Ministry for the Environment
Manatū Mō Te Taiao

Snapshot
April 2019

New Zealand's Greenhouse Gas Inventory 1990–2017

The Greenhouse Gas Inventory is the official annual estimate of all human-generated greenhouse gas emissions and removals in New Zealand.

This snapshot summarises the latest inventory, which covers the years 1990–2017. For background information on the inventory, see the last page of this snapshot.

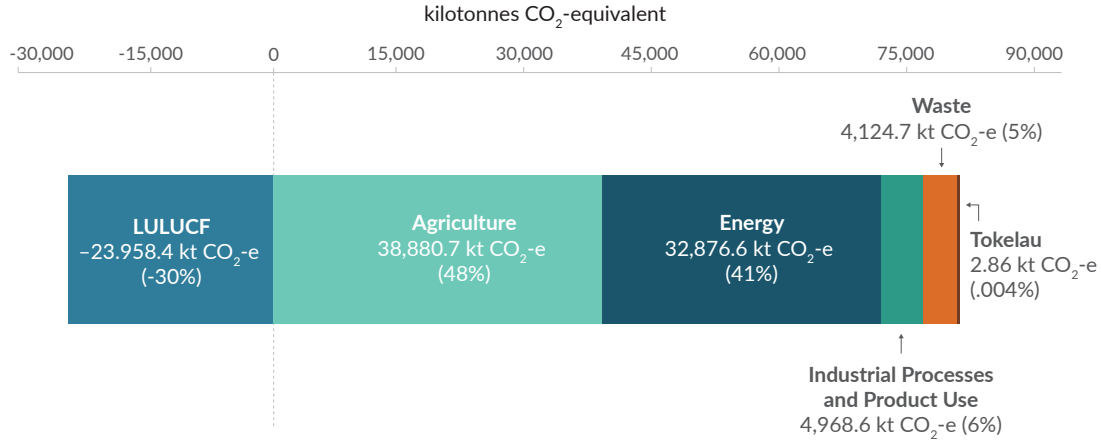
The full inventory report is available on our website at **www.mfe.govt.nz/publications/climate-change/new-zealands-greenhouse-gas-inventory-1990-2017**

The **interactive emissions tracker** (available at **https://emissionstracker.mfe.govt.nz**) provides the latest inventory data, showing trends in sectors and greenhouse gases since 1990, in a user-friendly format.

Key points

- New Zealand's gross emissions have increased 23.1 per cent since 1990 (figure 2).
- Methane from dairy cattle digestive systems and carbon dioxide from road transport have contributed the most to this increase.
- Between 1990 and 2017, New Zealand's gross methane emissions increased by 6.2 per cent.
- Between 2016 and 2017, gross emissions increased by 2.2 per cent, mainly from an increase in emissions from road transport and fossil fuel-generated electricity production.
- The agriculture and energy sectors were the two largest contributors to New Zealand's gross emissions, at 48.1 per cent and 40.7 per cent respectively (figure 1).
- The Land Use, Land-Use Change and Forestry (LULUCF) sector offset 29.6 per cent of New Zealand's gross emissions (figure 1).
- New Zealand's net emissions increased by 65 per cent due to the underlying increase in gross emissions and the increased volume of timber harvested from New Zealand's plantation forest estate in 2017 compared with 1990.
- Between 2016 and 2017, an increase in the harvest rate of planted forests led to a decrease in net removals from the LULUCF sector of 3.5 per cent.
- In 2017, Tokelau was included as part of New Zealand's greenhouse gas inventory for the first time, contributing 0.004 per cent to New Zealand's gross emissions.

Figure 1: New Zealand's emissions profile in 2017. This graph shows how much each sector[1] contributed to our greenhouse gas emissions.



Note: Net emissions from the LULUCF sector are expressed as a negative number because the sector removes more greenhouse gases from the atmosphere than it emits.

