



Ministry for the
Environment
Manatū Mō Te Taiao

Net Position Report 2009

**New Zealand's projected balance of Kyoto
Protocol units during the first commitment period**

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Contents

Executive Summary	v
1 New Zealand's Emissions Profile 1990–2007	1
2 Kyoto Protocol Compliance Equation	2
New Zealand's initial assigned amount	3
New Zealand's Emissions Unit Registry	4
3 Projections of Emissions and Removals	6
Gross emissions	6
Inclusion of policy	7
Energy and industrial processes emissions	7
Agriculture emissions	11
Waste emissions	13
Emissions and removals from land use, land-use change and forestry	14
Emissions from solvents and other products	14
4 Projections Uncertainty	15
5 Reconciliation Against Previous Projections	17
References	19

Tables

Table 1:	Change in projected energy and industrial process emissions over the first commitment period	8
Table 2:	Projected net position over the first commitment period (million emissions units)	16
Table 3:	Reconciliation with historic net positions (million tonnes carbon dioxide equivalent)	17

Figures

Figure 1:	Changes to the net emissions estimates since 2008	vi
Figure 2:	New Zealand's gross emissions 1990–2007	1
Figure 3:	Kyoto Protocol Article 3.1 compliance equation	3
Figure 4:	Historical emissions data and projected emissions 1990–2012	6
Figure 5:	Historical emissions data and projected energy emissions 1990–2012	9
Figure 6:	Historical emissions data and projected transport emissions 1990–2012	9
Figure 7:	Historical emissions data and projected stationary energy emissions 1990–2012	10
Figure 8:	Historical emissions data and projected industrial processes emissions 1990–2012	10
Figure 9:	Historical emissions data and projected agricultural emissions 1990–2012	12
Figure 10:	Historical emissions data and projected waste emissions 1990–2012	13
Figure 11:	Uncertainty range between high and low projection by sector	16
Figure 12:	Highest and lowest projection by sector from net position reports between 2006 and 2009	18

Executive Summary

The April 2009 net position report updates New Zealand's projected balance of Kyoto Protocol units during the first commitment period 1 January 2008 to 31 December 2012 of the Kyoto Protocol. A Kyoto Protocol unit is equivalent to one tonne of greenhouse gas converted to its carbon dioxide equivalent by the global warming potential. The net position is a projection of what actual emissions and removals will be reported in New Zealand's national greenhouse inventory submissions over the commitment period and any transfers of Kyoto Protocol units.

As at April 2009, the net position is projected to be a **surplus of 9.6 million Kyoto Protocol units** during the first commitment period. The April 2009 update compares with a projected deficit reported in May 2008 of 21.7 million Kyoto Protocol units.

The change from the previous projection is explained mainly by lower projected emissions from the agriculture sector and increased net removals from planted forests. Projected agriculture emissions over 2008–2012 are now 184 million tonnes. This is a decrease of 14.4 million tonnes (7.3 per cent) from the 198.5 million tonnes projected in 2008. Agriculture emissions projections are lower largely due to the effect of the 2007/2008 drought. Net removals by post-1989 forests are projected to be 85 million tonnes, an increase of 17.8 million tonnes (26 per cent) from the previous projection of 67.2 million tonnes. The two key reasons for the change in removals are that new information on post-1989 planted forests indicates that these forests are removing more carbon dioxide per hectare than assumed previously (8.2 million tonnes) and new information on intended deforestation emissions (9.6 million tonnes). Total energy and industrial emissions projections for 2008–2012 remain at 185 million tonnes and have not changed from the 2008 projection.

The projections will continue to change over the commitment period. The projection will always be based on the best information available at the date of the projection. Change will be caused by the use of the latest assumptions on variables such as economic growth or oil prices, use of the latest scientific research on emissions and removals, and replacing projections with actual inventory data. For the first time, the April 2009 net position report uses provisional data for actual emissions from the agriculture and energy sectors for 2008.

The actual net position will remain uncertain until New Zealand's national greenhouse gas inventories covering the first commitment period have been submitted, reviewed, and the review report noted by the Enforcement Branch of the Compliance Committee of the Kyoto Protocol. The internationally agreed timelines for these processes mean that New Zealand will submit its annual inventory for the 2008 calendar year (the first year of the commitment period) in 2010. New Zealand's Kyoto Protocol compliance over the first commitment period will not be finalised until 2015.

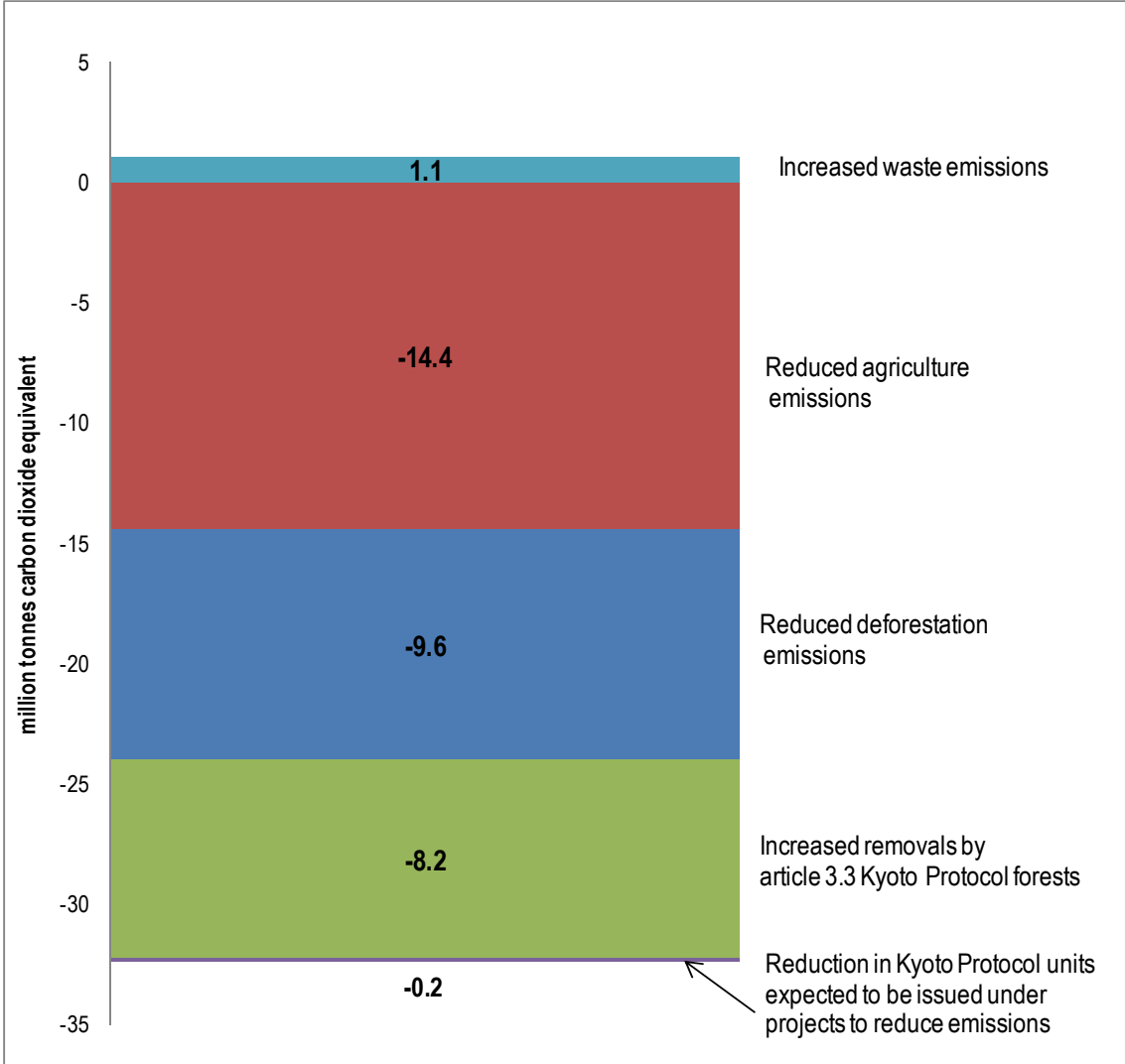
The net position report does not attempt to evaluate or report the effects of individual policies. All policies are aggregated together to get the best estimate of New Zealand's emissions and removals over the first commitment period. The net position is calculated to be consistent with the Public Finance Act 1989. This Act requires the net position to incorporate, to the fullest extent possible, all government decisions and all other circumstances that may have a material effect on the projection and that can be quantified with reasonable certainty (section 26U).

