

Inventory

National Greenhouse Gas Inventory

INFORMATION FROM THE AUSTRALIAN GREENHOUSE OFFICE—JULY 2000

Overview: 1998 National Greenhouse Gas Inventory

At a glance

1998 Estimated emissions and changes from 1990

- Australia's **net greenhouse gas emissions** for 1998, not including emissions from land clearing were 455.9 million tonnes carbon dioxide equivalents (Mt CO₂-e*), compared with 433.2 Mt in 1997 and 389.8 Mt in 1990. This represents a 5.2% increase since 1997 and a 16.9% increase during the period 1990 to 1998. This does not equate to the Kyoto Protocol accounting requirements.
- Incorporating the current best estimate of land clearing emissions would bring Australia's total emissions to 519.9 Mt CO₂-e in 1998 and 493.3 Mt CO₂-e in 1990. On this accounting basis, emissions are estimated to have increased by 5.4% between 1990 and 1998. The assessment of trends in land clearing emissions since 1990 is highly uncertain and is likely to change significantly in the future, for this reason land clearing emissions are excluded from the assessments in this fact sheet.

* Carbon dioxide equivalents, CO₂-e, provide the basis for comparing the warming effect of greenhouse gases such as methane, nitrous oxide, the perfluorocarbons, etc.

- The **Energy sector** accounted for 79.6% (362.9 Mt) of total net national emissions in 1998. Energy emissions increased by 5.7% from 1997 and 21.1% on the 299.6 Mt emitted in 1990. Stationary energy emissions, primarily those produced through electricity generation, were the main contributors to emissions from this sector - 56.8% of national emissions. Transport was another significant contributor with 15.9% of national emissions.
- **Agricultural emissions** comprised 20.2% (92.2 Mt) of the total for 1998. This compares with emissions of 90.6 Mt in 1990.
- In the Land Use Change and Forestry sector, **Forestry** and Other subsectors constituted a sink of 24.5 Mt in 1998 (equivalent to an offset of 5.4% of total net emissions excluding land clearing), decreasing from 27.2 Mt in 1990.
- The best estimate of **land clearing** emissions in 1998 is 64.0 Mt down from 103.5 Mt in 1990.
- The **Industrial Processes** and **Waste** sectors are minor sources of emissions, contributing 2.2% (9.8 Mt) and 3.4% (15.5 Mt) of net emissions respectively.

1990 and 1998 Emissions (CO₂-e) by sector



FACT SHEET
1998





What is counted in the Inventory?

The 1998 National Greenhouse Gas Inventory, released in July 2000, provides the latest report on Australia's greenhouse gas emissions and removals by sinks according to the international requirements of the Framework Convention on Climate Change. It reports on human-induced greenhouse gas emissions from six sectors specified by the Intergovernmental Panel on Climate Change.

1. **Energy:** comprises three subsectors

- *Stationary Energy*, for example, emissions from electricity generation
- *Fugitive Emissions* from, for example, coal seams and oil and natural gas production
- *Transport* emissions.

2. Industrial Processes: such as emissions from cement clinker manufacture and aluminium smelting.

3. Solvent and Other Product Use: includes emissions from the use of solvents and other products containing non-methane volatile organic compounds. No estimates of emissions from this sector are included in Australia's inventory.

4. Agriculture: such as methane emissions from livestock, nitrous oxide from fertilising soil and the burning of savannas.

5. Land Use Change and Forestry: made up of emissions and sinks from:-

- *Forest and Grassland Conversion*, that is land clearing, including burning and decay of cleared vegetation and emissions from soil disturbance (reported separately pending better estimates as methods and data improve)
- *Changes in Forest and Other Woody Biomass Stocks* (Forestry), including managed forests, plantations and vegetation establishment
- *CO₂ Emissions and Removals from Soils*, including the sink from pasture improvement and minimum tillage practices
- *Other*, including emissions from prescribed burning and wildfires.

