South Australia's emissions are the third lowest on a per capita basis compared to other Australian states and territories (DCCEEW 2023). South Australia's greenhouse gas emissions overall have been reducing since 2004-05. The emission sources within the state's greenhouse gas inventory have both increased and decreased over this time period.

Sources with **decreased** emissions since 2004-05

Emissions from energy industries decreased by 63%, driven by an increase in renewable energy generation. Other sources which decreased in emissions are fugitive emissions from fuels (-34%), agriculture (-7%), other energy (-4%) and land use, land use change and forestry (-305%).

Sources with **increased** emissions since 2004-05

While there was an increase in transport emissions (1%) since 2004–05, emissions from transport have decreased since 2017–18. This is mainly due to emissions from road transportation which contribute 88% to transport emissions and have been declining since 2017–18.

There have been increases in emissions from industrial processes (18%) since 2004–05. In 2020–21, emissions from the minerals industry contributed 27% to total emissions in this sector, however have been decreasing overall since 2004–05.

Waste emissions have increased by 5% since 2004–05. In 2020–21, emissions from solid waste disposal to landfill contributed 73% to total emissions in the waste category. Emissions from solid waste disposal have fluctuated since the peak in 2016–17.

3.3 Reliability

The overall reliability score for this report card is 3 out of 5, based on the minimum of the scores for the reliability rating criteria (Table 3.1). Based on definitions in Section 2.5.3, this translates to an overall reliability rating of 'Good'.

Table 3.1. Information reliability scores for greenhouse gas emissions trends

| Indicator | Applicability | Currency | Spatial | Accuracy | Reliability |
|--------------------------|---------------|----------|---------|----------|-------------|
| Greenhouse gas emissions | 3 | 5 | 5 | N/A | 3 |

3.3.1 Notes on reliability

The information has an applicability score of 3 because most data are based on indirect indicators of the measure.

The information has a currency score of 5 because the most recent information is 2 years old.

A spatial representation score of 5 has been applied because data are provided from across the whole state and disaggregated into emissions sources.

An accuracy score for the data is not applicable as the data are provided by the Australian Government modelling rather than by data collection methods that can be rated for accuracy compared with what can be expected by chance.