The net position report is compiled using sectoral projection reports from across government. Agricultural emissions and net removals by forests eligible under Article 3.3 of the Kyoto Protocol are projected by the Ministry of Agriculture and Forestry. Stationary energy, transport and industrial process emissions projections are provided by the Ministry of Economic Development. Projections of emissions from the waste sector are provided by the Ministry for the Environment. The Ministry for the Environment leads the net position update across government to ensure the internal consistency of projections and compile the Kyoto Protocol compliance equation (Kyoto Article 3.1).

What has changed since 2008?

The component breakdown of the changes in the net position between the 2008 and 2009 estimates are shown in Figure 1. The major changes are summarised below and are described in more detail in the appendices to this report.

Figure 1: Changes to the net emissions estimates since 2008



Agriculture emissions projections for 2008–2012 are lower due largely to the 2007/2008 drought. The drought reduced stocking rates for cattle and sheep. Emissions per head of livestock were also lower because the feed intake was reduced. New scientific research on a New Zealand-specific emission factor, and the incorporation of a nitrification inhibitor, dicyandiamide (DCD), also reduced estimated emissions by 4.1 million tonnes. Overall, projected agriculture emissions for 2008–2012 are now 184 million tonnes, 14.4 million tonnes (7.3 per cent) lower than the 198.5 million tonnes projected in 2008.

Net removals by planted forests are projected to be 95 million tonnes, 17.8 million tonnes higher than the 67.2 million tonnes projected in May 2008. The two key reasons for this change are:

- new information on post-1989 planted forests indicates that these forests are removing more carbon dioxide per hectare because they have been planted on more fertile sites than older forests. They have also received less intensive forest management, particularly thinning. These factors mean there are more trees per hectare growing at a faster rate. The impact of the change is a projected increase in removals from post-1989 forests of 8.2 million tonnes during the first commitment period 2008–2012. The information is from a preliminary analysis of the Land Use and Carbon Analysis System (LUCAS) planted forest inventory field data
- deforestation emissions are projected to be 9.6 million tonnes lower than in the May 2008 net position. This is due in part to improved information on the area of immature forests intended. This information has not been available previously. Deforestation of younger forests produces lower emissions than older forests. It was also assumed that all forest carbon is instantly emitted at the time of deforestation. It was previously assumed that harvesting residues decayed over time.

The total energy and industrial emissions projections remain at 185 million tonnes for 2008–2012 and have not changed from the May 2008 projection. There are reductions in the projected emissions from energy due to a lower than projected energy demand during 2008 and the expected effects of an economic recession. However, these have been offset by the effects of removing policies for a biofuels sales obligation and the renewable electricity preference, and a small increase in fugitive emissions from greater geothermal electricity generation. There has also been a small reallocation of emissions from the industrial processes sector to the energy sector, but this does not increase overall emissions.

The projected emissions from waste during 2008–2012 have increased to 8.3 million tonnes, an increase of 1.1 million tonnes from the 7.2 million tonnes in the May 2008 projection. This is the result of improvements to the method used to model emissions from solid waste disposal in the greenhouse gas inventory.

The projected quantity of Kyoto Protocol units awarded under the Projects to Reduce Emissions programme has been reduced from 7.0 to 6.8 million tonnes.

What is new in 2009?

For the first time, the net position report is using provisional estimates of actual emissions for 2008 – the first year in the commitment period of the Kyoto Protocol. The Ministry of Economic Development and the Ministry of Agriculture and Forestry are using provisional data for 2008 for the energy and agriculture sectors.

Preliminary results from the Land Use and Carbon Analysis System's field studies are being used to project removals by post-1989 planted forests.

A New Zealand-specific emission factor to determine nitrous oxide emissions from agricultural soils has been used in the 2009 net position. The New Zealand factor replaces the Intergovernmental Panel on Climate Change (IPCC) emission factor. The agriculture projection also includes use of dicyandiamide (DCD), a nitrification inhibitor which reduces nitrous oxide emissions from livestock dung and urine deposited onto agricultural soils.

The Ministry of Agriculture and Forestry has updated the Pastoral Supply Response Model. The key outputs of the model include projected animal performance data as well as animal populations, along with using a land-use change forecasting component. The Pastoral Supply Response Model is now linked to the inventory model used in calculating agricultural emissions. This update has enabled the inventory model to be used for the net position.

Planned improvements in the projections

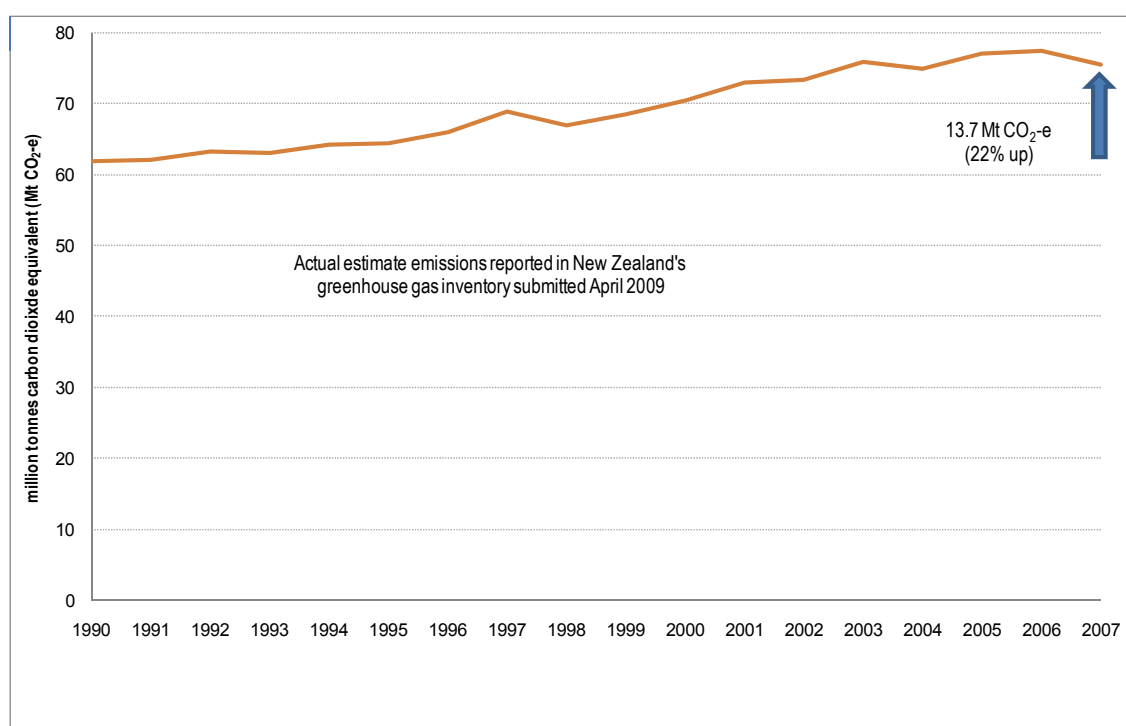
From mid-2009, new information on the area of post-1989 forests will become available from the Land Use and Carbon Analysis System. The system will provide the mapped and calculated areas of land-use change that will be used in the greenhouse gas inventory. The new information will change the projected removals from post-1989 forests which, if significant, would prompt an interim update of the net position report.

1 New Zealand's Emissions Profile 1990–2007

The update of the net position always includes the latest information from New Zealand's greenhouse gas inventory submitted under the United Nations Framework Convention on Climate Change and the Kyoto Protocol. In the 2007 inventory submitted in April 2009, gross greenhouse gas emissions were equivalent to 75.6 million tonnes carbon dioxide equivalent (referred to as million tonnes). This equates to a 13.7 million tonne (22 per cent) rise in gross greenhouse gas emissions since 1990 from the five sectors listed in Annex A to the Kyoto Protocol (Box 1, Section 3).

