

Inventory

National Greenhouse Gas Inventory

INFORMATION FROM THE AUSTRALIAN GREENHOUSE OFFICE—JULY 2000

Energy: Stationary sources and fugitive emissions

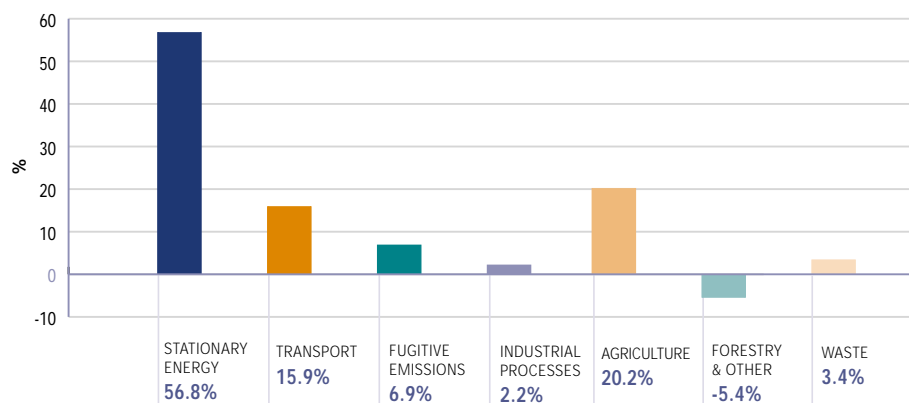
1998 inventory and trends

1998 emissions	Changes in emissions 1990–1998
Australia's estimated greenhouse gas emissions in 1998 totalled 455.9 million tonnes of carbon dioxide equivalent* (Mt CO ₂ -e), excluding emissions from land clearing.#	This represents an increase of 5.2% on 1997 national greenhouse gas emissions and a 16.9% increase on 389.8 Mt in 1990. This does not equate to the Kyoto Protocol accounting requirements.
Energy sector emissions in 1998 totalled 362.9 Mt CO ₂ -e, accounting for 79.6% of national net emissions.	Total emissions from the Energy sector in 1998 were 5.7% higher than in 1997, and 21.1% higher than the 1990 level.
Stationary energy combustion produced 258.7 Mt of emissions, contributing 56.8% to total national emissions.	Stationary energy emissions, in 1998 were 24.3% higher than in 1990.
Electricity generation contributed 168.6 Mt or 65.2% of stationary energy emissions. This represents 37.0% of total national emissions.	Emissions from electricity generation were 10.3% higher than in 1997 and 30.6% higher than in 1990. The production of electricity and the use of coal both increased significantly during 1998.
Fugitive fuel emissions equalled 31.5 Mt, contributing 6.9% of total national emissions in 1998. Coal mining was the largest contributor.	The total increase in fugitive emissions, from 1990 to 1998, was 2.0 Mt CO ₂ -e or 6.7%.

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

Including the current best estimate of land clearing emissions, Australia's total emissions would be 519.9 Mt in 1998 and 493.3 Mt in 1990, representing a 5.4% increase. This does not equate to the Kyoto Protocol accounting requirements.

1998 Estimated emissions by sector (excluding land clearing)
Total 455.9 Mt CO₂-e



FACT SHEET 2
1998



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The National Greenhouse Gas Inventory

Australia has produced an annual inventory of national greenhouse gas emissions since 1990 as part of its international commitments under the Framework Convention on Climate Change. The 1998 Inventory provides the latest report on Australia's greenhouse gas emissions. This Inventory incorporates improvements in data collection methods that have been used to update emission estimates in the 1990-1997 inventories.

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. For example, some of the land-based emissions and sinks that are reported in the national inventory will not be included or will be reported differently for the Kyoto Protocol.

Australia's National Greenhouse Gas Inventory is based on international guidelines established by the Intergovernmental Panel on Climate Change and reports on human-induced greenhouse gas emissions in six sectors:

1. Energy
2. Industrial Processes
3. Solvent and Other Product Use
4. Agriculture
5. Land Use Change and Forestry
6. Waste

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.



