

# New Zealand's Greenhouse Gas Inventory 1990–2012



New Zealand Government

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## **Executive summary**

#### Key points

- New Zealand's total greenhouse gas emissions were 76,048 Gg CO<sub>2</sub> equivalent (CO<sub>2</sub>-e) in 2012, showing a 2 per cent increase since 2011.
- The Energy and Agriculture sectors are the two largest contributors to New Zealand's emissions profile (approximately 90 per cent of total emissions in 2012).
- Since 1990, New Zealand's total emissions have increased by 25 per cent. The four emission sources that contributed the most to this increase were:
  - carbon dioxide from road transport
  - nitrous oxide from agricultural soils
  - emissions from the consumption of fluorinated compounds (hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride)
  - methane emissions from enteric fermentation.
- Emissions from the Industrial Process and Waste sectors and emissions from the road transportation category in the Energy sector showed a slight reduction from 2011.
- New Zealand's net emissions were 49,450 Gg CO<sub>2</sub>-e in 2012.
- Due to the contribution of carbon dioxide removals from forests in the LULUCF sector, New Zealand's net emissions are strongly influenced by cycles of harvesting of plantation forests and changes in land use.

## ES.1 Background

*New Zealand's Greenhouse Gas Inventory* (the Inventory) is the official annual report of all anthropogenic (human induced) emissions and removals of greenhouse gases in New Zealand. The Inventory measures New Zealand's progress against obligations under the United Nations Framework Convention on Climate Change (Climate Change Convention) and the Kyoto Protocol.

The Inventory reports emissions and removals of the greenhouse gases carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>). The indirect greenhouse gases, carbon monoxide (CO), sulphur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>X</sub>) and non-methane volatile organic compounds (NMVOCs) are also included. Only emissions and removals of the direct greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs and SF<sub>6</sub>) are reported in total emissions under the Climate Change Convention and accounted for under the Kyoto Protocol. The gases are reported under six sectors: Energy; Industrial Processes; Solvent and Other Product Use; Agriculture; Land Use, Land-Use Change and Forestry (LULUCF); and Waste.

This submission includes a complete time series of emissions and removals from 1990 through to 2012 (the current inventory year) and supplementary information required for the Kyoto Protocol. Consistent with the Climate Change Convention reporting guidelines, each inventory

report is submitted 15 months after conclusion of the calendar year reported, allowing time for data to be collected and analysed.

For Annex I Parties, reporting of afforestation, reforestation and deforestation activities since 1990 (Article 3.3 activities under the Kyoto Protocol) is mandatory during the first commitment period of the Kyoto Protocol. Reporting on forest management, cropland management, grazing land management and revegetation is voluntary for the first commitment period (Kyoto Protocol Article 3.4). New Zealand elected to account for Article 3.3 activities at the end of the first commitment period. New Zealand did not elect to account for any of the Article 3.4 activities during the first commitment period.

## **ES.2 National trends**

#### Total (gross) emissions

Total emissions include those from the Energy; Industrial Processes; Solvent and Other Product Use; Agriculture and Waste sectors, but do not include net emissions from the LULUCF sector. Reporting of total emissions excluding the LULUCF sector is consistent with the reporting requirements of the Climate Change Convention.<sup>1</sup>

#### 1990–2012

In 1990, New Zealand's total greenhouse gas emissions were 60,641.4 Gg carbon dioxide equivalent (CO<sub>2</sub>-e). In 2012, total greenhouse gas emissions had increased by 15,406.5 Gg CO<sub>2</sub>-e (25.4 per cent) to 76,048.0 Gg CO<sub>2</sub>-e (figure ES 2.1.1). From 1990 to 2012, the average annual growth in total emissions was 1.03 per cent per year.

The four emission sources that contributed the most to this increase in total emissions were: road transportation, agricultural soils, consumption of halocarbons and  $SF_6$ , and enteric fermentation.<sup>2</sup>

#### 2011–2012

Since 2011, New Zealand's total greenhouse gas emissions increased by 1,654.5 Gg CO<sub>2</sub>-e (2.2 per cent). The size of the overall increase is small because, although emissions from the Energy and Agriculture sectors rose, there was a decrease in emissions from the Industrial Processes and Waste sectors.

The increase in energy emissions is primarily due to an increase in emissions from electricity generation. This was due to abnormally low hydro inflows in 2012 that led to a decrease in the share of electricity generated from renewable energy sources. A lower contribution from renewable energy in the national grid resulted in a higher proportion of fossil-fuel based electricity generation over the year.

The increase in agricultural emissions is attributable to the favourable weather and good grass growth. There was an increase in the population of dairy cattle and amount of nitrogen fertiliser used in 2012. This increase in dairy and fertiliser emissions outweighed emission reductions from decreases in non-dairy cattle and deer. The increase in dairy cattle numbers and the reduction in non-dairy cattle and deer are primarily due to higher relative returns being achieved

<sup>&</sup>lt;sup>1</sup> UNFCCC. 2006. FCCC/SBSTA/2006/9. Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories (following incorporation of the provisions of decision 13/CP.9).