1 All emissions from Tokelau are reported as an individual 'sector' in the inventory.

New Zealand's gross and net emissions

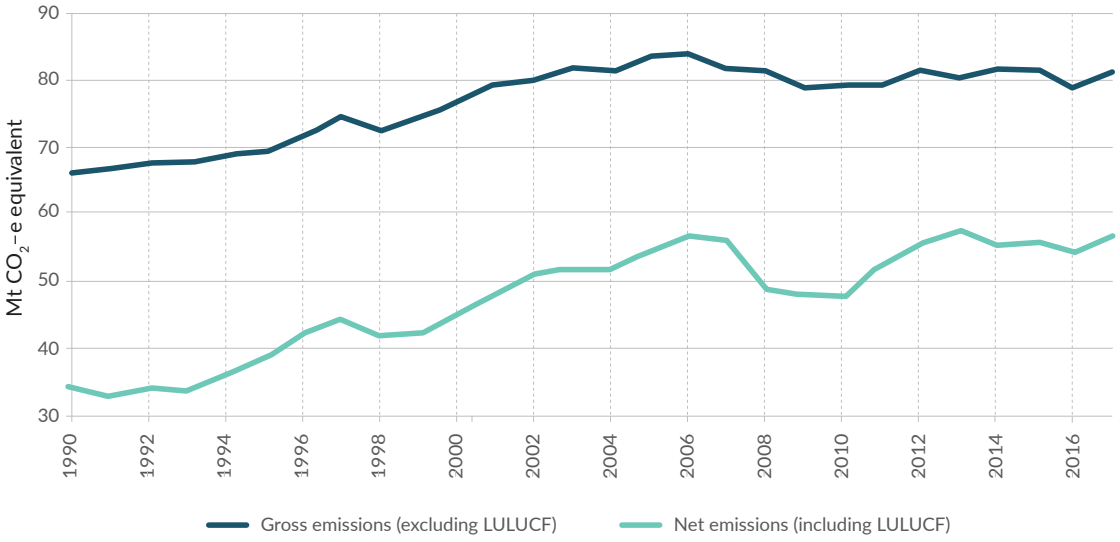
In the inventory, emissions and removals are categorised into five sectors:

> Energy (eg, road transport and electricity production)
> Industrial Processes and Product Use (IPPU) (eg, production of metals and chemicals, and use of refrigerants)
> Agriculture (eg, methane from livestock digestive systems and manure)
> Waste (eg, methane from landfills)
> Land Use, Land-Use Change and Forestry (LULUCF). The LULUCF sector keeps track of greenhouse gases from land use (eg, forests, crops and pasture). This is separate from the livestock emissions reported in the agriculture sector. It covers changes that occur in soils and vegetation from land management, and is the only sector where both emissions and removals of carbon dioxide occur.

Gross emissions are New Zealand's total emissions from the agriculture, energy, IPPU and waste sectors, as well as gross emissions from Tokelau.

Net emissions are gross emissions combined with emissions and removals from the LULUCF sector.

Figure 2: New Zealand's gross and net emissions from 1990 to 2017



Gross emissions are dominated by emissions from the agriculture and energy sectors

New Zealand's gross greenhouse gas emissions were 80.9 million tonnes of carbon dioxide equivalent* (Mt CO_2-e) in 2017. This is a 2.2 per cent increase from 2016 emissions, mainly caused by an increase of emissions from road transport, which is reported in the energy sector.

The agriculture and energy sectors contributed the most to New Zealand's emissions at 48.1 per cent and 40.7 per cent of gross emissions in 2017 respectively (figure 1). Emissions from road transport make up 17.9 per cent of gross emissions.

Methane and nitrous oxide, largely from agricultural sources, made up over half of our gross emissions. The remaining emissions consisted mostly of carbon dioxide (44.6 per cent in 2017), largely from the energy and IPPU sectors.

Since 1990, New Zealand's gross emissions have increased by 23 per cent. The five emission sources that contributed the most to this increase were:

> dairy cattle (methane from livestock digestive systems)
> road transport (carbon dioxide)
> chemical industry and food processing (carbon dioxide)
> nitrogen deposited onto agricultural soils (nitrous oxide)
> industrial and household refrigeration and air conditioning systems (fluorinated gases).

* Definition

Carbon dioxide equivalent (CO_2-e) is a measure for how much global warming a given type and amount of greenhouse gas causes, using the equivalent amount of carbon dioxide as the reference.[2] CO_2-e is used for describing different greenhouse gases in a common unit, which allows them to be reported consistently.