Energy industries, mostly electricity generation, accounted for the greatest proportion of greenhouse emissions and the greatest increase in emissions

Energy sector

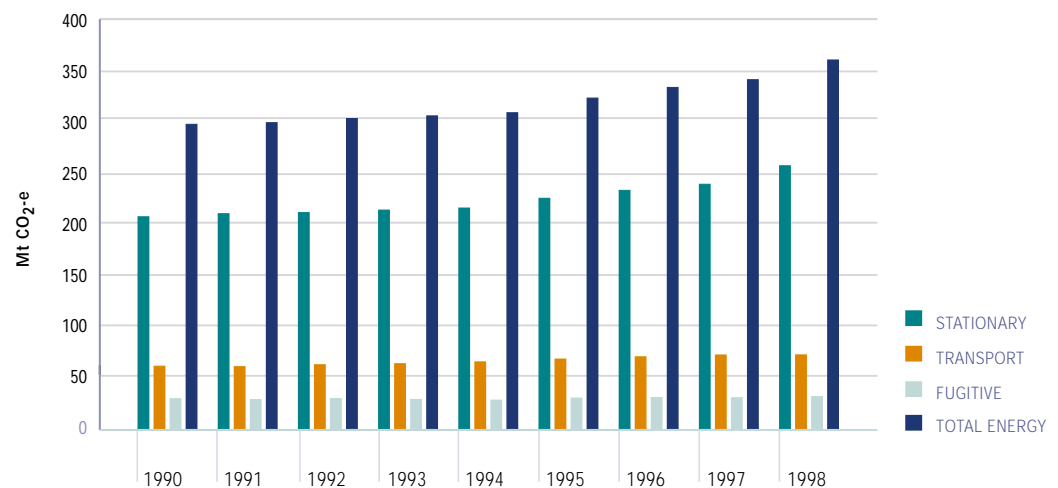
The Energy sector includes estimated emissions from the following sources:

Stationary - includes emissions from fuel combustion to provide energy in the following areas:

- *Energy industries* - electricity generation, petroleum refining, gas processing and solid fuel manufacturing
- *Manufacturing industries and construction* - energy used in major manufacturing such as steel, non ferrous metals, pulp and paper and food processing
- *Other sectors* - energy use by the commercial, institutional, residential sectors as well as fuel use by agricultural, fishery and forestry vehicles and all remaining fuel combustion emissions including those produced by combustion of engine lubricating oil and military fuel use.

Emissions from stationary energy are mostly carbon dioxide (98.9%), with a small contribution from methane (0.7%) and nitrous oxide (0.4%) generated during combustion.

Trends in CO₂-e emissions, Energy sector



National Greenhouse Gas Inventory

Fugitive - includes emissions from

- Coal mining and handling (solid fuels)
- Oil and natural gas production, processing and transportation.

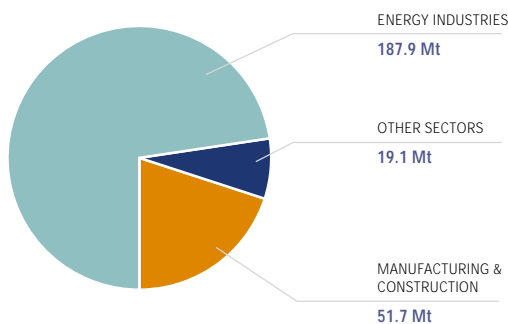
Methane comprises 81.1% of the emissions from fugitive sources, with the remainders from carbon dioxide (18.8%) and nitrous oxide (0.1%).

Transport - road, rail and domestic air and water transport (these emissions are covered by Fact Sheet 3 in this series).

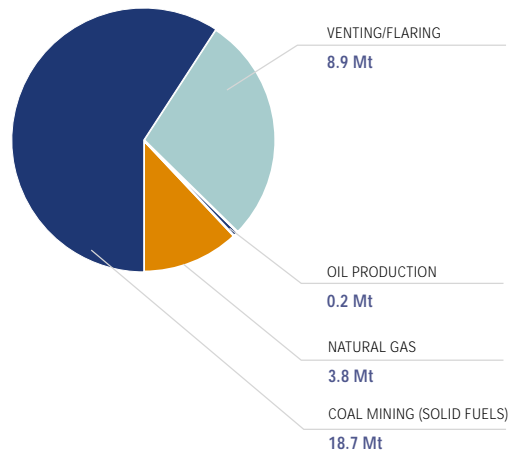
The Energy sector as a whole contributed 362.9 Mt of Australia's emissions in 1998, 258.7 Mt from stationary energy, 72.6 Mt from transport and 31.5 Mt from fugitive emissions. In 1998, Energy sector emissions were 5.7% higher than in 1997 and 21.1% higher than in 1990.

