Ministry for the Environment
Manatū Mō Te Taiao

SNAPSHOT
APRIL 2014

NEW ZEALAND'S GREENHOUSE GAS INVENTORY & NET POSITION REPORT 1990–2012

Key points:

In 2012, New Zealand's total greenhouse gas emissions were 76.0 million tonnes of carbon dioxide equivalent (Mt CO_2-e), which means total emissions are now 15.4 Mt CO_2-e higher than the 1990 level of 60.6 Mt CO_2-e, a 25 per cent increase.

In 2012, the net amount of carbon dioxide removed from the atmosphere (net removals) through afforestation, reforestation and deforestation under the Kyoto Protocol was 15.0 Mt CO_2-e.

The agriculture and energy sectors are the two largest contributors to New Zealand's emissions profile, together contributing approximately 90 per cent of total emissions in 2012.

New Zealand's net emissions over the first commitment period (2008-2012) under the Kyoto Protocol (301.2 Mt CO_2-e) are less than our target (309.6 Mt CO_2-e). We anticipate that New Zealand will meet its obligations for the first commitment period.

This snapshot presents commonly asked questions about New Zealand's emissions and provides answers from *New Zealand's Greenhouse Gas Inventory 1990–2012* released on 11 April 2014.

The inventory is the official annual report of human-caused emissions of greenhouse gases in New Zealand. The complete inventory submission is available on the Ministry for the Environment's website at **www.mfe.govt.nz/publications/climate/** under the Reporting section.

In the inventory, emissions are categorised into six different sectors:

- energy (eg, road transport and electricity production)
- industrial processes (eg, metals, minerals and chemicals)
- solvent and other product use
- agriculture (eg, agricultural soils, methane from livestock digestive systems[1] and manure management)
- land use, land-use change and forestry (LULUCF)
- waste.

1 Livestock emit methane from their digestive systems as part of a process called enteric fermentation.

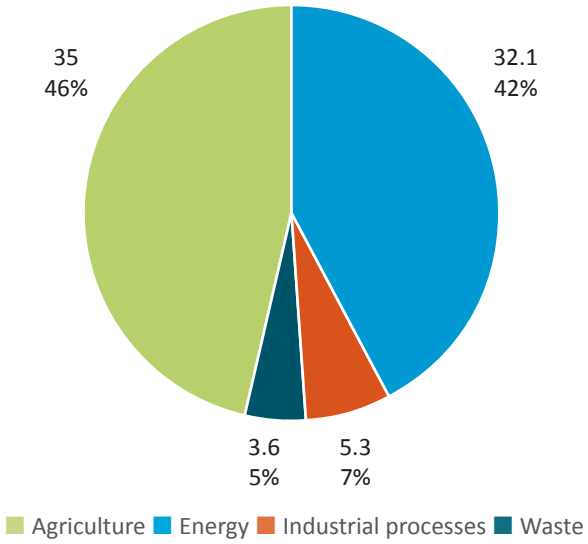
The timing of reporting is based on guidelines under the United Nations Framework Convention on Climate Change (UNFCCC). Each inventory report is submitted 15 months after the end of the calendar year, providing time for the data to be collected, processed and analysed.

How much does each sector contribute to total emissions?

Agriculture was the largest contributing sector to New Zealand's emissions in 2012. It contributed 35.0 million tonnes of carbon dioxide equivalent (Mt CO_2-e), and comprised 46.1 per cent of total emissions (figure 1). Energy was the second largest sector, contributing 32.1 Mt CO_2-e, comprising 42.2 per cent of total emissions.

Industrial processes, waste, and solvents and other products contributed 5.3, 3.6 and 0.03 Mt CO_2-e, respectively (making up 6.9 per cent, 4.7 per cent and 0.04 per cent of total emissions, respectively).