Annex A to the Kyoto Protocol does not include emissions or removals from the land use, land-use change and forestry sector. Internationally accepted practice in reporting under the United Nations Framework Convention on Climate Change is to report gross emissions. The annual changes in New Zealand's gross greenhouse gas emissions are shown in Figure 2. New Zealand's full inventory submission can be obtained from the website of the United Nations Framework Convention on Climate Change (<http://unfccc.int>).

Figure 2: New Zealand's gross emissions 1990–2007



Source: Ministry for the Environment (2009 a).

Note: Gross emissions include emissions from energy, agriculture, waste, industrial processes and solvents.

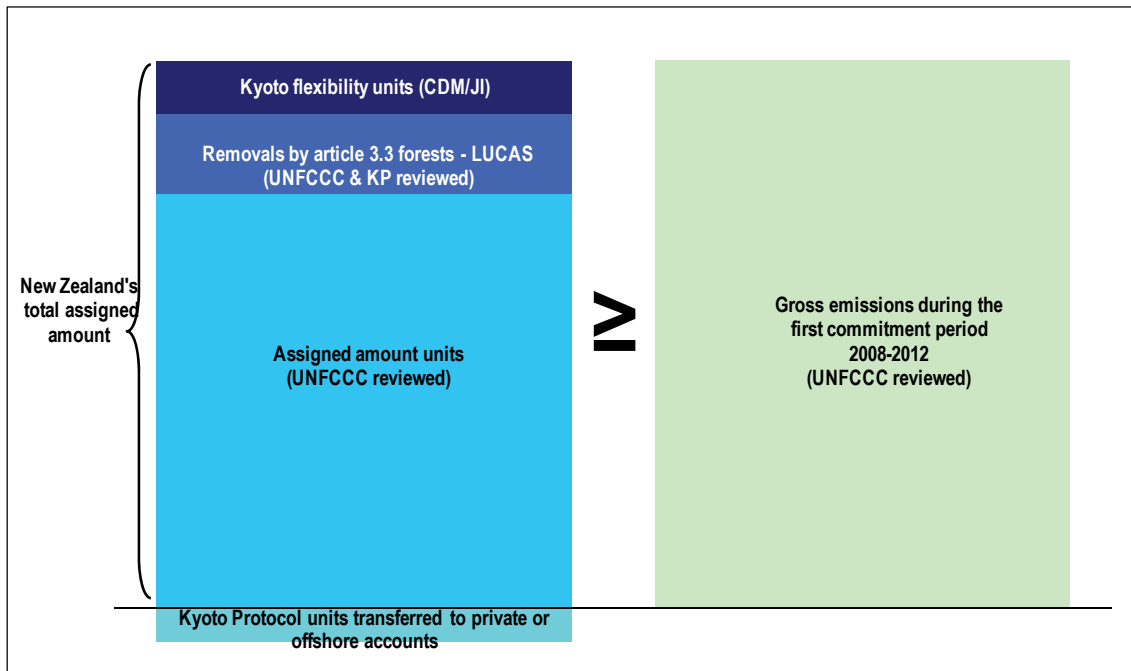
2 Kyoto Protocol Compliance Equation

The maximum amount of emissions that an Annex I party to the Kyoto Protocol may emit over the commitment period is known as a party's assigned amount. This is specified in Kyoto Protocol Article 3.1 and Annex B to the Kyoto Protocol (Box 1).

The initial assigned amount was calculated from New Zealand's emissions in 1990 as reported in the Initial Report under the Kyoto Protocol (MfE, 2006). Parties may add to their assigned amount by removing greenhouse gases from the atmosphere through carbon sinks in the land use, land-use change and forestry sector. Reporting afforestation, reforestation and deforestation activities since 1990 (Kyoto Protocol Article 3.3) is mandatory in the first commitment period. 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 did not elect to report on any of these Article 3.4 activities. The removal of greenhouse gases from the atmosphere through eligible sink activities generates removal units (RMUs). Removal units must be cancelled for any harvesting and deforestation emissions. Removal units are popularly known as carbon credits.

A party with a commitment under the Kyoto Protocol must hold sufficient assigned amount units (AAUs) to cover the total emissions during the first commitment period. If the party's emissions exceed its assigned amount plus removal units, it must take responsibility for its excess emissions through the Kyoto Protocol's flexibility mechanisms. Flexibility mechanisms include the Clean Development Mechanism, Joint Implementation and the trading of units between Annex I parties. Parties incur a 130 per cent penalty during any future commitment period if, during the first commitment period, they do not hold enough emissions units to cover their total emissions. The Kyoto compliance equation for the first commitment period is simplified in Figure 3.

Figure 3: Kyoto Protocol Article 3.1 compliance equation



Note: Gross emissions include energy, agriculture, waste, industrial processes and solvents and excludes emissions from deforestation between 2008 and 2012. Total removals of article 3.3 forests are net of deforestation emissions.

The New Zealand Government has promised to provide assigned amount units to participants in its Projects to Reduce Emissions programme. The net position accounts for units promised under these projects by subtracting them from the assigned amount. The projected reduction in emissions from the Projects to Reduce Emissions programme is included in the emissions projections from the energy sector.

New Zealand's initial assigned amount

New Zealand's initial assigned amount is fixed at 309,564,733 metric tonnes of carbon dioxide equivalent or assigned amount units. The initial assigned amount is based on the estimate of emissions for 1990 from the inventory which was submitted as part of the Initial Report under the Kyoto Protocol (MfE, 2006) and reviewed by an international review team in February 2007 (UNFCCC, 2007).

The initial assigned amount is fixed for the first commitment period. In contrast, emissions and removals for all years of the national greenhouse gas inventory will change due to continuous improvement of the inventory. Consequently, the level of emissions in 1990 reported in the 2009 inventory submission is 0.06 million tonnes lower (less than 0.1 per cent) than the 1990 level used in the initial assigned amount calculation.

Each emissions unit is equal to one tonne of greenhouse gas emissions, converted to carbon dioxide equivalents using the global warming potentials as specified by the Second Assessment report of the Intergovernmental Panel on Climate Change (IPCC Second Assessment Report, 1995).

New Zealand's Emissions Unit Registry

The Climate Change Response Act 2002 puts in place a legal framework to allow New Zealand to ratify the Kyoto Protocol and to meet its obligations under the United Nations Framework Convention on Climate Change.

The Act includes powers for the Minister of Finance to manage New Zealand's holdings of units that represent New Zealand's target allocation for greenhouse gas emissions under the Protocol. It enables the Minister to trade those units on the international market. The Act establishes a National Inventory Agency to record and report information relating to greenhouse gas emissions in accordance with international requirements. The Act also requires New Zealand to establish an emissions registry. The emissions registry records holdings of Kyoto Protocol emissions units and is called the New Zealand Emission Unit Register (NZEUR). The New Zealand Emissions Unit Register is administered by the Ministry of Economic Development and may be viewed online at <https://www.eur.govt.nz/eats/nz/>.

The New Zealand Emission Unit Register manages the accounting, reporting and reconciliation of emissions unit holdings and transactions as part of the New Zealand Emissions Trading Scheme and also to meet New Zealand's commitment and obligations under the Kyoto Protocol (Article 7). The New Zealand national registry complies with the registry requirements as defined by decisions 13 and 5 of the first Conference and Meeting of Parties under the Kyoto Protocol in Montreal in December 2005.

If units are transferred to or from private and offshore holding accounts (Figure 3) then the net position estimate will need to be revised accordingly.

Box 1: Kyoto Protocol Article 3.1

“The Parties included in Annex I shall, individually or jointly, ensure that their aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A [to the Kyoto Protocol, refer below] do not exceed their assigned amounts, calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B [to the Kyoto Protocol, refer below] and in accordance with the provisions of this Article, with a view to reducing their overall emissions of such gases by at least 5 per cent below 1990 levels in the commitment period 2008–2012.”

