



NEW ZEALAND'S GREENHOUSE GAS INVENTORY 1990–2009

Environmental Snapshot
April 2011

Key points

- In 2009, New Zealand's total (gross) greenhouse gas emissions were 70.6 million tonnes of carbon dioxide equivalent (Mt CO₂-e), which means total emissions are now 11.5 Mt CO₂-e (19.4%) higher than the 1990 level of 59.1 Mt CO₂-e.
- In 2009, net removals from afforestation, reforestation and deforestation under the Kyoto Protocol were -17.3 Mt CO₂-e.
- New Zealand's net emissions are less than the average assigned amount units for 2008 and 2009. We are on track to meet our Kyoto Protocol target without needing to purchase units offshore.

Between 2008 and 2009:

- Total emissions decreased by 2.3 Mt CO₂-e (3.1%).
- In the energy sector, there was an increase in inflows into hydro-electric storage lakes and an increase in electricity supply from geothermal and wind generation.
- Road transport emissions decreased as a downstream effect of the 2008 economic recession.
- Agricultural emissions decreased due to the reduction in the use of nitrogen fertiliser in New Zealand. In addition, the effects from the widespread 2008 drought and lower returns for sheep, beef and deer relative to dairy, continued to have an influence on sheep, non-dairy cattle and deer populations in 2009.
- UNFCCC net removals from land use, land-use change and forestry decreased by 2.7 Mt CO₂-e (9.1%). Paradoxically, this was largely the result of increased new forest planting (as the biomass of the vegetation cover removed before planting is greater than the growth of the new vegetation cover in the first year) as well as an increase in harvesting of pre-1990 forests.

This snapshot presents commonly asked questions about New Zealand's emissions and provides answers from *New Zealand's Greenhouse Gas Inventory 1990–2009* released on 15 April 2011. The inventory is the official annual report of all human-caused emissions and removals of greenhouse gases in New Zealand. The inventory measures New Zealand's progress against its obligations under the Kyoto Protocol as well as the United Nations Framework Convention on Climate Change (UNFCCC). The complete inventory submission is available on the Ministry for the Environment's website at: www.mfe.govt.nz/publications/climate/.

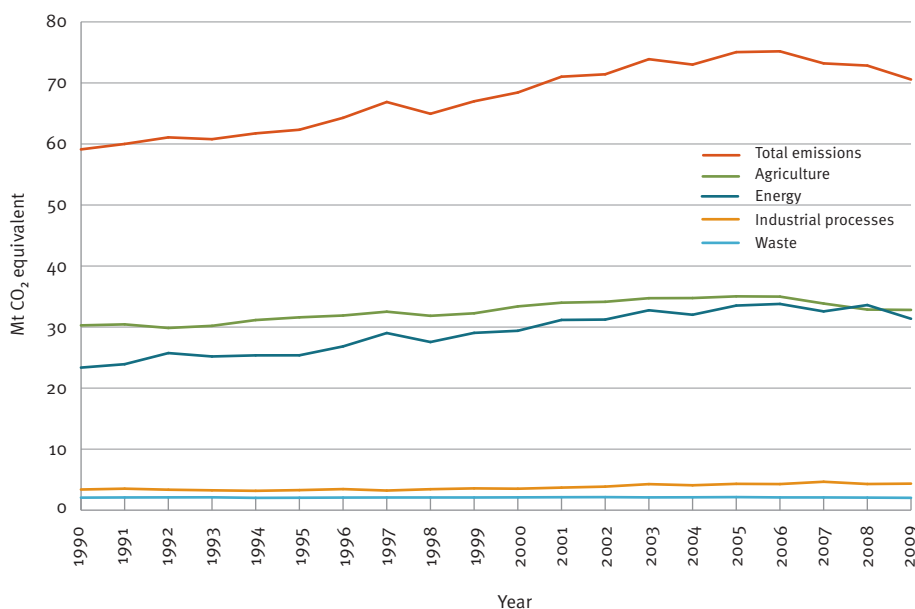
Why have New Zealand's total (gross) emissions increased since 1990?