Figure 1: New Zealand's greenhouse gas emissions in 2012 (by sector, in million tonnes of CO_2 equivalent)



Note: *Emissions from the solvent and other product use sector are not represented in this figure due to the small size of emissions from this sector. Emissions from the LULUCF sector are not included in the estimate of total emissions so are also not represented in this figure.*

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

In 1990, New Zealand's total emissions were 60.6 Mt CO_2-e. In 2012, this total increased by 15.4 Mt CO_2-e (25.4 per cent) to 76.0 Mt CO_2-e. The four sources that contributed the most to the increase in total emissions were carbon dioxide from road transport, nitrous oxide from agricultural soils, hydrofluorocarbons (HFCs) released from industrial and household refrigeration and air-conditioning systems, and methane from livestock digestive systems. New Zealand's total emissions peaked in 2005, decreased from 2006 to 2009, and showed an increasing trend from 2009 to 2012 (figure 2).

Agriculture

Although agriculture was New Zealand's largest emitting sector in 2012, the proportion of total emissions attributed to agriculture has declined since 1990. In addition, the emissions intensity of New Zealand's agricultural production has declined since 1990. Agricultural productivity has increased due to improvements in technology and animal breeding, the expansion of the average size of farms, and improved animal and plant nutrition.

Agricultural emissions decreased between 2006 and 2008 due to a reduction in sheep, non-dairy cattle and deer populations as a result of widespread drought. The drought also reduced livestock productivity. Since 2008, agricultural emissions have been increasing due to more favourable growing conditions, as well as greater demand for New Zealand agricultural produce in the dairy sector. A national drought during the 2012-2013 summer season did not affect 2012 emissions, but is likely to affect emissions for 2013.

Energy

Between 1990 and 2012, emissions from the energy sector increased by over a third. Most of this increase came from road transport and electricity generation. Energy emissions decreased between 2008 and 2011 for a number of reasons, including:

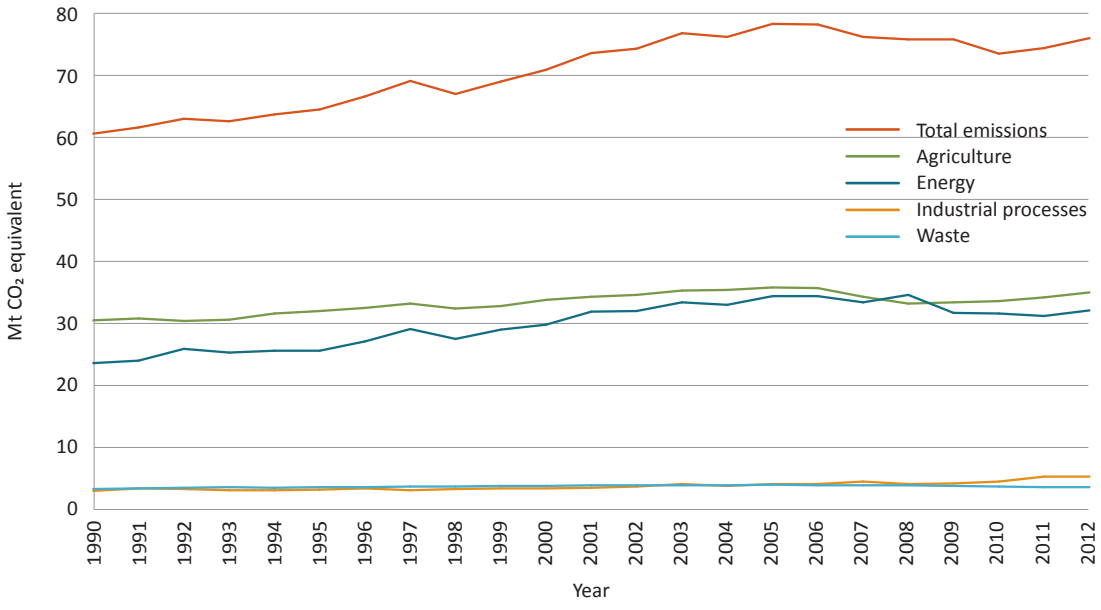
- a reduction in coal-fired and gas-fired electricity generation and an increase in renewable electricity generation (hydro, geothermal and wind)
- a decrease in electricity demand after the Canterbury earthquake in 2011
- a decrease in road transport emissions between 2008 and 2009 due to the economic downturn
- a decrease in the release of methane emissions from coal mining activities between 2010 and 2011 (a result of the sealing of the Pike River mine following an explosion and the suspension of coal production at Spring Creek mine on the West Coast of the South Island).

