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Dragging our tail on greenhouse

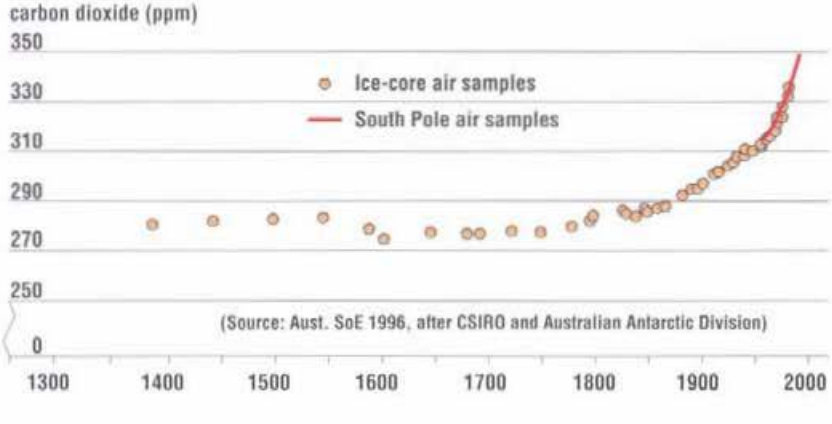
The red-tailed phascogale: destined to be a casualty of global warming

Next time you reach for the hot water tap, spare a thought for the kowari and the red-tailed phascogale. These tiny creatures inhabit small, isolated territories: the kowari in the red sands of the central desert, and the red-tailed phascogale in the tree hollows of Western Australia's south-western forests.

Both mammals lead a fragile existence, largely due to habitat changes wrought by human activities. But even greater changes are in store. Less than 1% of each mammal's core habitat is likely to remain by the end of next century, unless drastic steps are taken to curb greenhouse gas emissions.

Greenhouse gases absorb infrared radiation emitted by the Earth's surface, keeping the planet warmer than it would otherwise be. Climate models suggest that this natural warming effect is being enhanced by the production of greenhouse gases through human activities, in particular the burning of fossil fuels.

Atmospheric carbon dioxide concentrations since 1300 determined from Antarctic ice cores.



Since pre-industrial times, atmospheric concentrations of the greenhouse gas carbon dioxide have risen by more than 30%. Global mean surface temperature has increased by 0.3-0.6°C, and global sea level by 10-25 cm. Carbon dioxide concentrations are expected to more than double during the next century, causing an increase in global temperature (relative to 1990) of about 2°C by 2100 and a sea level rise of about 50 cm.

The only hope of reversing this trend is to reduce global emissions to well below 1990 levels. Sadly for the kowari and the red-tailed phascogale, the chances of this happening are slim. Many industrialised nations, Australia included, are falling well short of their national and international obligations. As a result, global emissions are increasing.

Chapter 5 of *Australia: State of the Environment 1996* outlines the causes and consequences of climate change, and assesses Australia's efforts to curb greenhouse gases. It reports that while Australia produces only 1-2% of global carbon dioxide, the country's per capita emissions are among the world's highest. Reasons for this include a heavy reliance on fossil fuels, government subsidisation of energy-intensive industries, land clearing for agriculture and high rates of road transport use.

In 1992, Australia became part of a global effort to reduce greenhouse gas emissions. At the Rio Earth Summit it joined more than 150 other countries in signing the United Nations Framework Convention on Climate Change. A National Greenhouse Response Strategy has been developed to address Australia's obligations under the convention. Its target is to stabilise greenhouse gas emissions based on 1988 levels by the year 2000 and the reduce them by the year 2005.

Initiatives to reduce emissions under the strategy have achieved limited success. A program called

Greenhouse 21C includes cooperative agreements with industry and has the potential to reduce greenhouse gas emissions, though not enough to achieve the national targets. Projections in Greenhouse 21C indicate that emissions in 2000 will be about 3% above those needed for stabilisation at 1990 levels.

According to *Australia: State of the Environment 1996*, the most obvious problem is institutional. Energy and resource development agencies in some states, having charters that limit the consideration of broad issues such as climate change, are pressing ahead with plans to expand energy-intensive activities.

Despite the gloomy outlook, a few positive signs are noted in the report. These include the establishment of a Cooperative Research Centre for renewable technologies; the Queensland Government's subsidisation of solar hot water systems and compact fluorescent light bulbs as part of a scheme to encourage a more responsible pattern of energy use; and South Australia's commitment to obtaining 25% of its non-transport energy from renewable forms within 10 years.

The conversion of domestic water heating to solar power is highlighted in the report as an immediate measure that could be taken to reduce greenhouse emissions. Other options include more use of natural gas, the least carbon-intensive of the three main fossil fuels (coal, oil and gas); increased general use of renewable energy sources such as solar and wind power; and reducing both the gases emitted, and the energy used, by urban transport.