6. Waste: such as emissions from municipal landfill and wastewater treatment facilities.

The Australian National Greenhouse Gas Inventory covers the major greenhouse gases:

- carbon dioxide
- methane
- nitrous oxide
- carbon monoxide*
- oxides of nitrogen*
- non-methane volatile organic compounds (NMVOCs)*
- perfluorocarbons
- sulphur hexafluoride

These gases are expressed in terms of their carbon dioxide equivalents (CO₂-e), where global warming potentials are available, which provides the basis for comparing the warming effect of the different greenhouse gases.

**Global warming potentials, used to convert gases into CO₂-e, are not available*

How does the Inventory relate to the Kyoto Protocol?

The National Greenhouse Gas Inventory provides an indication of Australia's annual contribution to global greenhouse gas emissions and the relative contribution of key industry sectors. It is a comprehensive report of all anthropogenic emissions and sinks. The information supports strategic policy development to reduce global warming. It also helps Australia monitor and review the effectiveness of greenhouse gas reduction measures.

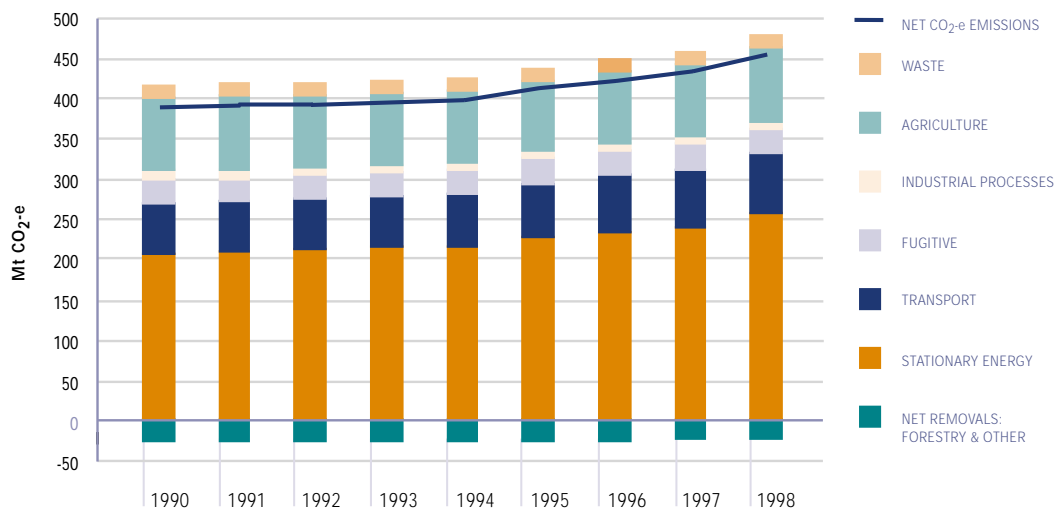
The total emissions reported in the national inventory do not represent Australia's performance against the Kyoto Protocol. Guidelines for reporting on the Kyoto Protocol, are still being negotiated. The Kyoto Protocol does not include sinks in the estimate for the base year emissions (1990) but certain sinks will be accounted towards our target. Some parts of the land-based emissions and sinks that are reported in the national inventory will not be included in reporting for the Kyoto Protocol commitment period, or will be accounted for on a different basis.

The numbers presented in the text and figures may not add up to the reported total due to rounding errors. Inclusion of the decimal place does not necessarily indicate a level of precision in the estimates.



House Gas Inventory

1990 – 1998 Greenhouse gas emissions by sector, excluding land clearing.