From 2011 to 2012, emissions from the energy sector increased slightly, primarily due to an increase in emissions from electricity generation. This was caused by unfavourable hydrological conditions that resulted in a reduced amount of electricity generated by hydro power and subsequent increased coal-fired electricity generation.

Industrial Processes

Emissions from industrial processes have increased since 1990 due to the continued increase in the release of HFCs from industrial and household refrigeration and air-conditioning systems. This increase is due to their use as a substitute for chlorofluorocarbons phased out under the Montreal Protocol. In addition, CO_2 emissions from mineral, chemical and metals production have gradually increased due to increasing product outputs.

Figure 2: New Zealand's total greenhouse gas emissions by sector (1990-2012)



What are New Zealand's net emissions?

In 1990, New Zealand's net greenhouse gas emissions under the UNFCCC were 23.4 Mt CO_2-e.
In 2012, net greenhouse gas emissions increased by 26.1 Mt CO_2-e (111.4 per cent) to 49.4 Mt CO_2-e.

Definitions

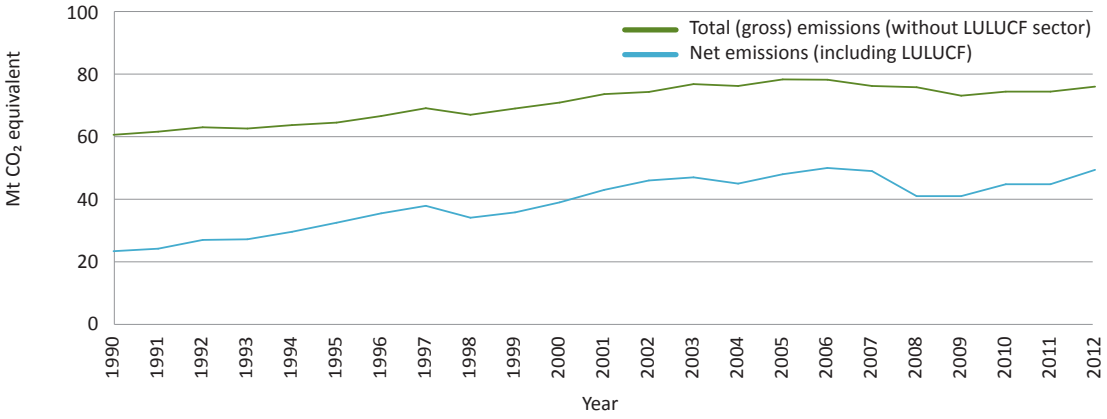
Total emissions reported under the UNFCCC and under the Kyoto Protocol come from the following sectors: agriculture, energy, industrial processes, waste, and solvent and other product use.

Net emissions under the UNFCCC are total emissions plus emissions and removals from land use, land-use change and forestry (LULUCF).

Net emissions under the Kyoto Protocol are total emissions plus emissions and removals from activities under Article 3.3 of the Kyoto Protocol (afforestation, reforestation and deforestation since 31 December 1989).

The main difference between the two definitions of net emissions is that reporting under Article 3.3 of the Kyoto Protocol excludes removals and harvesting emissions from forests established before 1990. This 1990 baseline is a reference against which to measure progress, allowing for comparison between countries and between sectors.

Figure 3: New Zealand's total and net emissions (under the UNFCCC) from 1990 to 2012



How much carbon is removed from the atmosphere by New Zealand's forests?

Under the UNFCCC, net emissions are total emissions plus emissions and removals from the land use, land-use change and forestry (LULUCF) sector. Removals are generated from carbon sinks. Carbon sinks are natural or human-made reservoirs that remove and store more carbon than they release. Forests act as a carbon sink as they grow by absorbing carbon dioxide from the atmosphere and storing it in tree trunks, branches, leaves, roots and soils.

When trees are harvested, they switch from being a carbon sink to a carbon source, releasing carbon into the atmosphere rather than removing it. Consequently, planting and harvesting cycles have a large impact on the amount of CO_2 removed by New Zealand's forests. The speed at which the stored carbon is released from the harvested wood is hard to predict, as it depends on the product into which the wood is transformed. During the first commitment period under the Kyoto Protocol (2008–2012), however, it is assumed that all the carbon stored in wood is emitted at time of harvest.