Annex A to the Kyoto Protocol

<u>Greenhouse gases</u>	<u>Sector</u>	<u>Sub-sectors</u>	
Carbon dioxide (CO ₂)	Energy	Fuel combustion	
Methane (CH ₄)		Energy industries	
Nitrous oxide (N ₂ O)		Manufacturing industries and construction	
Hydrofluorocarbons (HFCs)		Transport	
Perfluorocarbons (PFCs)		Other sectors	
Sulphur hexafluoride (SF ₆)		Other	Fugitive emissions from fuels
			Solid fuels
	Oil and natural gas		
	Industrial processes	Mineral products	
		Chemical industry	
		Metal production	
		Other production	
		Production of halocarbons and sulphur hexafluoride	
	Solvent and other product use	Consumption of halocarbons and sulphur hexafluoride	
		Other	
	Agriculture	Enteric fermentation	
		Manure management	
		Rice cultivation	
Agricultural soils			
Prescribed burning of savannas			
Field burning of agricultural residues			
Other			
Waste	Solid waste disposal on land		
	Wastewater handling		
	Waste incineration		
	Other		

Annex B to the Kyoto Protocol (New Zealand only)

Party quantified emission limitation or reduction commitment (percentage of base year or period)

New Zealand	100
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Source: Kyoto Protocol, UNFCCC (1998).

3 Projections of Emissions and Removals

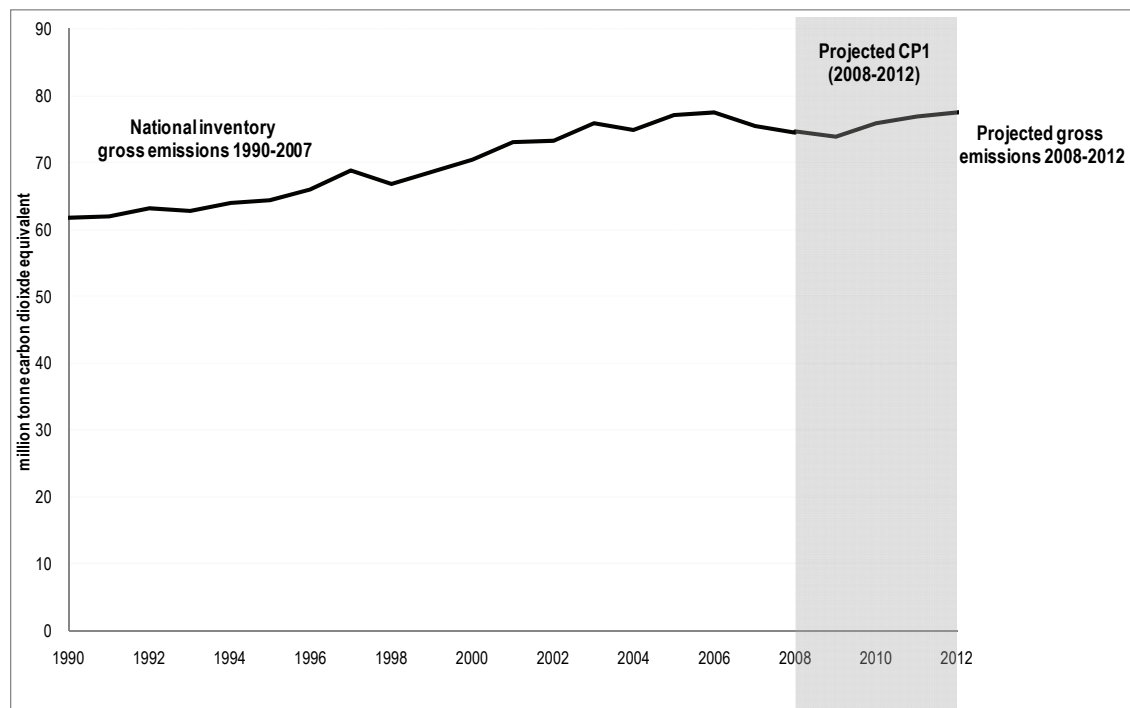
The Ministry for the Environment leads the net position update across government. This is to ensure the projections are consistent and to compile the Kyoto Protocol compliance equation. For the 2009 net position report, each department has produced a full, independent report of projected emissions and removals for their sector. Each report explains the modelling approaches used by the department, changes in projections since 2008 and how uncertainty was treated in each sector.

Gross emissions

Gross emissions over the first commitment period are a combination of emissions from the energy (including transport), industrial processes, solvents, agriculture and the waste sectors as specified in Annex A and Article 3.1 of the Kyoto Protocol (Box 1). Gross emissions exclude emissions and removals from land use, land-use change and forestry (such as deforestation emissions).

Emissions projections for each sector are based on detailed sectoral modelling. Gross emissions of greenhouse gases over the first commitment period are projected to be 378.2 million tonnes. This equates to average gross emissions of 75.7 million tonnes during the five years of the first commitment period (Figure 4).

Figure 4: Historical emissions data and projected emissions 1990–2012



Note: Gross emissions include emissions from energy, agriculture, waste, industrial processes and solvents.

Inclusion of policy

The net position does not evaluate or report the effects of individual policies. All policies are aggregated together to get the best estimate of New Zealand's emissions and removals over the first commitment period. The net position is calculated to be consistent with the Public Finance Act 1989. This requires the net position to incorporate, to the fullest extent possible, all government decisions and all other circumstances that may have a material effect on the projection, and that can be quantified with reasonable certainty (section 26U).

This report takes account of confirmed policies, assumptions (including expected economic growth) and transfers of Kyoto Protocol units in and out of the Crown account in effect as at 28 February 2009. The modelled effects of the New Zealand Emissions Trading Scheme were included in the 2008 projection and remain in the 2009 projection. The modelled effects of the biofuels sales obligation and the renewable electricity preference are no longer included in the net position estimate.

Energy and industrial processes emissions

The projections of energy, transport and industrial process emissions are provided by the Ministry of Economic Development (Appendix B, MED (2009)). Historical data on emissions for the period 1990–2007 and projected emissions for energy, transport, stationary energy and industrial processes are shown in Charts 4, 5, 6 and 7 below. Stationary energy refers to emissions from energy sources excluding transport.

Total emissions from stationary energy, transport and industrial processes are projected to be 185.6 million tonnes and have not changed from the 2008 projection. There have been reductions in the projected emissions from energy due to a lower than projected energy demand during 2008 and the expected effects of a continued economic recession. However, these have been offset by the effects of removing the biofuels sales obligation, the renewables electricity preference, and a small increase in fugitive emissions from greater geothermal electricity generation. There has also been a small reallocation of emissions from the energy sector to the industrial processes sector, but this does not increase overall emissions.

Total energy and transport sectors account for 164.9 million tonnes over the first commitment period. This compares to a 2008 projection of 163.7 million tonnes – an increase of 1.3 million tonnes. Industrial process emissions are projected to be 20.7 million tonnes over the first commitment period. This compares with a 2008 projection of 22.0 million tonnes – a decrease of 1.3 million tonnes.

Table 1 explains some of the substantive changes to subsectors of the energy sector projection.

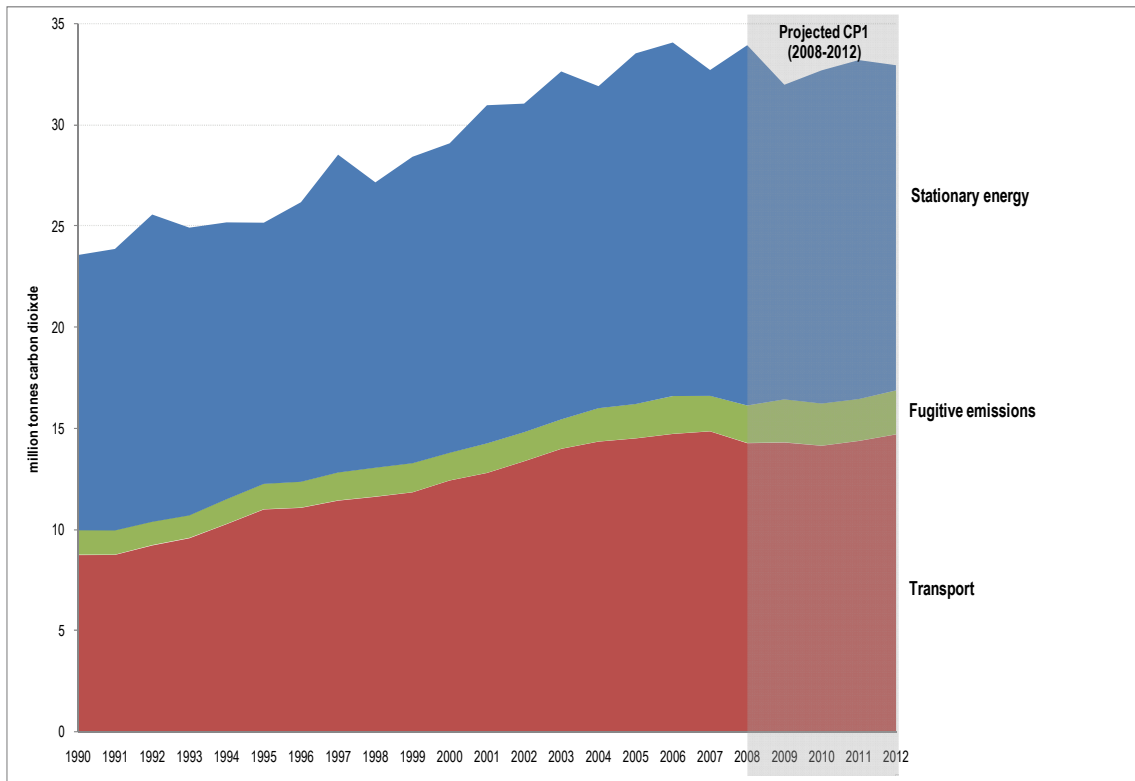
Table 1: Change in projected energy and industrial process emissions over the first commitment period