In 1990, New Zealand's total emissions were 59.1 million tonnes of carbon dioxide equivalent (Mt CO₂-e). In 2009, this total had increased by 11.5 Mt CO₂-e (19.4%) to 70.6 Mt CO₂-e. This long-term trend is largely due to growth in energy emissions, particularly from road transport and electricity generation.

While agriculture was New Zealand's largest emitting sector in 2009, since 1990 energy emissions have increased over three times as much as those from agriculture. Consequently, the proportion of energy emissions as part of total emissions has increased over time. Energy and agricultural emissions now occupy almost equal proportions.

However, the volatility in agricultural emissions can have a significant impact on total emissions. For instance, in 2007 while energy emissions increased, the widespread drought decreased agricultural emissions to the point that they offset the energy increase, resulting in a decrease in total emissions.

FIGURE 1
NEW ZEALAND'S TOTAL GREENHOUSE GAS EMISSIONS FROM 1990 TO 2009



Definitions

Total emissions under the UNFCCC and gross emissions under the Kyoto Protocol come from the following sectors: agriculture, energy, industrial processes, waste, and solvent and other product use. **Net emissions under the UNFCCC** are total emissions plus emissions and removals from land use, land-use change and forestry. **Net emissions under the Kyoto Protocol** are gross emissions plus emissions and removals from activities under Article 3.3 of the Kyoto Protocol (afforestation, reforestation and deforestation).

The main difference between the two definitions of net emissions is the exclusion from Kyoto Protocol accounting of removals from forests established before 1990. This 1990 baseline is a reference against which to measure progress, allowing for comparison between countries and between sectors.

Why have New Zealand's total emissions decreased since 2006?

Between 2006 and 2009 our total emissions have been decreasing because of the weather and a weaker economy affecting the two largest sectors, agriculture and energy.

Between 2006 and 2007 the decrease in total emissions resulted from:

- a reduction in coal-fired electricity generation with the commissioning of the combined cycle gas turbine at the Huntly power station
- a reduction in sheep, non-dairy cattle and deer populations from the widespread drought.

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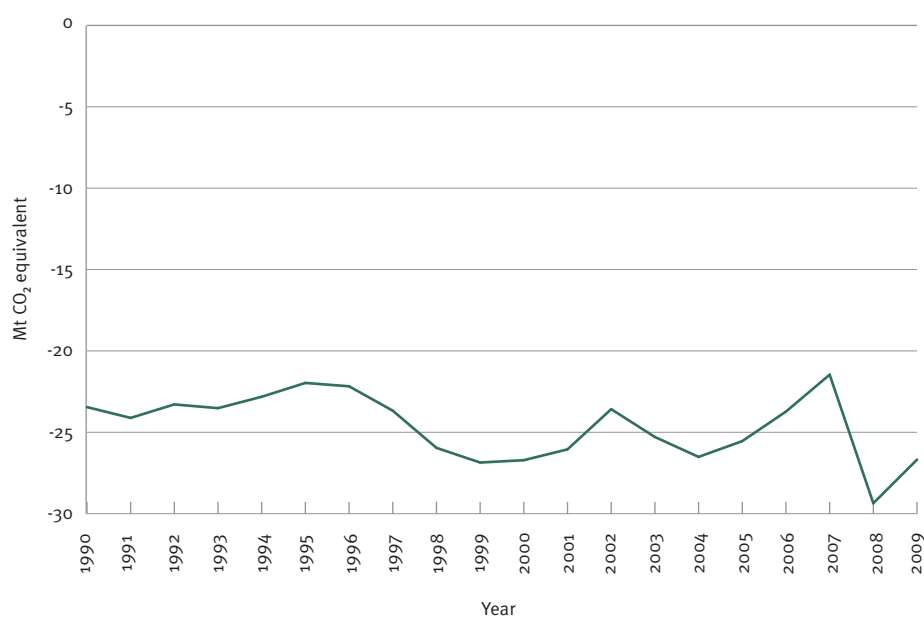
- an increase in inflows into hydro-electric storage lakes which reduced demand for thermal electricity generation
- an increase in electricity supply from geothermal and wind generation which reduced demand for thermal electricity generation
- a reduction in road transport emissions due to the downstream effects of the 2008 economic downturn
- a reduction in the use of nitrogen fertiliser in New Zealand which reduced agricultural emissions. In addition, the effects from the widespread 2008 drought and lower returns for sheep, beef and deer relative to dairy, continued to have an influence on sheep, non-dairy cattle and deer populations in 2009.