In New Zealand, the LULUCF sector is currently a net sink, and for this reason the term 'net removals' has been used to describe the contribution from this sector. Net removals of CO_2 from New Zealand's forests have fluctuated over the period 1990–2012 (figure 3). This is due to tree growth, harvesting and changes in the forest area. In 2012, under UNFCCC reporting, New Zealand's net removals from the LULUCF sector were 26.6 Mt CO_2-e.[2]

In addition to the LULUCF sector reporting, New Zealand reports on emissions under the Kyoto Protocol for the period 2008-2012 (the first commitment period). Unlike UNFCCC reporting, it includes emissions and removals from afforestation, reforestation and deforestation activities for forests planted after 1989 (see Definitions). Reporting under the Kyoto Protocol is used in the Net Position Report to monitor New Zealand's progress towards its target under the Kyoto Protocol (see page 7). In 2012, net removals under the Kyoto Protocol were 15.0 Mt CO_2-e, which is slightly lower (0.7 per cent) than those in 2011.

2 Net emissions under UNFCCC reporting also include emissions from non-forest land categories that are excluded from Kyoto Protocol accounting.

Definitions

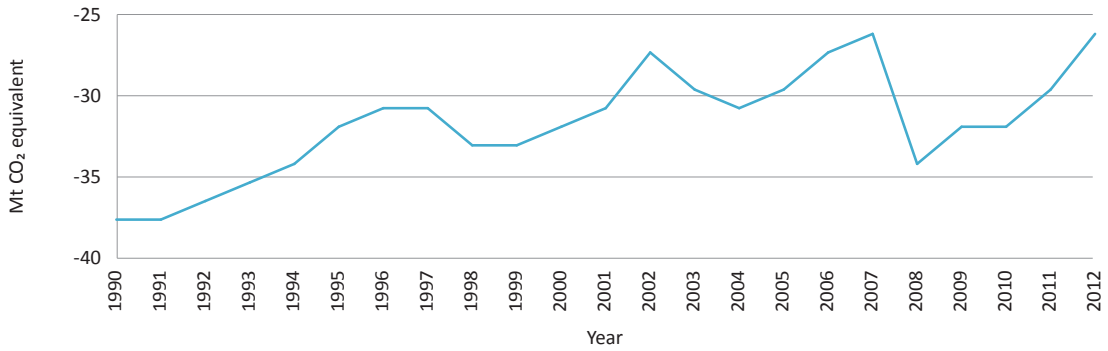
Afforestation
The establishment of a forest in an area where there has been no forest for at least 50 years.

Reforestation
The re-establishment of a forest in an area where forest was converted to other land uses during the past 50 years.

For the first commitment period under the Kyoto Protocol (2008-2012), reforestation is limited to areas that were non-forest on 31 December 1989.

Deforestation
The removal of a forest from an area, which is then converted to a non-forest use (eg, dairy farm).

Figure 4: Net removals from land use, land-use change and forestry (under the UNFCCC)[3]



What influences the area of forest?

The size of New Zealand's planted forest area, the age of the forests, and the level of harvesting all affect the amount of net removals from forestry. Historically, the planted forest area has 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.[4]
The removal of agricultural subsidies in New Zealand and generally poor performance of the New Zealand and international share markets also encouraged investors to seek alternative investments such as forestry, during this time.

Between 2004 and 2008, the area of New Zealand's forests decreased due to deforestation of planted forests before the introduction of the New Zealand Emissions Trading Scheme (NZ ETS). The decrease in net removals observed since 2008 is largely due to increased harvesting levels in pre-1990 planted forests as a larger proportion of the estate reached harvest or thinning age. In 2012, deforestation emissions increased to 4.0 Mt CO_2-e.

3 Net removals are expressed as a negative value to help the reader clarify the value is a removal and not an emission.

4 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 and why have New Zealand's emissions changed between 2011 and 2012?