Sector	Explanation	Change (million tonnes)
Stationary energy	Increased electricity demand is projected to increase stationary energy emissions. The increase in electricity demand is due to modelling changes for future energy efficiency improvements.	+0.4 +0.2
	Emissions from urea production are reallocated from industrial processes to stationary energy.	+0.7
	Lower demand for other energy uses are projected to reduce stationary energy emissions.	+0.5
Fugitive emissions	Fugitive emissions of gas from the Kapuni treatment plant and from higher geothermal electricity production have increased.	+0.2 +0.2
Transport	Reduced transport demand.	+0.7 -0.4
	Removing biofuels sales obligation.	+1.1
Industrial processes		-1.3
	Projected reduced activity in industrial processes.	-0.6
	Emissions from urea production are reallocated from industrial processes to stationary energy.	-0.7
Total energy and industrial processes		0.0

Source: Ministry of Economic Development (2009).

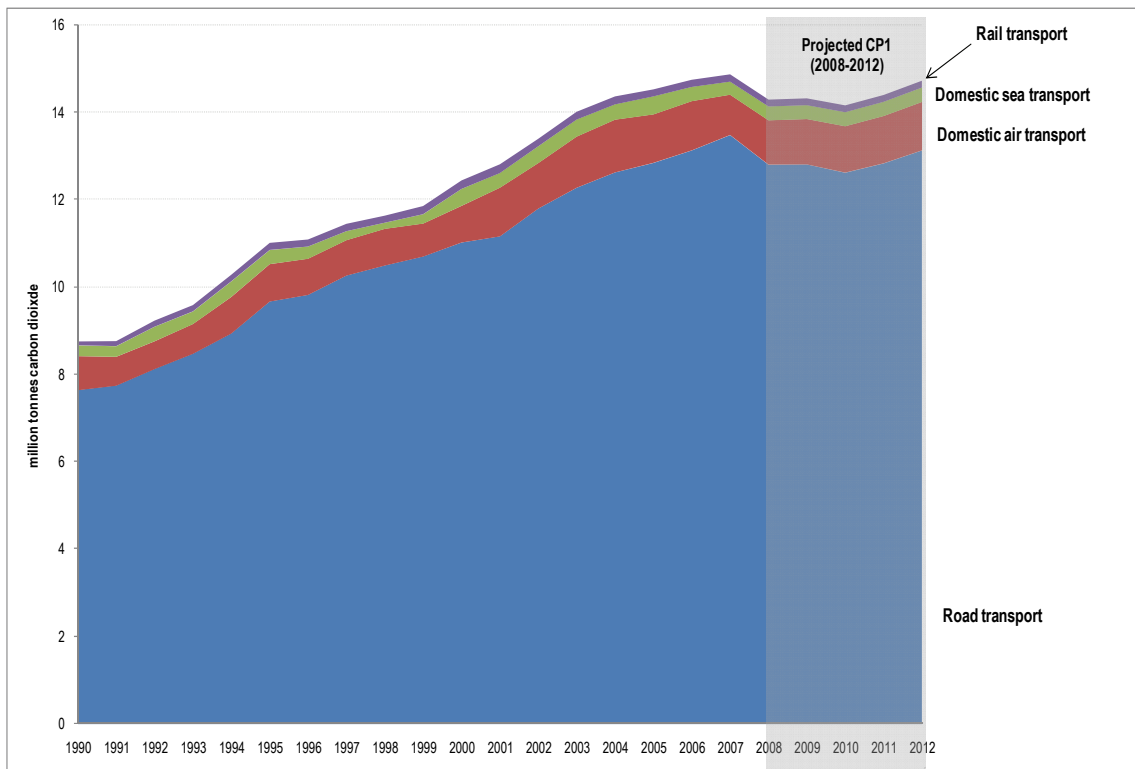
The dry year in 2008 increased electricity emissions by between 0.6 million tonnes and 1.0 million tonnes. The projected energy emissions assume that a one-in-five year drought will reduce the hydro electricity supply and increase the thermal electricity generation emissions. For the remaining four years of the first commitment period (ie, 2009 to 2012) it is still assumed that a one-in-five year drought could occur.

Figure 5: Historical emissions data and projected energy emissions 1990–2012



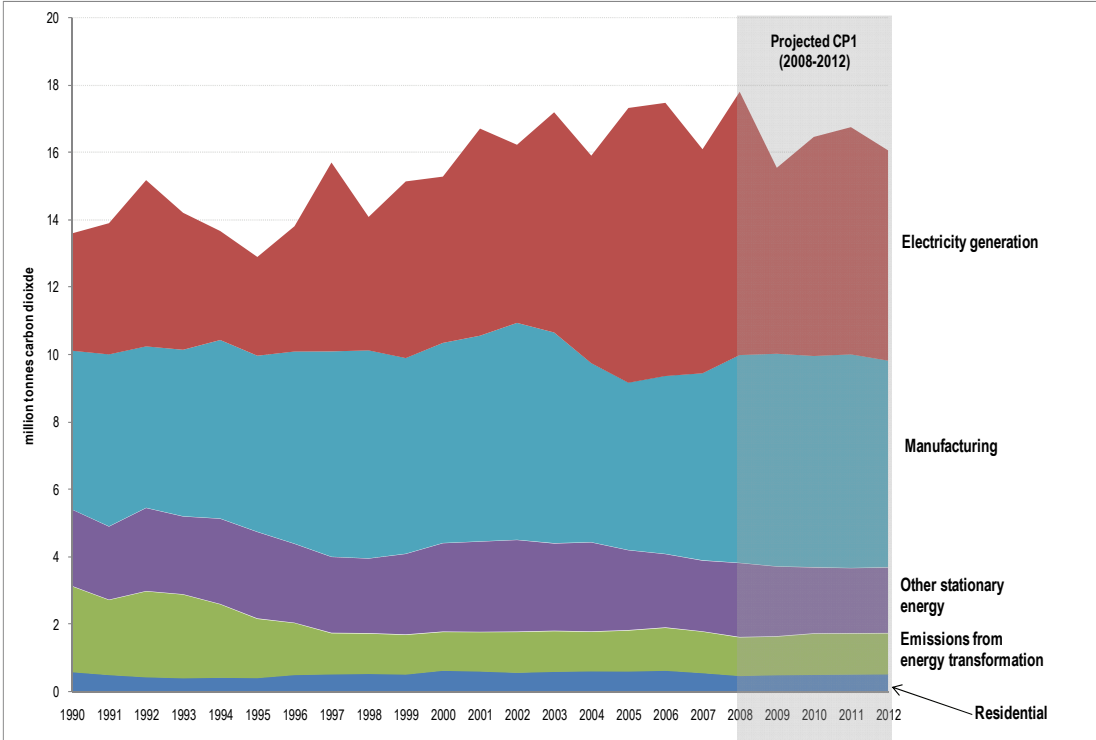
Source: Ministry of Economic Development (2009).