Sectors - a close up

Energy

- *Energy sector* emissions accounted for 79.6% (362.9 Mt) of the total net emissions (455.9 Mt CO₂-e excluding land clearing).
- *Stationary energy* contributed 56.8% of national emissions in 1998 compared with 53.4% in 1990. This subsector includes emissions from electricity generation, energy produced by the manufacturing, construction and industrial sectors, and emissions from other sources like domestic heating.
- *Electricity generation* accounted for most of the stationary energy emissions at 168.6 Mt. This was 37.0% of national emissions. Emissions from electricity generation increased by 30.6% between 1990 and 1998 with the greatest increase of 10.3% between 1997 and 1998. The amount of *electricity generated* nationally increased by 6.1% from 1997 to 1998. In the same period, the amount generated by power stations using brown coal increased by 11.5%. *The emission intensity* (emissions produced per unit of electricity generated) of *brown coal* is about 5% higher than for black coal and 83% higher than for natural gas.
- *Transport* was the next largest contributor to emissions from the Energy sector with 15.9% of national emissions in 1998, similar to the proportion in 1990. *Road transport* is the largest contributor to transport emissions and makes up 14.2% of total national emissions. Road transport emissions increased by 2.8% during 1998. *Cars* contribute 9% of national emissions and domestic aviation around 1%.
- *Fugitive* emissions from fuels contributed 6.9% of national emissions in 1998 compared with 7.9% in 1990. Over the period, increases in emissions from coal, oil and natural gas production have been offset by a decline in leakage from natural gas distribution and by the capture of coalmine waste gas.

- *Methane leakage* from coal mining accounted for the majority of fugitive emissions.

Agriculture

- Agriculture contributed 92.2 Mt of national emissions in 1998. Emissions were 2.5% higher than in 1997 and 1.8% higher than in 1990.
- All emissions accounted for in the Agriculture sector are *methane* and *nitrous oxide*. The Agriculture sector accounts for 61.2% of total methane emissions and 79.8% of total nitrous oxide.
- *Livestock* produced 62.9 Mt or 13.8% of national emissions in 1998. Emissions from livestock were similar to 1997 and 5.1% less than emissions in 1990. Though sheep numbers declined by 30% from 1990 to 1998, beef and dairy cattle numbers increased and the area under crops also increased.
- *Agricultural soils* contributed 3.5% of total net national emissions, and burning of savannas contributed 2.7%.

Industrial processes

- Emissions from *industrial processes* were 2.2% (9.8 Mt) of national emissions in 1998. This is 11.3% more than in 1997 and 18.4% less than in 1990.
- The decline in emissions during the early 1990's is due to a large reduction in emissions of *PFCs* from aluminium smelting as a result of technological changes. Production of aluminium has been increasing during this period and from 1997 to 1998 emissions due to increasing production began to outstrip reductions due to improved processes.
- Production of cement clinker and lime also increased from 1997 to 1998 with a consequent increase in emissions.

Greenhouse

Waste

- The *Waste sector* contributed 3.4% (15.5 Mt) of total national emissions in 1998. This is 1.1% less than in 1997 and 4.2% greater than in 1990.
- Most emissions are from *solid waste disposal*. Since 1994, *methane recovery* has grown significantly and in 1998 about 13% of methane generated from municipal solid waste disposal was recovered.
- Methane released from the decomposition of organic matter in sewage during disposal of domestic, commercial and industrial *wastewater* amounted to 0.3% of total national emissions.

Forestry and Other land management

- *Forestry*, including commercial forestry, is both a source of and sink for CO₂. In 1998, removals through growth of forests were 73.4 Mt. *Harvesting* of forests gave rise to 51.8 Mt of emissions resulting in a *net forestry sink* equivalent to 4.7% of total national emissions.
- Emissions from harvesting have increased by 4.9 Mt since 1990 while the removals by growth have increased by 2.1 Mt, leading to an overall *decline in the net sink* of 2.8 Mt (11.4%) from 1990 to 1998.
- *Minimum tillage* practices and *pasture improvement* contributed a sink of approximately 4 Mt or 1% of total net national CO₂-e emissions. As a result of a lack of data, estimates of this sink have remained unchanged since 1990.