Between 2011 and 2012:

- There was an increase in total emissions of 1.7 Mt CO_2-e (2.2 per cent).
- Emissions from the energy sector increased by 0.9 Mt CO_2-e (2.9 per cent) due to an increase in emissions from electricity and heat production. Hydro power generated less electricity than usual because of low rainfall levels. The shortfall was made up with increased electricity generation from gas and coal.
- Emissions from industrial processes decreased by less than 0.01 Mt CO_2-e (less than 1 per cent).
- Agricultural emissions increased by 0.8 Mt CO_2-e (2.4 per cent) because the dairy cattle population continued to increase. There was also a related increase in the use of nitrogen-containing fertiliser, which is used to improve pasture production.
- Net removals from land use, land-use change and forestry (LULUCF) decreased by 3.0 Mt CO_2-e (10.1 per cent). This was mainly due to a large increase in emissions in forest land as more of New Zealand's planted forests reached harvest or thinning age in 2012. There were also increased emissions in grassland due to larger areas of forest conversion to grassland.
- Waste emissions decreased by 0.05 Mt CO_2-e (1.4 per cent). This was largely due to an increase in the recovery of emissions from municipal landfills and a decrease in waste sent to both municipal landfills and farm fills.

How do New Zealand's emissions compare with other countries?

New Zealand is committed to playing its part in a global response to climate change. New Zealand has a broad range of measures to address climate change on both a domestic and an international level and focuses efforts where it can make the greatest contribution.

New Zealand's total emissions are low compared with our major trading partners and are approximately 0.15 per cent of total world emissions.[5] However, New Zealand's emissions intensity by population is high. In 2011, New Zealand's emissions per person were the fifth highest among 40 Annex 1 countries,[6] at 16.6 tonnes CO_2-e per person (figure 5).[7]

New Zealand has fewer low-cost options to reduce emissions compared with most other developed countries, with three-quarters of electricity generated from renewable energy, a growing and dispersed population, and around half of its emissions from agriculture.

New Zealand's emissions profile is unusual among developed countries. For many of those countries, the agricultural sector constitutes only a small proportion of emissions, on average around 12 per cent. Furthermore, CO_2 makes up about 80 per cent of most developed countries' emissions.[7] Due to the high level of agricultural production in New Zealand, most of it for export, our emissions profile is quite different. In New Zealand, methane and nitrous oxide (largely from agriculture) comprise around half of total emissions (52.5 per cent in 2012), while the other half of total emissions consists of CO_2 (45.0 per cent in 2012). In the absence of technological options to reduce agricultural emissions significantly, New Zealand works to improve the efficiency of agricultural production. This results in a decreasing intensity of emissions from the agriculture sector.