Figure 6: Historical emissions data and projected transport emissions 1990–2012



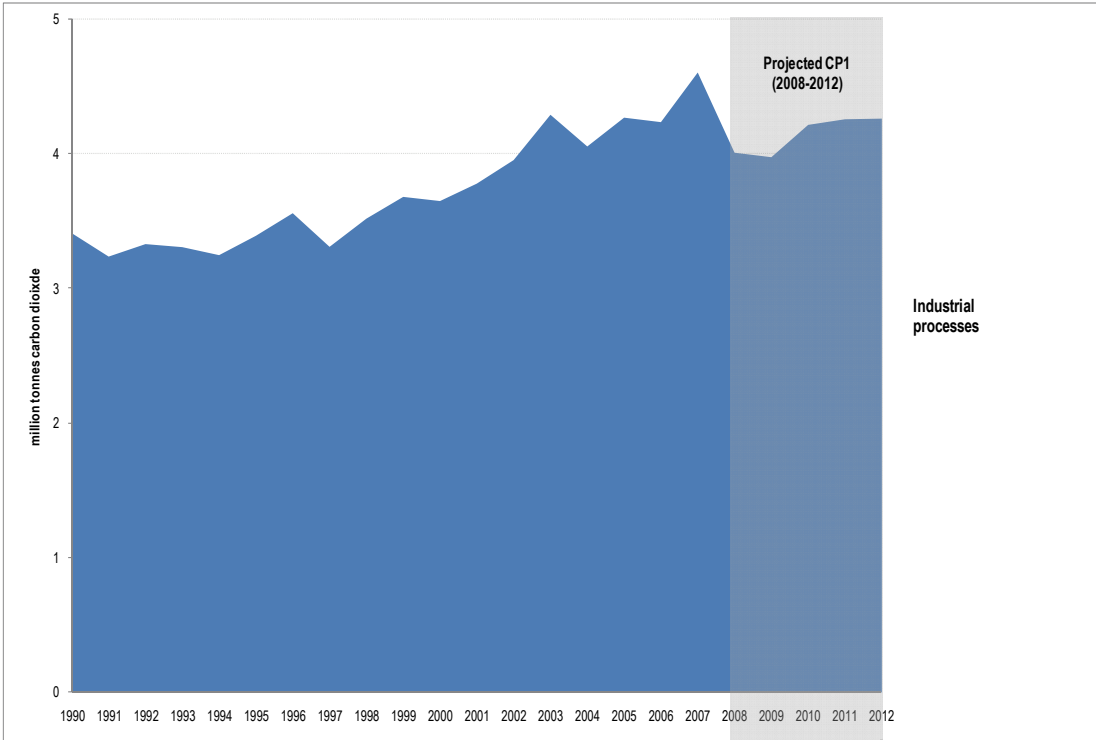
Source: Ministry of Economic Development (2009).

Figure 7: Historical emissions data and projected stationary energy emissions 1990–2012



Source: Ministry of Economic Development (2009).

Figure 8: Historical emissions data and projected industrial processes emissions 1990–2012



Source: Ministry of Economic Development (2009).

Agriculture emissions

The Ministry of Agriculture and Forestry has updated the Pastoral Supply Response Model. The key outputs of the model include projected animal performance data as well as animal populations, along with using a land-use change forecasting component. The Pastoral Supply Response Model is now linked to the inventory model used in calculating agricultural emissions.

Projected agricultural emissions from 2008 to 2012, using the improved model, are shown in Figure 10. Full details of the Ministry of Agriculture and Forestry's modelling are provided as an appendix (Appendix A, MAF (2009a)).

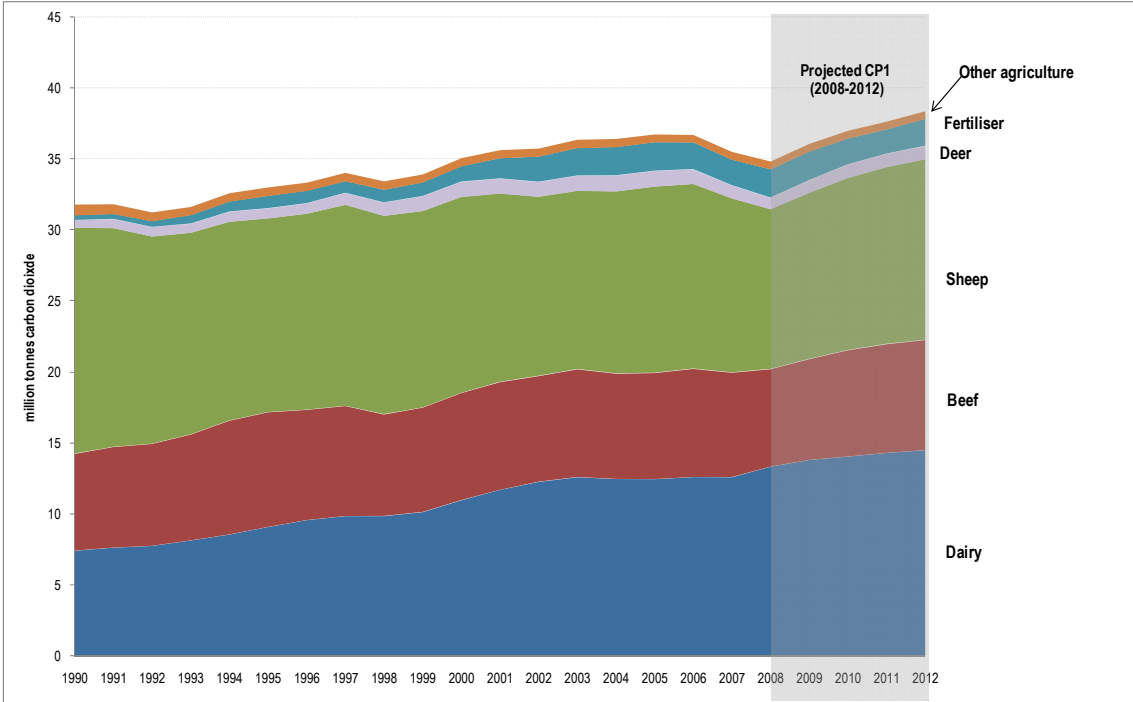
New Zealand's agriculture greenhouse gas emissions are projected to be 184.0 million tonnes – a decrease of 14.4 million tonnes (7 per cent) from the 198.5 million tonnes in the 2008 projection.

The drought during 2007/2008 decreased projected agricultural emissions by 10.3 million tonnes (5 per cent). The drought reduced emissions by causing a drop in stock numbers and by reducing the feed intake. Feed intake is a major input to estimating emissions because a lower feed intake reduces the emission per head of livestock.

The major source of New Zealand's nitrous oxide emissions comes from nitrogen excreted in urine and dung by livestock. To estimate the indirect contribution to nitrous oxide from nitrogen excreted by livestock, the fraction of nitrogen in excreta on New Zealand pasture that converts to oxides of nitrogen is required. Until 2008 New Zealand used the international default value of 0.2 for this fraction ($Frac_{gas}$, Table 4.19 (IPCC 2000)). In a report for Ministry of Agriculture and Forestry, Sherlock et al (2008) reviewed the relevant studies for this fraction of livestock-excreted nitrogen, and found that a more accurate New Zealand-specific fraction would be 0.1. The Sherlock et al (2008) report was internationally peer reviewed. The lower fraction reduced projected agriculture emissions between 2008 and 2012 by 3.8 million tonnes (2 per cent).

The reduction of nitrous oxide emissions due to the application of a nitrification inhibitor has also been incorporated and accounts for a further reduction in emissions of 0.3 million tonnes between 2008–2012. The application of the nitrification inhibitor dicyandiamide (DCD) to dairy pastures reduces nitrous oxide emissions from fertiliser and animal-excreted nitrogen and nitrate leaching. In a report contracted by the Ministry of Agriculture and Forestry on the use of dicyandiamide, Clough et al (2008) developed the methodology to quantify the effects of dicyandiamide on nitrous oxide emissions from New Zealand pasture.

