Module 3 Australia's greenhouse gas emissions

SOURCES OF GREENHOUSE GAS EMISSIONS

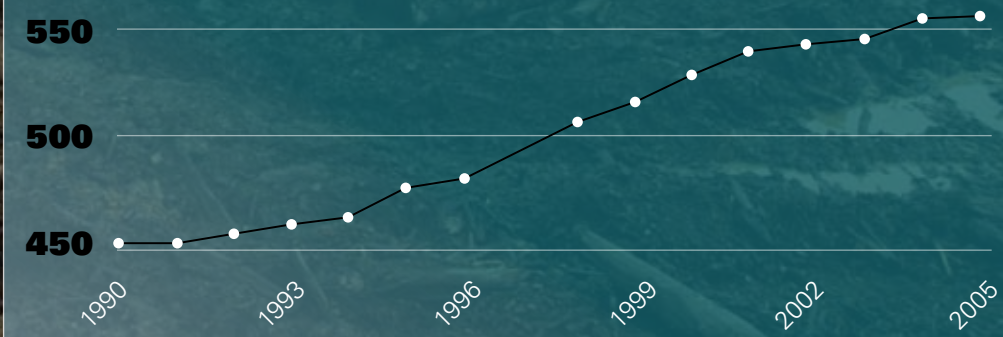
In Australia, most of our greenhouse emissions come from the burning of fossil fuels (coal, oil and natural gas). **Fossil fuels** are used mainly to generate electricity and to power transportation. Around 95 per cent of our electricity comes from fossil fuels and only five per cent comes from renewable energy. For transport most Australians rely on cars, buses and ferries, which require another fossil fuel; oil, to run.

The clearing of land for agriculture, mainly for beef cattle grazing, also results in significant greenhouse gas emissions in Australia. When vegetation is cleared some of it is burned immediately, releasing CO_2 into the atmosphere. Vegetation that is not burned together with the carbon in the soil eventually decays, releasing more CO_2 for a number of years.

Emissions are measured in millions of tonnes of carbon dioxide equivalent (Mt $CO_{2\text{-}e}$). In 1990 Australia's emissions were 457 Mt $CO_{2\text{-}e}$ but by 2005 they had risen to 559 Mt $CO_{2\text{-}e}$, an increase of 22 per cent. However, if land clearing is excluded, emissions rise by almost 26 per cent – see **Figure 1**. This is because land clearing rates have dropped in Australia since 1990. In the future, therefore, if Australia's emissions are to be reduced the reductions must come from fossil fuel use.

According to Federal Government figures, between 1990 and 2003 **land clearing** declined by 367,000 hectares, or almost 60 per cent. This is equivalent to more than 500,000 football fields. Most of this reduction was in Queensland.

Figure 1 Growth in Australia's greenhouse gas emissions 1990–2005 (Mt $CO_{2\text{-}e}$) (excluding land use change & forestry)



Source: National Greenhouse Gas Inventory, 2005.

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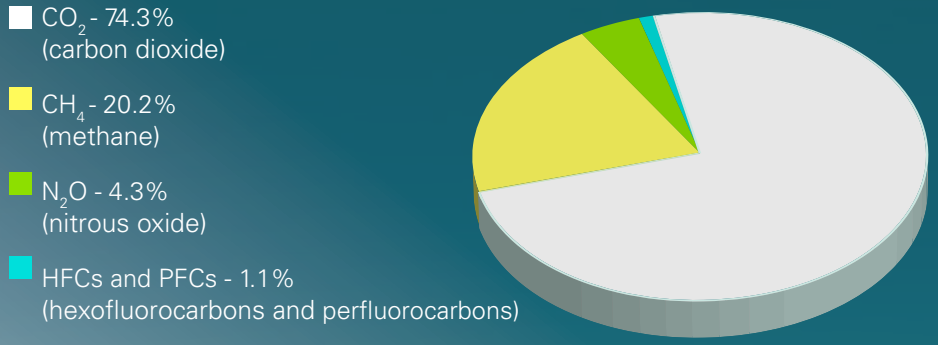
What is meant by carbon dioxide equivalent? Other greenhouse gases – like methane (CH_4) and nitrous oxide (N_2O) – can be converted into their equivalent to carbon dioxide using factors that compare their global warming effect. So one tonne of methane released into the atmosphere has the same warming effect as 21 tonnes of carbon dioxide. In this way, scientists can add up the effects of various greenhouse gases and measure them all in terms of their carbon dioxide equivalent ($CO_{2\text{-}e}$) (see **Module 1**).