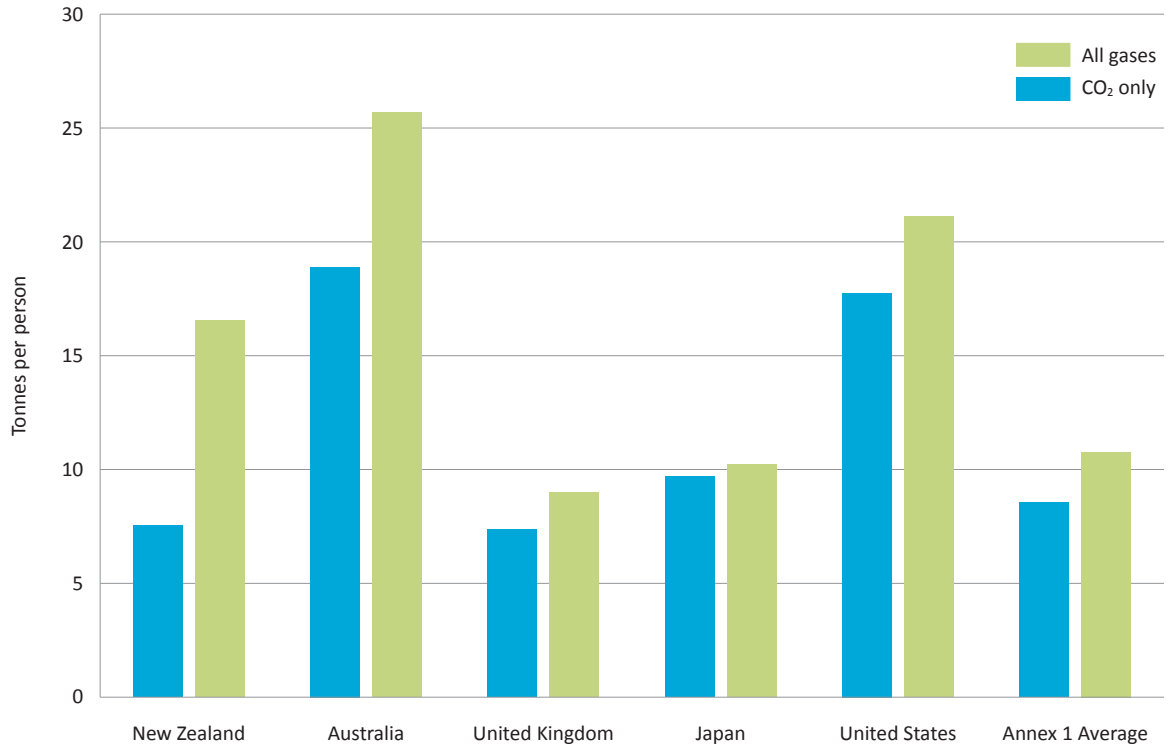
When considering atmospheric concentrations of greenhouse gases, reducing agricultural emissions from methane and nitrous oxide is important but CO_2 presents a greater challenge in the long term because it persists in the atmosphere for thousands of years. Methane and nitrous oxide have a strong warming effect in the short term, but do not persist in the atmosphere. If New Zealand is compared with other countries on a CO_2-only basis, our emissions are 21st highest among Annex 1 countries and below the Annex 1 average, at 7.5 tonnes CO_2 per person (figure 5).[7] New Zealand's lower CO_2 emissions per person reflect the high proportion of renewable generation in the electricity sector.

5 Based on 2010 data. The estimate of 50.1 Gt CO_2-e for global emissions comes from the Emission Database for Global Atmospheric Research (EDGAR) **http://edgar.jrc.ec.europa.eu/overview.php?v=GHGts1990-2010**.

6 A group of developed countries which took commitments under the UNFCCC. **http://unfccc.int/essential_background/glossary/items/3666.php**

7 UNFCCC. Annex 1 countries' emissions for 2011. **http://unfccc.int/di/Indicators.do**

Figure 5: International comparisons for per capita emissions in 2011[7]



How has the accuracy of estimates improved?

The continuous improvement of inventory development and reporting is an underpinning principle of UNFCCC reporting requirements. Greenhouse gas inventories are examined each year by a team of international expert reviewers, who critique the report against internationally agreed guidelines and recommend areas for improvement.

To implement these improvements, it is sometimes necessary to recalculate previous estimates of the greenhouse gas emissions and removals. The recalculations can arise from improvements in activity data, emission factors and methodology, or the identification of additional emission sources. It is international good practice to recalculate the entire time-series from 1990 (base year) to the latest inventory year to ensure consistency in emission estimates and trends. This means emissions reported in previous inventories may differ from those reported in this year's inventory.

Since the last inventory submission, improvements have been made to the accuracy of the emission estimates. The most significant improvements in this year's inventory are described below:

Energy

- Natural gas used for production of methanol has been split into fuel gas and feedstock gas. The emissions from the fuel portion are reported in the energy sector, and the emissions from the feedstock portion are allocated to the industrial processes sector.
- Natural gas used for production of ammonia/urea has been split into feedstock gas and energy-use gas.
- Venting of natural gas has been separated from flaring.
- Emissions of N_2O as a result of flaring have been included and are now aligned with the IPCC 1996 reporting methodology.

Industrial Processes

- Carbon dioxide emissions from fuel combustion in the production of ammonia for urea fertiliser are now reported in the energy sector.
- Data reported by NZ ETS participants has been used to simplify data collection and to improve accuracy.

Agriculture

- The equation for partitioning nitrogen in excreta between dung and urine has been revised.
- The monthly lactation assumptions for dairy cows have been updated as a result of newly available data.