All emissions from the Energy sector will be included in both the 1990 baseline (that will provide a benchmark for comparison of future emissions) and the accounting for the Kyoto Protocol commitment period in 2008 - 2012.

1998 Stationary energy combustion emissions
Total 258.7 Mt CO₂-e



1998 Fugitive fuel emissions
Total 31.5 Mt CO₂-e

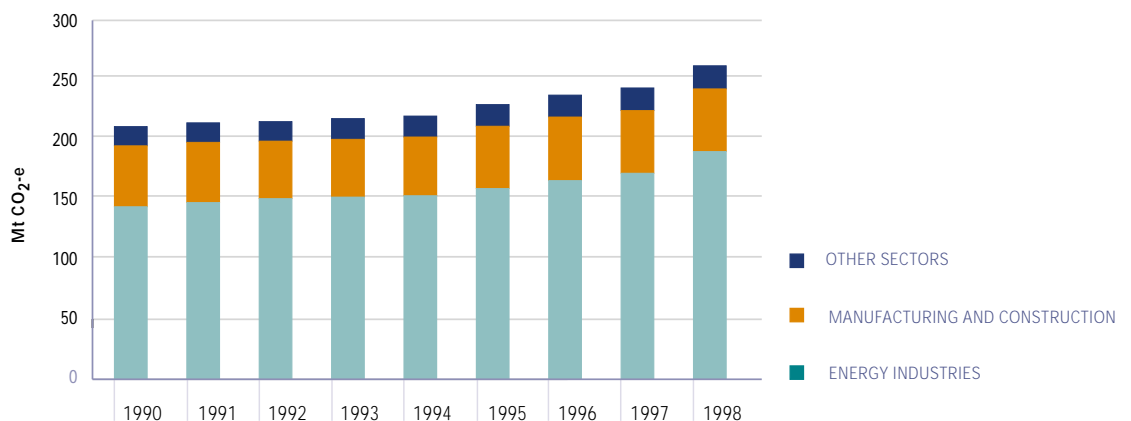


Emissions estimates and trends 1990 to 1998

Stationary energy

Estimated emissions from stationary energy sources were 258.7 Mt in 1998, a 50.5 Mt or 24.3% increase since 1990. Energy industries contributed 187.9 Mt of emissions in 1998, 168.6 Mt of which was produced by generation of electricity. Electricity production accounted for 37.0% of national emissions during 1998. Other components of the energy industries were small contributors with petroleum refining contributing 6.5 Mt and manufacture of solid fuels contributing 12.8 Mt. A 1.6 Mt increase in emissions from coke ovens from 1997 to 1998 contributed to a 19% increase in emissions from manufacture of solid fuels.

Stationary energy combustion emissions by subsector, 1990 to 1998



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Energy production

Most of the increase in stationary energy emissions is attributable to the generation of electricity, emissions from which have increased by 30.6% (39.5 Mt) since 1990 and 10.3% (15.7 Mt) since 1997.

There was a 6.1% increase in the quantity of electricity generated (and consumed) from 1997 to 1998. In particular, production from coal fired power stations increased. Electricity production from brown coal increased by 11.5% between 1997 and 1998, black coal by 7.1% and natural gas by 4.5%. On average, use of brown coal produces 93.2 gigagrams of carbon dioxide per peta joule of energy compared to 89 gigagrams for black coal and 51 gigagrams for natural gas.

Coal fired power stations produced 87.4% of Australia's electricity in 1998 compared to 83.7% in 1990. 37.4% of electricity produced by coal fired power stations in 1998 was generated using brown coal as fuel, compared with 34.3% in 1990

Energy use

Energy used in manufacturing and construction industries accounted for 11.3% (51.7 Mt) of total national emissions in 1998. Emissions from these industries have been increasing slowly with an increase of 2.8% between 1990 and 1998, and virtually no change in emissions between 1997 and 1998. This is associated with a greater use of natural gas and corresponding lower use of coal and petroleum by these industries.