Carbon dioxide, the main greenhouse gas, accounted for around 74 per cent of all Australia's emissions in 2005. The two other main greenhouse gases are methane, which accounted for 20 per cent, and nitrous oxide, which accounted for 4 per cent – see **Figure 2**.

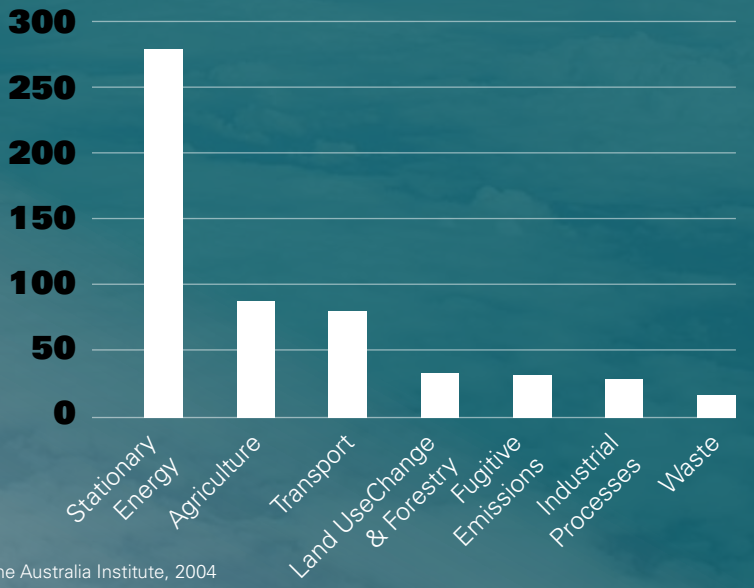
In 2005, the largest source of emissions in Australia was stationary energy that came mainly from electricity production (around 70 per cent) but included direct emissions from manufacturing, metals and some other industries. Stationary energy accounts for 50 per cent of total emissions – see **Figure 3**. The other big contributors were transport (14 per cent) and agriculture (16 per cent).

Figure 2 Contribution of main greenhouse gases, per cent, 2005



Source: National Greenhouse Gas Inventory, 2005.

Figure 3 Australia's greenhouse gas emissions by sector, 2005 (Mt $CO_{2\text{-}e}$)



Source: The Australia Institute, 2004

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HOW DO AUSTRALIA'S EMISSIONS COMPARE TO OTHER COUNTRIES?

Sometimes people argue that because Australia only contributes 1.4 per cent of global greenhouse gas emissions, any move to cut emissions in Australia would make no appreciable difference.

The most obvious way to compare Australia's emissions is to look at the absolute number. In 2005 Australia's emissions were 525 Mt $CO_{2\text{-}e}$. In comparison the UK had emissions of 657 Mt $CO_{2\text{-}e}$, France 558 Mt $CO_{2\text{-}e}$, and Italy 580 Mt $CO_{2\text{-}e}$. This shows that if Australia's emissions are too small to worry about, so too are those of the UK, France and Italy.

But there is another way to compare Australia's emissions. We can look at how much each Australian is responsible for compared to people in other countries. This involves taking the total amount of a country's emissions and dividing it by the number of people in that country to determine the average emissions of each person.