Figure 9: Historical emissions data and projected agricultural emissions 1990–2012



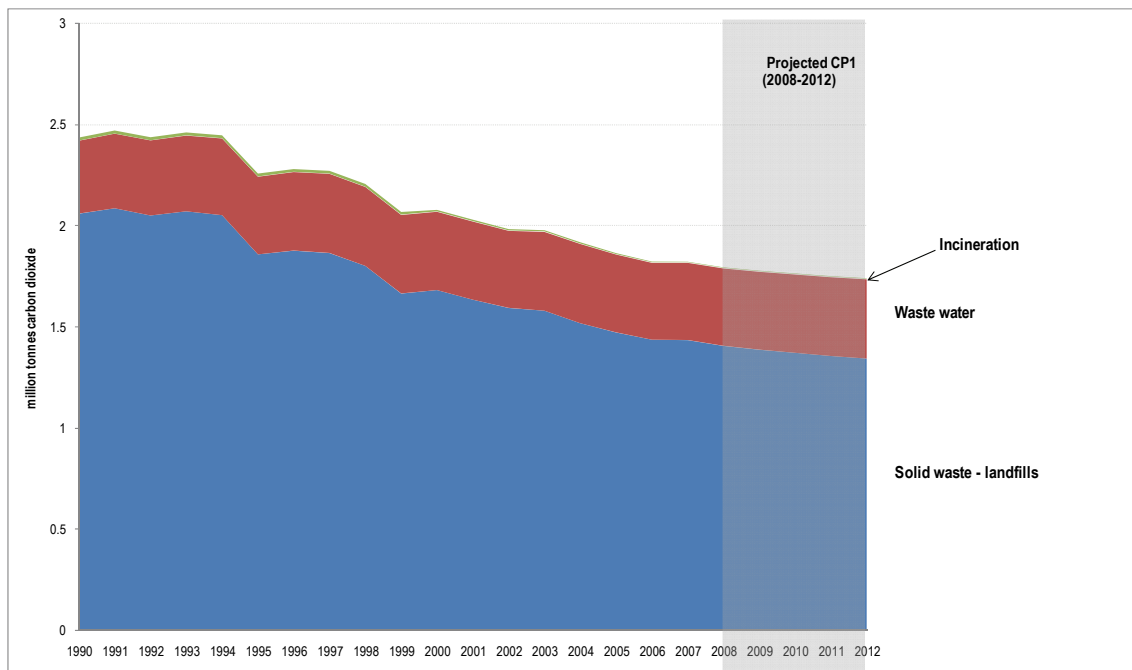
Source: Ministry of Agriculture and Forestry (2009a).

Note: Other emissions include savanna burning, agricultural residue burning, nitrogen fixing crops and livestock emissions from poultry, pigs, horses and goats.

Waste emissions

The waste emissions projections were provided by the Ministry for the Environment (Appendix D, (MfE, 2009b)). Figure 10 shows historical data on emissions of greenhouse gases from the waste sector reported in the 2009 national greenhouse gas inventory submission (MfE, 2009a) and projected emissions by the Ministry for the Environment. Projected emissions from waste during 2008–2012 have increased by 1.1 million tonnes (15 per cent) compared to the 2008 projection. This is the result of improvements to the method used to model emissions from solid waste disposal.

Figure 10: Historical emissions data and projected waste emissions 1990–2012



Source: Historical emissions data and projected emissions, Ministry for the Environment (2009a,b).

Emissions and removals from land use, land-use change and forestry

Projections of net removals from land use, land-use change and forestry (total removals less deforestation emissions) were provided by the Ministry of Agriculture and Forestry (Appendix C, (MAF, 2009b)).

Net carbon dioxide removals are removals by afforestation and reforestation, minus emissions from deforestation activities. Net removals are projected to be 85.0 million tonnes. This is an increase of 17.8 million tonnes of net removals over the first commitment period compared to the 2008 projection. The increase is due to:

- new information on post-1989 planted forests indicates that these forests are removing more carbon dioxide per hectare because they have been planted on more fertile sites than older forests. They have also received less intensive forest management, particularly thinning. These factors mean there are more trees per hectare growing at a faster rate. The impact of the change is a projected increase in removals from post-1989 forests of 8.2 million tonnes during the first commitment period 2008–2012. The information is from a preliminary analysis of the Land Use and Carbon Analysis System (LUCAS) planted forest inventory field data
- deforestation emissions are projected to be 9.6 million tonnes lower than in the May 2008 net position. This is due in part to improved information on the area of immature forests intended. This information has not been available previously. Deforestation of younger forests produces lower emissions than older forests. It was also assumed that all forest carbon is instantly emitted at the time of deforestation. It was previously assumed that harvesting residues decayed over time.

Emissions from solvents and other products

Solvents and other products' emissions are less than 0.1 per cent of total emissions and are projected by a simple linear trend by the Ministry for the Environment and included in the estimate of the net position for completeness.

4 Projections Uncertainty

The projections will continue to change over the commitment period. The projection will always be based on the best information available at the date of the projection. Change will be caused by the use of the latest assumptions on variables such as economic growth or oil prices, use of the latest scientific research on emissions and removals, changes to government policy, and replacing projections with actual inventory data. For the first time, the April 2009 net position report uses provisional data for actual emissions from the agriculture and energy sectors for 2008.

The actual net position will remain uncertain until New Zealand's national greenhouse gas inventories covering the first commitment period have been submitted, reviewed, and the review report noted by the Enforcement Branch of the Compliance Committee of the Kyoto Protocol. The internationally agreed timelines for these processes mean that New Zealand will submit its annual inventory for the 2008 calendar year (the first year of the commitment period) in 2010. New Zealand's Kyoto Protocol compliance over the first commitment period will not be finalised until 2015.

To accommodate this uncertainty, upper and lower emissions projections are included for each sector (Figure 11). The projected net position is expected to change each year as a result of new information being incorporated. The high and low estimates for each sector are reported in Table 2.

The total range of uncertainty summing across all sectors has decreased from 138.7 million tonnes reported in the 2008 net position report, to 117.7 million tonnes.

- **Agriculture:** upper and lower emissions projections for the first commitment period are based on variations in animal numbers, animal performance and nitrogen fertiliser use. These variations are driven by the uncertainty in the economic factors (such as farm incomes and prices) and weather conditions (daily soil moisture deficit). These projections use current science and do not account for any future changes in science or methodology.
- **Stationary energy, transport and industrial processes:** upper and lower emissions projections for the first commitment period are based on variations in the macroeconomic factors, levels of production and consumption, and policy measures. The projected energy emissions assume that a one-in-five year drought will reduce the hydro-electricity supply and increase the thermal electricity-generation emissions. Although there was a drought during 2008, for the remaining four years of the first commitment period (ie, 2009 to 2012) it is still assumed that a one-in-five year drought could occur.
- **Net removals from land use, land-use change and forestry:** upper and lower projections for the first commitment period are based on assumptions around the future deforestation and afforestation rates, the area of post-1989 forests, forest growth rates and soil carbon changes with afforestation.
- **Waste emissions:** upper and lower emissions projections for the first commitment period are based on variations in the outcome of existing waste minimisation and management practices.