Land-Use, Land-Use Change and Forestry

- Estimates of carbon stock change in natural forests have been included for the first time.
- The 2012 land-use map has been completed, and continued improvements have been implemented to the 1990 and 2008 land-use maps. This includes the integration of mapping data provided from the NZ ETS.
- The methodology for modelling the planted forest area has changed so that the land area data are better aligned with the harvesting and planting activity data. The planted forest yield tables and emission factors have been revised accordingly.

Waste

- The inclusion of emissions estimates from non-municipal and farm fills has led to more complete information on emissions from solid waste disposal on land.
- A review of emission estimates from the municipal landfills has resulted in improved estimates of historic waste (quantities, composition, and correction factors for oxidation and methane) as well as more accurate annual estimates of waste disposal from 2010.

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

NEW ZEALAND'S NET POSITION UNDER THE KYOTO PROTOCOL

We anticipate that New Zealand will meet its obligations for the first commitment period (2008-2012) of the Kyoto Protocol with a surplus of 90.8 million units. New Zealand's net emissions over the first commitment period are less than our target.

How is the net position calculated?

The net position is a comparison of New Zealand's greenhouse gas emissions over the 2008-2012 period with our emissions target under the Kyoto Protocol. Accounting for this target is based on emission units; each unit represents one metric tonne of CO_2 equivalent greenhouse gas (CO_2-e).

Under the Kyoto Protocol, New Zealand committed to reduce emissions to 1990 levels on average over 2008-2012 (309.6 million metric tonnes (Mt) of CO_2-e) or to take responsibility for emissions over this level. Based on internationally reviewed estimates of New Zealand's 1990 emissions, the Government issued 309.6 million Assigned Amount Units (AAUs) to reflect its commitment. The net position is calculated as the surplus or deficit of Kyoto emission units available to the New Zealand Government compared with the country's emissions during that period.

Previous net positions relied on projections of emissions and removals. However, this net position only uses information on emissions from *New Zealand's Greenhouse Gas Inventory 1990-2012*. The Inventory information will be final once an international review by the UNFCCC is completed (in late 2014) and, consequently, the net position is provisional at this stage.

How has the net position changed since the last update in April 2013?

The 2014 net position surplus is estimated as 90.8 million units, compared with 29.6 million units in 2013. Participants in the New Zealand Emissions Trading Scheme (NZ ETS) have surrendered more international Kyoto emission units to the Government and fewer New Zealand Units (NZUs) than expected. As this is now a consistent source of international Kyoto emission units to the Government, some expected surrenders of international Kyoto emission units for 2013 emissions (due in by 31 May 2014) are included in this net position calculation.

What are the net emissions used for the net position?

Net emissions used for calculating the Net Position are based on New Zealand's total emissions and net removals from forestry under the Kyoto Protocol (see Definitions) over the first commitment period (2008-2012). New Zealand's total emissions during this time were 372.8 Mt CO_2-e which are partially offset by forestry removals of 71.6 Mt CO_2-e under Article 3.3 of the Kyoto Protocol. This means the **net emissions under the Kyoto Protocol for 2008-2012 are 301.2 Mt CO2-e**. While this is an increase from the 286.3 Mt CO_2-e projected in the 2013 Net Position, it is less than the 309.6 Mt CO_2-e New Zealand committed to for the 2008-2012 period.

The NZ ETS and the net position

Under the NZ ETS, participants with surrender obligations must surrender emission units to the Government for some or all of their emissions. These can be New Zealand Units (NZUs), which can only be used in the NZ ETS, or one of a variety of international Kyoto emission units. The surrendered international units can be used to meet the Government's obligations under the Kyoto Protocol, so they increase our net position surplus.

NZ ETS participants can continue surrendering international Kyoto units emission units for the calendar years 2013 and 2014. Therefore the net position surplus is likely to increase when the 2014 NZ ETS surrenders are included.

What happens next?

A team of the UNFCCC experts will review and confirm the numbers in *New Zealand's Greenhouse Gas Inventory 1990-2012* by mid-November 2014. The estimates in the inventory may change slightly after this process. Once emissions for all parties to the Kyoto Protocol have been confirmed, which is likely to be by late 2015, a 100 day 'true-up' period will begin.