<sup>&</sup>lt;sup>2</sup> Methane emissions produced by livestock digestive processes.

in the dairy sector. The dairy industry is the main user of nitrogen fertiliser in New Zealand, and this increased the sale and use of nitrogen fertiliser.

#### Net emissions – Climate Change Convention reporting

Net emissions include emissions from the Energy; Industrial Processes; Solvent and Other Product Use; Agriculture and Waste sectors, together with emissions and removals from the LULUCF sector.

In 1990, New Zealand's net greenhouse gas emissions were 23,391.1 Gg CO<sub>2</sub>-e. In 2012, net greenhouse gas emissions had increased by 26,058.6 Gg CO<sub>2</sub>-e (111.4 per cent) to 49,449.7 Gg CO<sub>2</sub>-e (figure ES 2.1.1).

Figure ES 2.1.1 New Zealand's total and net emissions (under the Climate Change Convention) from 1990 to 2012



#### Accounting under the Kyoto Protocol

New Zealand's initial assigned amount under the Kyoto Protocol is recorded as 309,564,733 metric tonnes CO<sub>2</sub> equivalent (309,565 Gg CO<sub>2</sub>-e). The initial assigned amount is five times the total 1990 emissions reported in the Inventory submitted as part of *New Zealand's Initial Report under the Kyoto Protocol.*<sup>3</sup> The initial assigned amount does not change during the first commitment period (2008-2012) of the Kyoto Protocol. In contrast, the time series of emissions reported in each inventory submission are subject to continuous improvement. Consequently, the total emissions in 1990 as reported in this submission are 2.1 per cent lower than the 1990 level of 61,912.9 Gg CO<sub>2</sub>-e, which was estimated in 2006 and used in the initial assigned amount calculation.

In 2012, net removals were 14,968.6 Gg  $CO_2$ -e from land subject to afforestation, reforestation and deforestation (see section 2.5 for further detail). The accounting quantity for 2012 was 15,149.5 Gg  $CO_2$ -e. This is different from net removals, because debits resulting from harvesting of afforested and reforested land during the first commitment period are limited to the level of credits received for that land.

<sup>&</sup>lt;sup>3</sup> Ministry for the Environment. 2006. New Zealand's Initial Report under the Kyoto Protocol: Facilitating the calculation of New Zealand's assigned amount and demonstrating New Zealand's capacity to account for its emissions and assigned amount in accordance with Article 7 paragraph 4 of the Kyoto Protocol. Wellington: Ministry for the Environment.

### **ES.3 Gas trends**

The relative proportions of greenhouse gases emitted by New Zealand have changed since 1990. Whereas  $CH_4$  and  $CO_2$  contributed equally to New Zealand's total emissions in 1990, in 2012,  $CO_2$  was the major greenhouse gas in New Zealand's emissions profile (table ES.3.1.1). This growth in emissions of  $CO_2$  corresponds with growth in emissions from the Energy sector.

Direct greenhouse gas emissions	Gg CO <sub>2</sub> equivalent		Change from 1990 (Gg CO	Change from 1990
	1990	2012	equivalent)	(%)
CO <sub>2</sub>	24,915.9	34,258.2	+9,342.3	+37.5
CH <sub>4</sub>	26,834.7	29,038.5	+2,203.8	+8.2
N <sub>2</sub> O	8,245.8	10,885.7	+2,639.9	+32.0
HFCs	NO	1,804.7	+1,804.7	NA
PFCs	629.9	40.8	-589.1	-93.5
SF <sub>6</sub>	15.2	20.2	+5.0	+32.8
Total	60,641.4	76,048.0	+15,406.5	+25.4

Table ES 3.1.1 New Zealand's total (gross) emissions by gas in 1990 and 2012

**Note:** Total emissions exclude net removals from the LULUCF sector. The per cent change for hydrofluorocarbons is not applicable (NA) as production of hydrofluorocarbons in 1990 was not occurring (NO). Columns may not total due to rounding.

### **ES.4 Sector trends**

The Agriculture sector contributed the largest proportion of total emissions in 1990 (table ES.4.1.1 and figure ES.4.1.1). The proportion of emissions from the Agriculture sector has generally been decreasing between 1990 and 2008. Emissions from agriculture have increased from 2009 to 2012 due to favourable growing weather and a greater demand for New Zealand agricultural produce in the dairy sector and a favourable milk price. This led to an increase in the dairy cattle population and the amount of nitrogen applied as fertiliser to agricultural soils resulting in an increase of  $CH_4$  and  $N_2O$  emissions from the sector.

The Energy sector experienced the greatest increase over the period 1990–2008 (figure ES.4.1.2). Energy emissions have increased approximately two-and-a-half times as much as those from the Agriculture sector. The Energy sector had the most influence on the trend in total emissions between 1990 and 2008 becoming the largest contributing sector to total emissions in 2008 (figure ES.4.1.2). In 2009–11 emissions from the Energy sector showed a decrease resulting from the effects of the global recession, recent earthquakes and the closure of coal mines following accidents as well as greater investment in renewable energy sources in New

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