Fuel combustion in the residential, commercial and institutional sectors, together with fuel use by agricultural, fisheries and forestry vehicles, accounted for 16.7 Mt or 3.7% of total national greenhouse gas emissions in 1998. This compares to 16.5 Mt in 1997 and 14.2 Mt in 1990.

The commercial sector recorded 3.6 Mt of direct emissions in 1998 compared to 3.1 Mt in 1990. The residential sector recorded 9.0 Mt of direct emissions in 1998. This represents an increase of 22.3% in emissions from the residential sector since 1990. Most of these emissions arise from combustion of natural gas.

The remaining sources, military vehicles and combustion of lubricants were only small contributors with estimated emissions of 2.4 Mt in 1998.

The national inventory accounts for emissions at the point of production, not consumption, so emissions from electricity used in industry and residential and commercial sectors are included under energy production.

Fugitive emissions

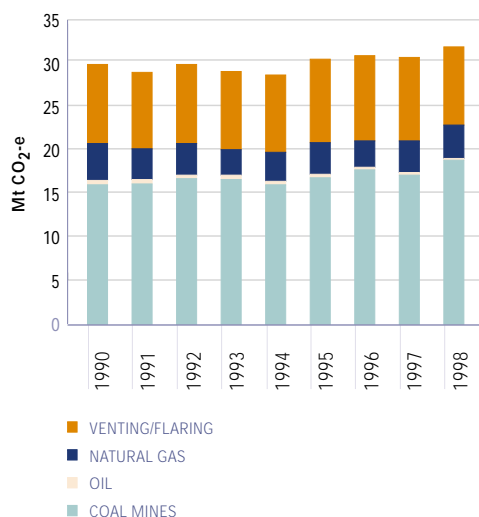
Fugitive emissions accounted for 31.5 Mt or 6.9% of national net emissions during 1998, an increase of 2.0 Mt or 6.7% from 1990.

Methane contributes 81.1 % of fugitive emissions, and 73.1% of these are from surface and underground coal mining. Emissions of carbon dioxide and methane as by-products of natural gas and oil production and leakage from distribution accounted for the remainder of the fugitive emissions.

Fugitive emissions from coal mining and handling were 18.7 Mt in 1998, a 17.4% increase from 1990. However, methane emissions have not increased as fast coal production due to increased mining from less 'gassy' sites and capture of coal mine gas (methane recovery). As a result, emissions per tonne of coal mined have declined from 4.1kg in 1990 to 3.1 kg in 1998.

Emissions from oil and natural gas systems declined by 5.8% between 1990 and 1998. Reduced leakage from natural gas distribution, mainly because of the relining of the Sydney gas system in the early 1990s, has more than offset increased emissions from oil and gas production.

Fugitive emissions by subsector, 1990 to 1998



Use Gas Inventory

Reliability of emissions estimates

Estimates of emissions of carbon dioxide from combustion depend on the amount of fuel consumed and the characteristics of that fuel, both of which are known reasonably accurately. The uncertainty associated with carbon dioxide emissions from the Energy sector is estimated to be less than 5%.

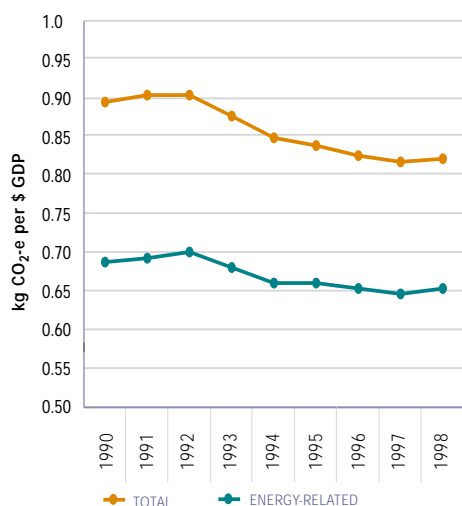
Estimates of methane and nitrous oxide emissions depend on quantities of fuel consumed and also on emission factors associated with the type of equipment or process that uses the fuel and the relative proportions of these in use. While the amount of fuel is relatively well known, the mix of technology in use is less well known and can change with time. Information on emissions under various operating conditions is also limited. Estimates of emissions of non-CO₂ gases in the energy sector have an associated uncertainty of greater than 20%.