Land clearing

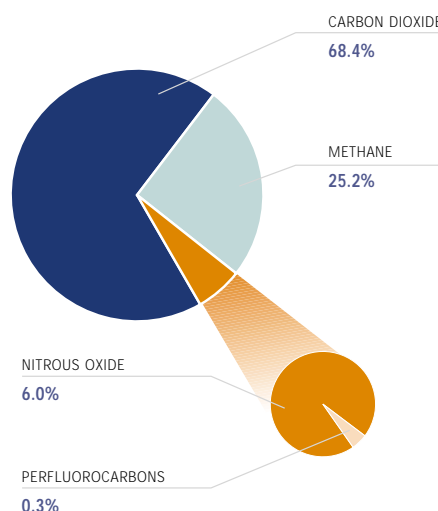
- *Land clearing* is accounted separately from other sectors due to the high level of uncertainty associated with the estimates and major improvements in methodology and sources of data. Developments over the next couple of years are expected to lead to a more robust approach to estimating emissions in this sector that will be applied to estimates for all years.
- Emissions from land clearing are the result of burning cleared vegetation, decay of unburnt vegetation, and emissions from soil disturbed in the process of clearing. This is offset to some extent by carbon sequestration due to regrowth of vegetation on previously cleared land.

- In 1998, *gross emissions* from land clearing were estimated at 81.5 Mt, partly offset by *regrowth* of 17.5 Mt, resulting in net emissions of 64.0 Mt, compared with 65.4 Mt in 1997 and 103.5 Mt estimated for 1990.
- The estimates indicate that *land clearing emissions have fallen* by 38.2% since 1990. However, past clearing rates and trends in emissions since 1990 are subject to *large uncertainties*. The annual estimates and trends should be treated with caution.
- Through the National Carbon Accounting System and the Cooperative Research Centre for Greenhouse Accounting, Australia is making a large investment in improving tools, methods and data for estimating emissions and sinks from land clearing. This will be achieved by improving estimates of rates of clearing, cover and biomass of vegetation and emissions from soil carbon. This work will also improve estimates of emissions and sinks from forestry and agricultural management.

Emissions by gas

- The main greenhouse gases emitted are carbon dioxide (68.4%), methane (25.2%) and nitrous oxide (6.0%). Small quantities of PFCs also contribute to total emissions.

Contribution to total net national CO₂-e emissions by gas – 1998 (excluding land clearing)



Household Gas Inventory

Carbon dioxide (CO₂)

- Net emissions of CO₂ were 312.1 Mt in 1998 (not including land clearing). Stationary Energy was the largest source (255.8 Mt), mainly from *electricity generation* (168.0 Mt).
- *Transport* was next largest source of CO₂, 68.4 Mt in 1998.
- *Forest growth* provided a CO₂ sink of 73.4 Mt, more than offsetting 51.8 Mt emissions from harvesting.

Methane (CH₄)

- In 1998, CH₄ emissions contributed 114.8 Mt CO₂e to national emissions. *Agriculture* contributed 61.2% of CH₄ emissions. The majority of these emissions result from the digestive processes of *livestock*.
- *Fugitive sources*, such as losses from oil and gas production, and emissions from coal mines, contributed 22.2% of CH₄ emissions.

Nitrous oxide (N₂O)

- In 1998, 6.0% of national emissions were N₂O. 79.8% of N₂O emissions are from *agriculture*. The majority of these emissions are from *agricultural soils*.
- *Burning savannas* to increase grass production for grazing, or for fuel reduction and wildfire prevention produces approximately 24% of N₂O emissions from agriculture.

Changes in emissions relative to economic growth

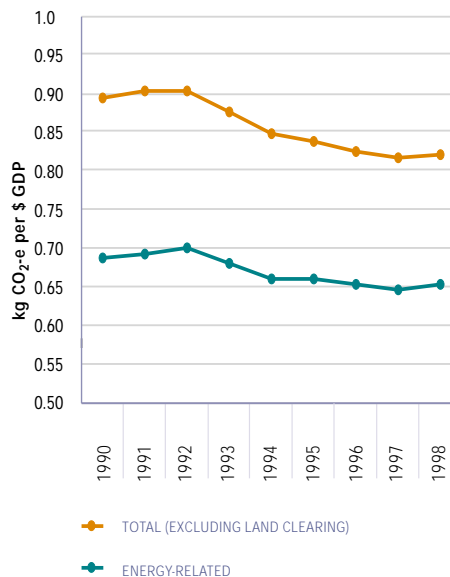
Emissions per capita

- Australia's population has increased by 9.7% from 1990 to 1998. In 1990, emissions per capita were 22.8 tonnes and 24.3 tonnes in 1998.