4 Discussion

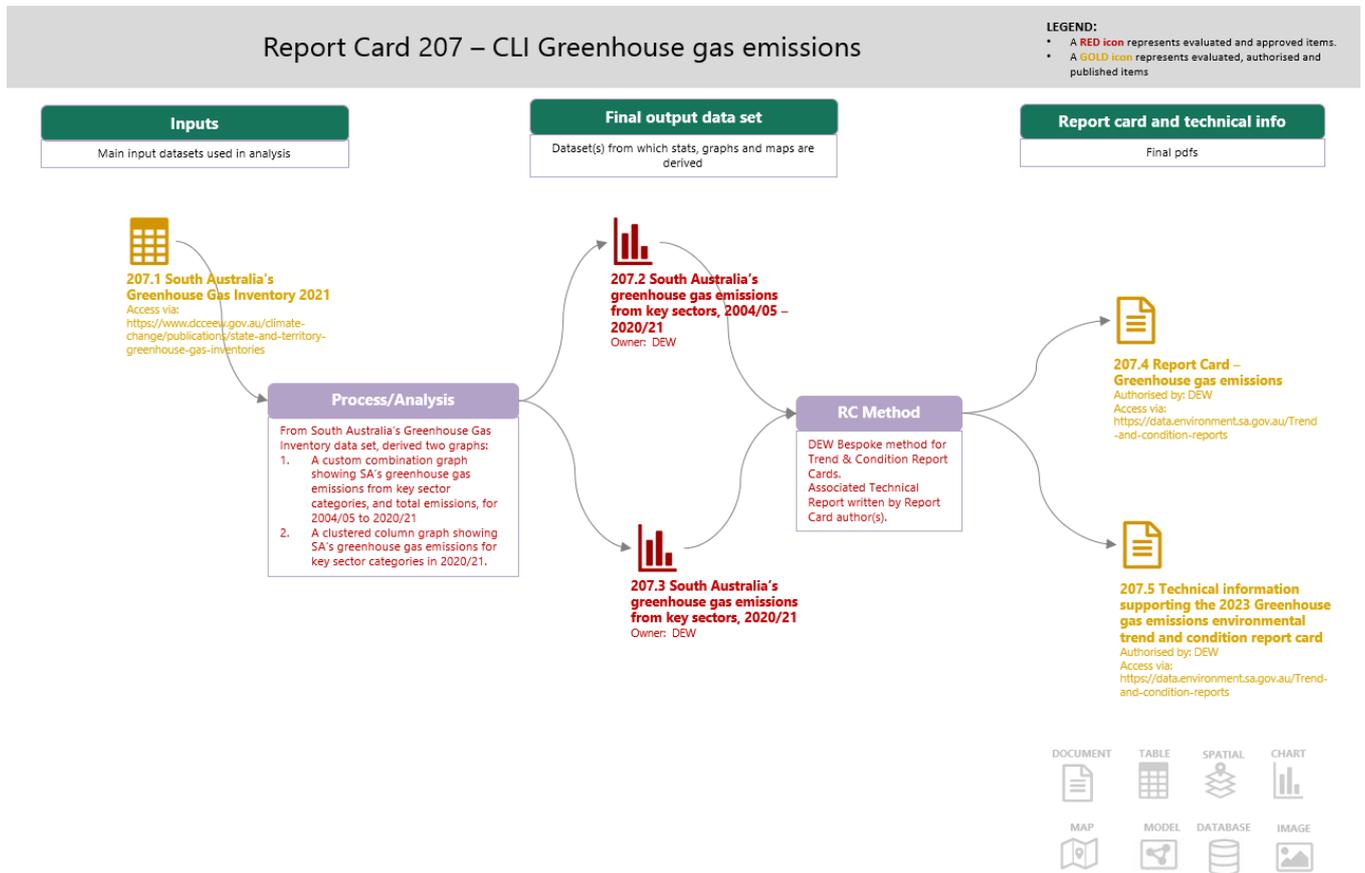
4.1 Trend

The trend rating for greenhouse gas emissions was determined to be 'Getting better' as the observed changes over the 16 years from 2004–05 to 2020–21 show a decline in net greenhouse gas emissions in South Australia.

4.2 Condition

The condition rating assigned is 'Good'. South Australia's emissions are the third lowest on a per capita basis compared to other Australian states and territories.

5 Appendix A: Managing environmental knowledge chart for Greenhouse gas emissions



6 References

Australian Academy of Science (2015). "The science of climate change: Questions and answers", Australian Academy of Science, Canberra, www.science.org.au/climatechange.

Australian Government (2022). Australia's National Greenhouse Accounts, www.greenhouseaccounts.climatechange.gov.au (accessed May 2023).

DCCEEW (2023). State and territory greenhouse gas inventories: Data tables and methodology, Australian Government, Department of Climate Change, Energy, the Environment and Water, www.dcceew.gov.au/climate-change/publications/national-greenhouse-accounts-2021/state-and-territory-greenhouse-gas-inventories-data-tables-and-methodology (accessed June 2023).

Monforti Ferrario F, Crippa M, Guizzardi D, Solazzo E, Muntean M, Schaaf E, Banja M, Olivier J, Grassi G, Rossi S, Vignati E, (2021). Emissions Database for Global Atmospheric Research, version v6.0_FT_2020 (GHG time-series). European Commission, Joint Research Centre (JRC) [Dataset] PID: <http://data.europa.eu/89h/2f134209-21d9-4b42-871c-58c3bdcfb549>.

UNFCCC (2023). The Paris Agreement, United Nations Climate Change, <https://unfccc.int/process-and-meetings/the-paris-agreement> (accessed June 2023).



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