Changes in emissions relative to economic growth

While gross domestic product (GDP) and total emissions both increased, total emissions per dollar of GDP declined by nearly 8.2% between 1990 and 1998. GDP increased at an average rate of 3.1% while emissions increased at an average rate of 2.0% during this period.

Energy related emissions per dollar of GDP declined by 4.9% from 1990 to 1998. However, the general downward trend was reversed during the last year with a 1.1% increase from 1997 to 1998.

Greenhouse gas emissions per \$ GDP



The falling trend in emissions per dollar of GDP from 1990 to 1998 is related to several factors:

- structural change in the economy:
The manufacturing sector grew by 10% but the less energy intensive services sector increased by about 31%
- a reduction in the average CO₂ emission factor of coal, which partly offset the rising share of coal in the fossil fuel mix
- increases in the average efficiency of energy conversion equipment, such as power stations (although these took place in the early 1990s and began to reverse in 1998)
- improvement in the average efficiency of energy use.

The increase in emissions per dollar of GDP between 1997 and 1998 against the long-term downward trend is mostly attributable the increase in emissions from electricity generation during this period.

Reducing greenhouse gas emissions in the Energy sector

Australia's emissions target under the Kyoto Protocol factored in a projected growth in greenhouse gas emissions from the Energy sector. Australia is undertaking a range of actions that, by the year 2010, are expected to reduce emissions from the Energy sector compared to the levels that would otherwise have been reached.

The Commonwealth Government has introduced a range of measures that address both the supply and use of energy.

On the supply side, actions to encourage the development of cost effective renewable energy, improve the efficiency of energy markets and ensure best practice in fossil fuel conversion efficiency, are key measures being implemented.

Both the Prime Minister's 1997 greenhouse package and the 1999 *Measures for a Better Environment* package provide substantial support for the commercialisation and deployment of renewable energy technologies, and for industry development.



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The Commonwealth Government is also helping to encourage demand for renewable energy in the electricity market with the introduction of a mandatory target of 9,500GWh of new renewable electricity by 2010. This measure will require an increase of renewable electricity generation in the order of 60% over current levels.

Additionally, the Government will implement Generator Efficiency Standards from July 2000 that will require all fossil fuel electricity generators to improve the efficiency of their power plants. This measure is expected to achieve greenhouse savings of about 4 Mt per annum during the Kyoto Protocol reporting period, 2008-2012.

On the demand side, measures to improve the efficiency of energy end use are also being implemented. The Greenhouse Challenge program, implemented through the Australian Greenhouse Office, is a cooperative effort between Australian industry and the Commonwealth Government that aims to encourage industry to reduce their greenhouse emissions by improving efficiency in energy use and processing.

The National Greenhouse Strategy, an initiative by Commonwealth and State and Territory governments released in 1998, also contains a number of measures that target the reduction of greenhouse gas emissions from the Energy sector. These range from actions to encourage energy market reform, to developing abatement strategies for energy industries and retailers, to strategies aimed at harnessing renewable energy sources and improving the energy efficiency of consumer products.

Improvements in the energy efficiency of domestic appliances and commercial and industrial equipment will be promoted by:

- extending and enhancing the effectiveness of Energy Rating labelling
- introducing minimum energy performance standards on certain appliances and equipment.

The Commonwealth Government has established the \$400 million Greenhouse Gas Abatement Program to further assist Australian in meeting its commitments under the Kyoto Protocol. 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).



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

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

Copies of the 1998 Inventory and related documents can be obtained by contacting AGO Publications:

Telephone: 1 300 130 606

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.

Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks: Workbook for Fuel Combustion Activities (Stationary Sources), Workbook 1.1 reprinted with supplements 1998.

Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks: Workbook for Fugitive Fuel Emissions (Fuel Production, Transmission, Storage and Distribution), Workbook 2.1 reprinted with supplements 1998.

Fact Sheets—1998 National Greenhouse Gas Inventory—Frequently Asked Questions, Overview and other sectors in this series.