How good are New Zealand's forests at removing CO₂?

In 2009, under UNFCCC reporting New Zealand's forests absorbed 29.6 Mt CO₂. This estimate is different to the 2009 estimate of forest removals reported under the Kyoto Protocol of 17.6 Mt CO₂. This is because under Kyoto Protocol Article 3.3 activities New Zealand can only account for removals from forests first established after 1989.

Net removals have changed over the period 1990–2009 (Figure 2). This is due to tree growth, harvesting and the changes in the area of forestry. A key factor in the ability of a forest to remove CO₂ is the age of the forest. A newly planted forest is

FIGURE 2
NET REMOVALS FROM LAND USE, LAND-USE CHANGE AND FORESTRY (UNDER THE UNFCCC)



Assigned amount units

An assigned amount unit is a Kyoto unit representing an allowance to emit one metric tonne of carbon dioxide equivalent. AAUs are created (issued) up to the level of a Party's initial assigned amount. New Zealand's initial assigned amount is the 1990 level of emissions that was reviewed in 2007; 61.9 Mt CO₂-e multiplied by 5 for the length of the commitment period and multiplied by 100 per cent for New Zealand's target (100 per cent of 1990 emissions). This estimate was made on the best available information at the time.

slow at removing carbon, but once established the forest will enter a period of rapid growth during which it removes the most carbon. Once a forest has reached maturity, the growth slows and the rate at which it removes carbon decreases. Consequently, planting and harvesting cycles have a large impact on New Zealand's net removals.

What influences the area of forestry?

The area of a forest has historically been influenced by government policy, returns from forestry and the relative returns compared to other land uses. New Zealand's planted forest area increased significantly between 1992 and 1998. This followed a change in the taxation regime, an unprecedented price spike for forest products with subsequent favourable publicity, a government focus on forestry as an instrument for regional development, and the conclusion of the state forest assets sale.¹ The removal of agricultural subsidies in New Zealand and generally poor performance of the New Zealand and international share market also encouraged investors to seek alternatives.

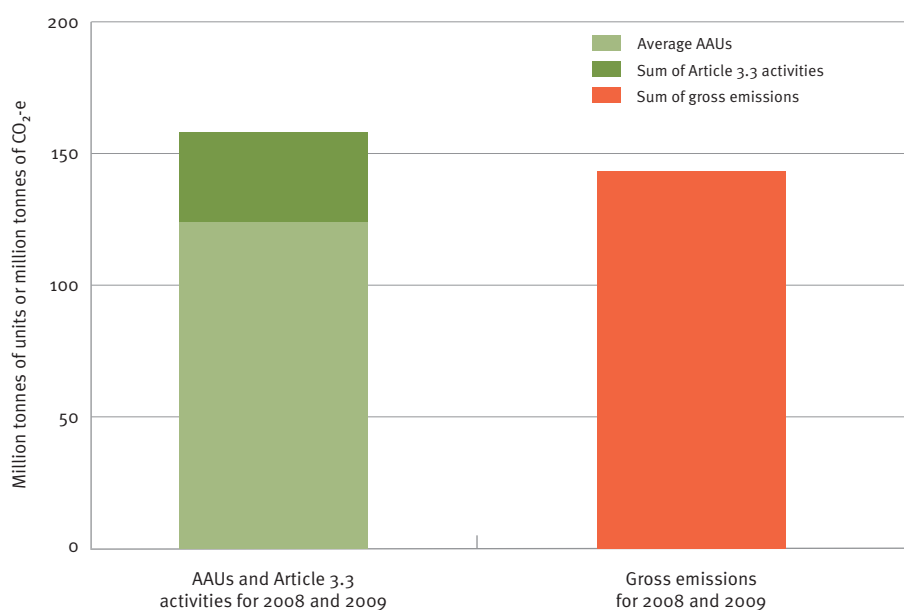
Between 2004 and 2008, the area of New Zealand's forests decreased due to an increase in deforestation of planted forests before the introduction of the New Zealand Emissions Trading Scheme (NZ ETS). The high price of pastoral land between 2004 and 2008 also contributed to an increase in deforestation.