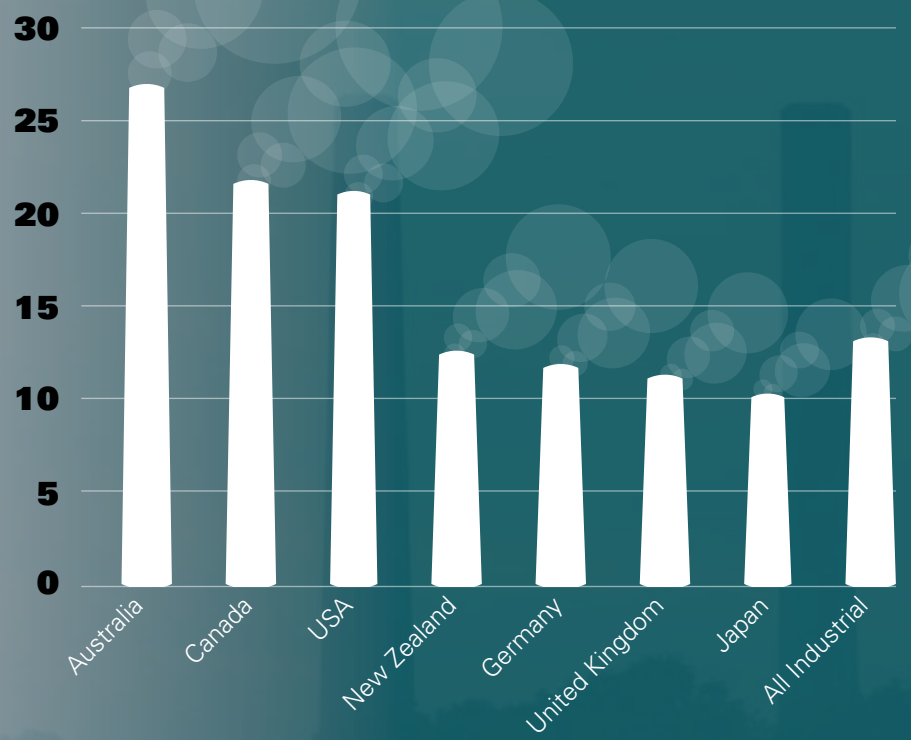
Figure 4 shows that Australia has the highest **annual emissions per person** of any industrialised country, around 27 tonnes per person. This is 30 per cent higher than emissions per person in the United States (21.2 tonnes). In developing countries emissions per person are much lower – around three tonnes per person in China and one tonne in India.

There are three main reasons for Australia's high emissions per person. First, electricity generation in Australia is very fossil fuel intensive, with coal being the main source (see **Module 7**). Second, compared to many countries, Australia is not very efficient in its energy use. For example, fuel efficiency standards for cars in Australia are worse than those in China.

Finally, the mining, steel-making and aluminium smelting industries are large contributors to Australia's total emissions. Because the Australian aluminium industry relies on coal-fired generation, the greenhouse gas emissions are around double the world average for each tonne of aluminium produced.

If wealthy nations like Australia, with high emissions per person, do not reduce their emissions it will be much more difficult to encourage countries like China and India to reduce their emissions. (This is discussed further in **Module 5** on ethics and climate change).

Figure 4 Greenhouse gas emissions per person in some industrialised countries, 2001 (Mt $CO_{2\text{-}e}$ per person)



Source: The Australia Institute, 2004

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STUDENT ACTIVITIES

Comprehension Questions

- When figures for greenhouse gas emissions are given, what unit are they measured in?
- What is the major source of Australia's emissions?
- Why does land clearing add to a country's greenhouse gas emissions?
- How have Australia's emissions changed between 1990 and 2004?
- Why are Australia's greenhouse gas emissions per person so high in comparison to other countries?

Analysis Questions

- Evaluate what impact land clearing has on Australia's total emissions.
- Why is it important to convert emissions of other greenhouses gases to their carbon dioxide equivalent?
- What are the two main ways of comparing Australia's greenhouse gas emissions with those of other countries? What are the advantages and disadvantages of each way?

Exercise 1

- Compare Australia's emissions with two other countries taking into account the size of the population. Explain why this is necessary.
- Using the following information:
  - emission data is available from the **UNFCCC**, and the **World Resources Institute**, but teachers will need to register to access the WRI database; and
  - population data is available from the **UN** and from the **World Bank**.

  Propose possible sources of data and other relevant information and justify why these are necessary.
- Identify the appropriate units of data to be collected.

  The most important thing for students to remember is to use the same sources and units of data throughout their calculations. For example, all emissions data should be in CO_2 or $CO_{2\text{-}e}$ and should include or not include Land Use Land Use Change and Forestry (LULUCF), which includes land clearing. For example, Australia's total emissions in 2005 are 525 Mt of $CO_{2\text{-}e}$ excluding LULUCF, but if LULUCF is included they rise to 559 Mt of $CO_{2\text{-}e}$. As a result, it is important to make sure that comparisons are always in the same units of data.
- Once the correct data has been identified students should write up a table with four columns. Column 1 (country title), Column 2 (country emissions) Column 3 (country population) Column 4 (per capita emissions).
- Students can then divide into groups and discuss their sources, units of data and findings.