Emissions per \$ GDP

- Greenhouse gas emissions per dollar of Gross Domestic Product (GDP) declined by 8.2% from 1990 to 1998. GDP increased at an average rate of 3.1% while emissions increased at an average rate of 2.0% during this period.

Greenhouse gas emissions per \$ of GDP, 1990 to 1998



Improvements to the 1998 Inventory

- The 1998 Inventory has incorporated improvements and changes to the methodology and data, developed over the past year. Examples include:
 - the quality of emission estimates for the Manufacturing and Construction subsector was improved through actual data provided by the plastics industry on the quantity of carbon sequestered in plastics
 - the CO₂ content of distributed natural gas that becomes a fugitive emission at the burner tip is now included in the inventory (less than 1 Mt per year)
 - a correction was made to the estimate of animal numbers in calculations of emissions of CH₄ and N₂O from livestock
 - the estimated resident population is now used for all years. Mean resident population is no longer published by the Australian Bureau of Statistics.



Greenhouse

Taking action to reduce Australia's greenhouse gas emissions

- Australia is undertaking a range of activities to reduce greenhouse gas emissions.
- The \$180 million climate change package *Safeguarding the Future: Australia's Response to Climate Change*, committed by the Commonwealth Government in November 1997 contains programs aimed at promoting and enhancing renewable energy sources and energy market reform. Strategies to decrease emissions from motor vehicles through fuel efficiencies and investment in planting of trees to absorb carbon dioxide are also included in the package, which is largely being implemented through the Australian Greenhouse Office.
- The Greenhouse Challenge - a joint voluntary initiative between the national Government and industry to abate greenhouse gas emissions - now has several hundred members. An independent evaluation of the program has demonstrated that the Challenge has been effective in achieving greenhouse gas emissions abatement and in building the capacity of both Government and industry to identify, monitor, manage and report greenhouse gas emissions.
- The National Greenhouse Strategy, released by the Commonwealth and State and Territory governments in 1998, provides a framework for

action by all levels of government. Implementation plans are currently being finalised for this Strategy which focuses action on three fronts: improving awareness and understanding of greenhouse issues; reducing greenhouse gas emissions and enhancing greenhouse sink capacity; and developing adaptation responses.

- The Commonwealth Government's \$400 million Greenhouse Gas Abatement Program, commencing in 2000, further assists Australia in meeting its commitments under the Kyoto Protocol to the United Nations Framework Convention on Climate Change. This program aims to deliver cost-effective and large-scale abatement across all sectors of the economy, particularly in the first commitment period under the Protocol (2008 - 2012).
- This Program is one of several major greenhouse initiatives included in the revised tax system package, *Measures for a Better Environment*. Other initiatives include renewable energy generation, alternative fuels use and household energy reduction. The total funds assigned for greenhouse response actions amount to nearly \$1 billion.
- Global warming presents challenges for the way we live and work. Addressing this will require changes for industry, governments at all levels and the community at large—everyone has a role to play.



AUSTRALIAN
Greenhouse
Office

The lead Commonwealth
agency on greenhouse
matters

Information about the National Greenhouse Gas Inventory and initiatives to reduce greenhouse gas emissions can be obtained from the Australian Greenhouse Office web site:

<http://www.greenhouse.gov.au>

Copies of the 1998 Inventory and related documents as follows can be obtained by contacting:

Telephone 1300 130 606

Facsimile 02 6299 6040

National Greenhouse Gas Inventory 1998 with Methodology Supplements.

National Greenhouse Gas Inventory Land Use Change and Forestry Sector 1990 - 1998.

National Greenhouse Gas Inventory: Analysis of Trends and Greenhouse Indicators 1990 to 1998.

Other Fact Sheets in this series include Frequently Asked Questions and Sheets on Energy, Transport, Agriculture, Waste, Industrial Processes, and Forestry and Land Clearing.