The area of new planting has slowly increased since 2007. The contributing factors are the NZ ETS, Permanent Forest Sinks Initiative and Afforestation Grant Scheme which have been introduced by the New Zealand Government to encourage new planting and regeneration of natural forest. In 2009, deforestation emissions were 0.4 Mt CO₂-e, primarily from the conversion of forest land to grassland for dairy farming. This is relatively minor compared to previous years.

What were New Zealand's emissions compared to its target under the Kyoto Protocol?

Under the Kyoto Protocol, New Zealand's target is to return emissions to 1990 levels on average over the commitment period or otherwise take responsibility for the excess. Figure 3 shows New Zealand's total emissions for 2008 and 2009 compared to the Kyoto Protocol target (AAUs) and net removals from Article 3.3 activities.

FIGURE 3
THE KYOTO PROTOCOL COMPLIANCE EQUATION APPLIED TO 2008 AND 2009



Note: AAUs are assigned amount units. New Zealand selected 'end of commitment period accounting' for Article 3.3 activities under the Kyoto Protocol. This means that removal units generated by post-1989 forests are not added to New Zealand's assigned amount until the end of the commitment period. Due to ongoing improvements to inventory reporting, all data (for both gross emissions and Article 3.3 activities) is subject to change before the end of the commitment period.

¹ Rhodes D, Novis J. 2002. *The Impact of Incentives on the Development of Plantation Forest Resources in New Zealand*. MAF Information Paper No: 45. MAF Policy Division. ISSN no: 1171-4654 ISBN no: 0-47807681-9 August 2002.

How has the accuracy of estimates improved?

Since the 2010 inventory submission, many improvements have been made to the accuracy of the emission and removal estimates. The most significant improvements are described below.

Backcasting of land use, land-use change and forestry

Data on areas in various land uses since 1962 was used to estimate lagged emissions and removals from land-use change before 1990, which continued to have an effect between 1990 and 2009 (also known as backcasting). Backcasting reduced net removals in 1990 by 5.1 Mt CO₂-e and reduced net removals in 2008 by 0.02 Mt CO₂-e.

Mapping of deforestation

Mapping of deforestation based on satellite imagery and aerial photography replaced previous estimates that were based on a deforestation intentions survey. This had the impact of decreasing the emissions from deforestation by 2.5 Mt CO₂-e in 2008.

Dung emission factor

A New Zealand-specific emission factor for estimating nitrous oxide emissions from cattle, sheep and deer dung was introduced to the calculation of agricultural soil emissions. Previously, one New Zealand-specific emission factor was used for dung and urine emissions from these species. However, the research to develop this single New Zealand-specific emission factor was generally carried out on urine samples. New research showed that N₂O emissions from dung are substantially lower than emissions from urine. Consequently, a new emission factor for dung was developed for the purpose of estimating nitrous oxide emissions from cattle, sheep and deer. For consistency, the emission factor has been applied to the entire period (1990–2009). The introduction of the dung emission factor has reduced total emissions by 1.6 Mt CO₂-e in 1990 and 1.5 Mt CO₂-e in 2008.

Solid waste disposal to land

The accuracy of the estimates for net methane emissions from solid waste disposal to land has been improved, largely due to improved methodologies. These improvements have come from:

- a better understanding of the management and design of landfills with operational CH₄ recovery systems
- the application of nationally consistent assumptions on the composition of solid waste.

These improvements are largely responsible for the recalculation of the trend in the waste sector which now shows that waste emissions in 2009 were 0.03 Mt CO₂-e (1.6 per cent) below waste emissions in 1990, as opposed to the decrease of 0.8 Mt CO₂-e (31.5 per cent) as reported in the previous inventory submission.

The complete inventory submission is available on the Ministry for the Environment's website at: www.mfe.govt.nz/publications/climate/.



FOR MORE INFORMATION:

- about the state of New Zealand's environment see: www.mfe.govt.nz/environmental-reporting.
- about climate change see: www.mfe.govt.nz/publications/climate
- about the Ministry for the Environment's reporting on New Zealand's greenhouse gases contact: info@mfe.govt.nz.



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