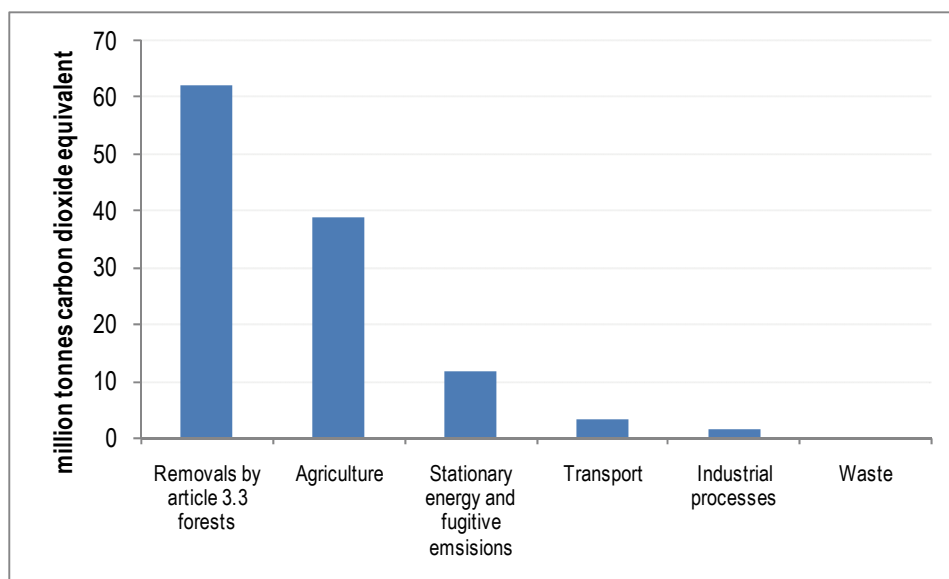
Land use, land-use change and forestry projections will continue to have the largest uncertainty bounds compared to all other sectors until the Land Use and Carbon Analysis System, being developed by the Ministry for the Environment, has been fully implemented. The Land Use and Carbon Analysis System will accurately map changes in the forest area since 1990. This is a requirement of reporting Article 3.3 sinks under the Kyoto Protocol. Presently the forest area estimates are based on a postal survey of forest owners known as the National Exotic Forest Description. Preliminary estimates from the mapping work are expected around mid-2009. Final forest areas will be available at the end of the commitment period.

Table 2: Projected net position over the first commitment period (million emissions units)

	Upper emissions scenarios	Most likely scenarios	Lower emissions scenarios
Projection of assigned amount units			
Projected aggregate emissions		378.2	
Stationary energy	99.6	93.0	87.7
Transport	73.6	71.9	70.4
Industrial processes	21.5	20.7	20.0
Total energy and industrial processes	194.7	185.6	178.1
Solvent and other product use		0.2	
Agriculture	204.8	184.0	166.0
Waste	8.8	8.8	8.8
Projection of removal units			
Removals by article 3.3 forests	70.2	92.3	115.4
Deforestation emissions	-24.2	-7.3	-7.3
Net removals via forests	46.0	85.0	108.1

Note: One emissions unit is equivalent to one tonne of greenhouse gas emissions converted to carbon dioxide equivalents by its global warming potential.

Figure 11: Uncertainty range between high and low projection by sector



5 Reconciliation Against Previous Projections

The detailed changes in all the components of the Kyoto Protocol compliance equation since the 2005 net position report are shown in Table 3. Full explanations of the changes in the methodology, assumptions and results for each sector may be found in the sectoral projection appendices in this, and previous, net position reports. A summary of the changes since the 2008 net position may be found in the executive summary and Section 4 of this report.

**Table 3: Reconciliation with historic net positions
(million tonnes carbon dioxide equivalent)**

	May 2009	Change 09-08	May 2008	Change 08-07	May 2007	Change 07-06	May 2006	Change 06-05	December 2005	Change December-May	May 2005
Projected emissions											
Gross emissions	378.2	-13.3	391.5	-14.0	405.4	6.3	398.5	-16.3	414.8	13.1	401.7
Stationary energy	93.0	0.6	92.4	-0.4	92.8	0.3	91.3				
Transport	71.9	0.7	71.3	-8.8	80.1	1.3	78.8				
Industrial processes	20.7	-1.3	22.0	-0.2	22.2	-0.6	22.9				
Total energy and industrial processes	185.6	0.0	185.6	-9.5	195.1	0.9	193.0	-14.5	207.5	13.1	194.4
Solvent and other product use	0.2	0.0	0.2	0.0	0.3	0.0	0.3	0.3	0.0		0.0
Agriculture	184.0	-14.4	198.5	-4.7	203.1	4.8	198.8	-3.2	202.0		202.0
Waste	8.3	1.1	7.2	0.2	7.0	0.5	6.5	1.2	5.3		5.3
Assigned amount units	309.6	0.0	309.6	0.1	309.5	1.9	307.6	0.0	307.6		307.6
Projected removals											
Removals by forests (article 3.3)	92.3	8.2	84.1	5.1	79.0	0.8	78.2	1.0	77.2		77.2
Deforestation emissions	7.3	-9.6	16.9	-24.1	41.0	0.0	38.5	0.0	21.0	14.7	6.3
Net removals via forests	85.0	17.8	67.2	29.2	38.0	0.8	39.7	1.0	56.2	-14.7	70.9
New Zealand's net emissions	16.4	31.1	-14.7	43.3	-58.0	-3.6	-51.2	17.3	-51.0		-23.2
Additional policy and unit transfer adjustments											
Kyoto Protocol Units committed to projects	6.8	-0.2	7.0	-0.5	7.5	0.0	7.5		7.5		7.5
Effect of deforestation emissions cap	0.0	0.0	0.0	-20.0	20.0	2.5	17.5	17.5	0.0		
Monte Carlo modelling difference								5.5	-5.5		-5.5
New Zealand's net position	9.6	31.3	-21.7	23.8	-45.5	-3.6	-41.2	22.8	-64.0	27.8	-36.2

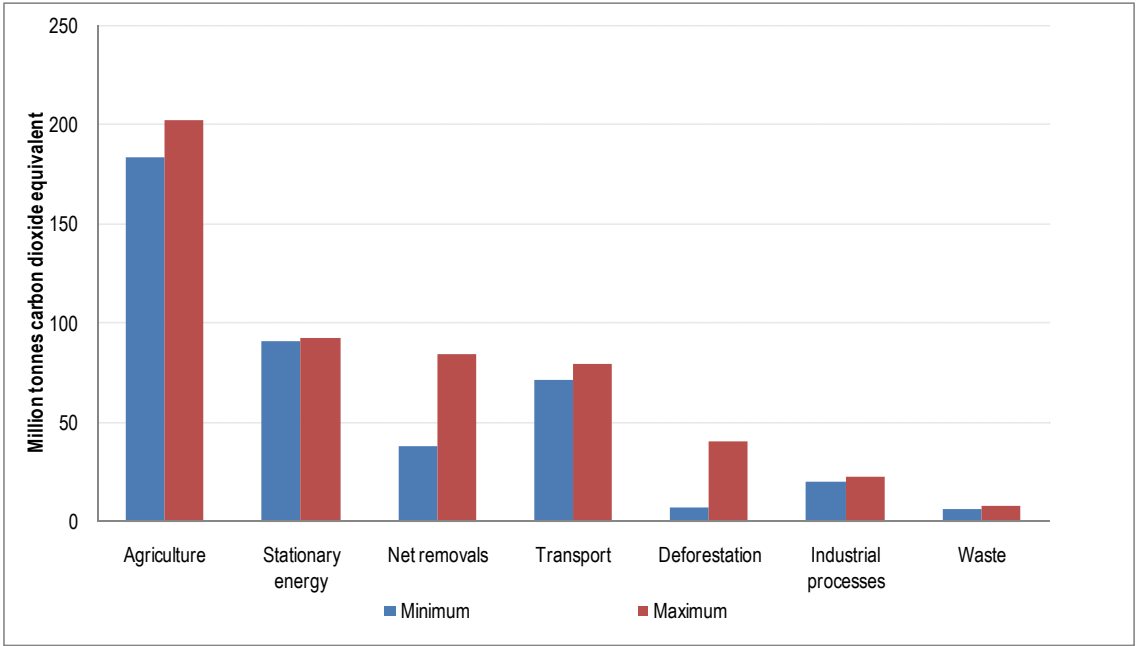
Note: One emissions unit is equivalent to one tonne of greenhouse gas emissions converted to carbon dioxide equivalents by its global warming potential.

Net removals by forests offset emissions and reduce net emissions in the net position calculation.

This table shows the impact of the deforestation cap separately under policy and unit transfers, rather than being included with deforestation emissions as in previous reports.

Figure 12 picked the highest and lowest projection reported for each sector between 2006 and 2009 net position reports (from the most likely scenarios). It shows that the uncertainty ranges have remained small for most of the various greenhouse gas sectors over the last several years. Only projections of emissions and removals from forestry have a significant uncertainty component. The Land Use and Carbon Analysis System will reduce this uncertainty when its satellite data replaces the current data from postal surveys. Note that only projections since 2006 have been used because sub-sector detail was not provided for energy before 2006.

Figure 12: Highest and lowest projection by sector from net position reports between 2006 and 2009



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