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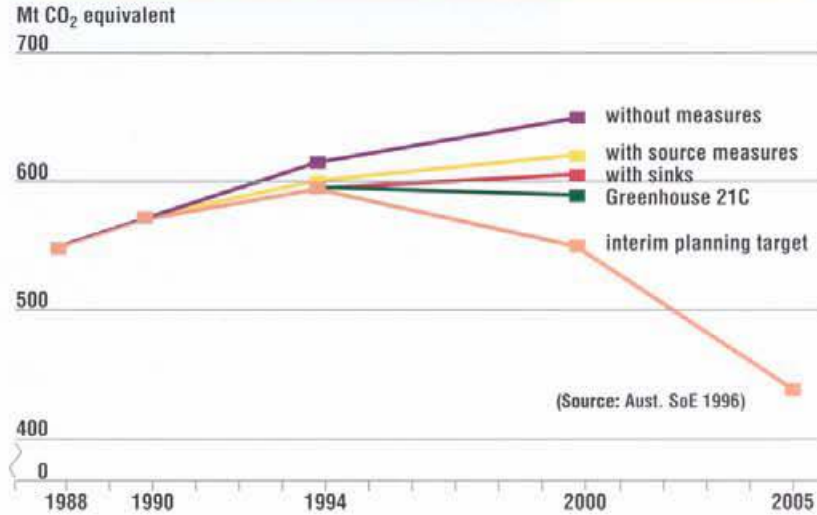
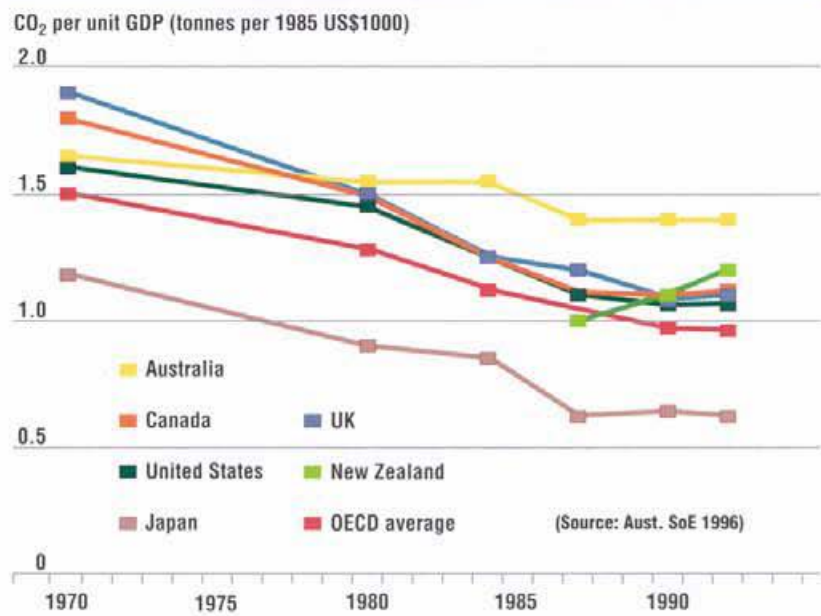
The report suggests greater use could be made of renewable energy sources such as solar and wind power.

Interim planning target and projected greenhouse gas emissions to the year 2000. These figures indicate that considerable further reductions will be required to meet the interim planning target.



Energy-related carbon dioxide emissions per unit GDP for selected OECD countries, 1970–92.



Accounting for aerosols

IN recent years, scientists have realised that, in addition to raising greenhouse gas levels, human activity is also leading to an increase of aerosols in the lower atmosphere. The most significant are sulfate aerosols that come from sulfur dioxide emissions from power generation and ore processing. Carbon-based aerosols produced by burning biomass are also important.

Aerosols can reflect sunlight as well as change the amount, type and radiative behaviour of clouds, resulting in lowering of surface temperatures. Due to their short lifetime (days/weeks), their cooling effects are temporary and regional, but for some regions, particularly in the northern hemisphere, the cooling is estimated to be about the same as the warming effects of CO2.

Calculating the effect of aerosol particles on the Earth's climate is difficult due to the lack of globally distributed data and the complexity of the processes linking gas emissions with particle formation and growth. CSIRO scientists are taking part in a series on international experiments designed to learn more about aerosols to enable the inclusion of aerosol particles in global climate models.

The first experiment, involving scientists from 44 research institutions in 11 countries, took place south of Australia in 1995. Measurements were taken from aircraft, ships (including CSIRO's Southern Surveyor), land-based stations and satellites. The next experiment in the series will be conducted in the North Atlantic.