At that point, New Zealand can issue 71.6 million Removal Units (RMUs) into the Government account as a result of the forestry removal activities under Article 3.3 of the Kyoto Protocol. RMUs are another type of Kyoto unit that can be surrendered to account for New Zealand's emissions.

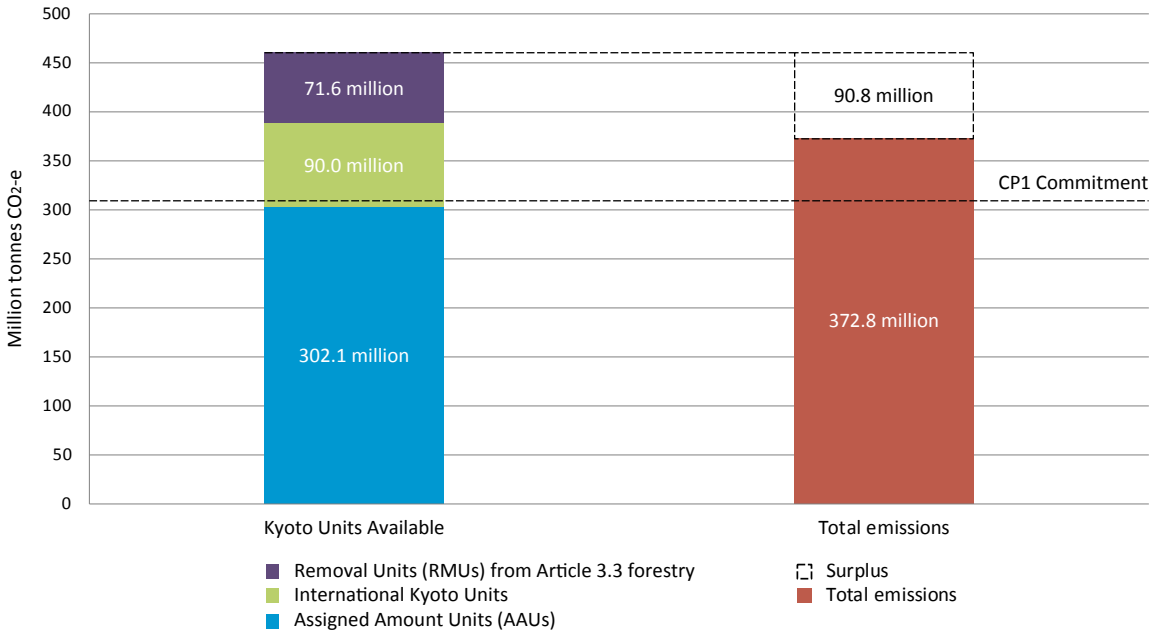
Kyoto Financial Position

The net position surplus in units represents a financial asset to the Government because these units can be traded on the international market. Changes in the international price of emission units and fluctuations in the New Zealand Dollar exchange rate also affect the value of the net position (the Kyoto financial position). The latest value can be found on the Ministry's website.

Further Information

Can be found at **www.mfe.govt.nz/issues/climate/greenhouse-gas-emissions/net-position/index.html**

Figure 6: Estimates of total emissions between 2008 and 2012 (left column) and the units available to the Government to balance those emissions (right column). These are made up of 302.1 million AAUs (7.5 million AAUs have left the Government account) and 90.0 million International Kyoto Units already in the Government account. 71.6 million RMUs can be issued by NZ at the start of the 'true-up' period.



Emission units

Emission units all represent one metric tonne of carbon dioxide equivalent gases

Assigned Amount Units (AAUs): 309.6 million AAUs were issued by New Zealand to represent the emissions target over 2008-2012, based on 5 years' emissions at 1990 levels (61.9 Mt CO2-e).

Removal Units (RMUs): At the start of the true-up period, New Zealand can issue RMUs equivalent to the amount of carbon dioxide that our forestry activities sequester, according to Article 3.3 of the Kyoto Protocol.

Kyoto Emission Units: Emissions units recognised by the Kyoto Protocol (which can be AAUs, RMUs or other types of units, but exclude NZUs) can be purchased by the Government or by participants of the ETS and surrendered to the Government to account for their emissions up to the end of 2014.

FOR MORE INFORMATION:

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

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