2 The 1990–2017 greenhouse gas inventory uses the 100-year global warming potential values from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report. See Annex III of UNFCCC decision 24/CP.19: **http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf**

Net emissions are influenced by forest planting cycles

Net emissions include gross emissions combined with the emissions and removals from the LULUCF sector. Forests remove carbon dioxide from the atmosphere as they grow. Forests also emit carbon dioxide after being harvested, deforested, or following natural disturbances, such as storm damage. This means that historical planting rates and harvesting cycles have a large impact on the net amount of carbon dioxide removed by our forests in any given year.

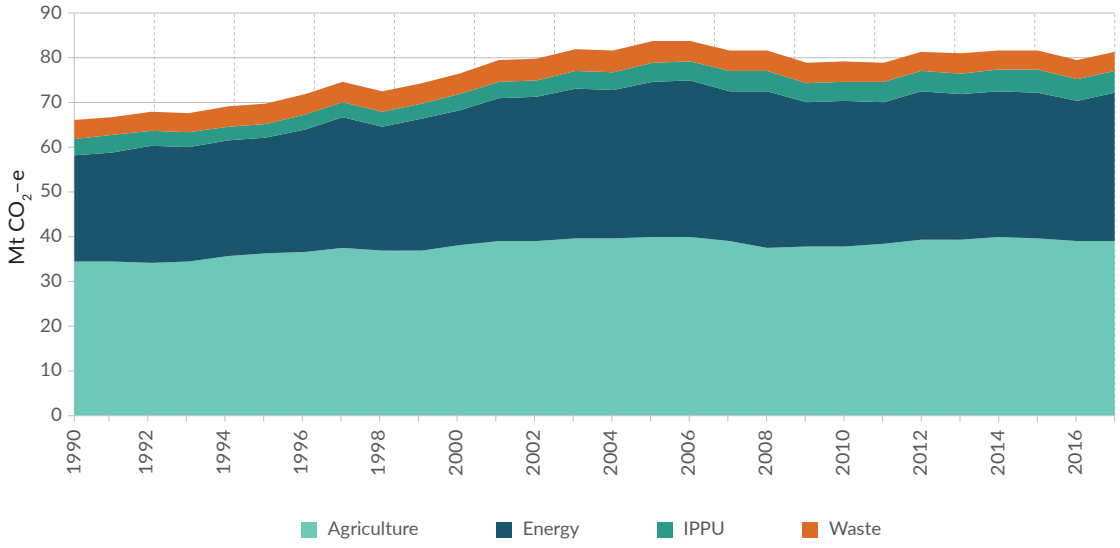
To estimate net emissions, the Ministry for the Environment and the Ministry for Primary Industries calculate the area of forest in New Zealand. According to these estimates, approximately 6536 hectares of new forest was planted and 4007 hectares deforested in 2017.

New Zealand's net emissions under the United Nations Framework Convention on Climate Change (UNFCCC) were 56.9 Mt CO_2-e in 2017. This is calculated by subtracting 24.0 Mt CO_2-e of net removals from the LULUCF sector from gross emissions of 80.9 Mt CO_2-e. Net emissions have increased by 65 per cent compared with 1990 levels due to more forests being harvested, fewer trees being planted and an increase in gross emissions.

Under the UNFCCC reporting rules, net emissions from the LULUCF sector offset 29.6 per cent of New Zealand's gross emissions in 2017 (figure 1). This is a decrease from 1990 when the LULUCF sector offset almost half of New Zealand's gross emissions (figure 2).

Emissions trends by sector

Figure 3: Trends in New Zealand's gross greenhouse gas emissions by sector from 1990 to 2017



Note: The emissions contribution from Tokelau is too small to be visible on the figure.

Agriculture

1990–2017

Between 1990 and 2017, emissions from the agriculture sector increased by 13.5 per cent (figure 3). This is primarily due to the national dairy herd nearly doubling in size since 1990 and an increase of approximately 650 per cent in the application of nitrogen-containing fertiliser during the same period.

Decreases of 52.5 per cent in the sheep population and 21.4 per cent in the non-dairy cattle population since 1990 have partially offset the increases in dairy cattle emissions.

2016–2017

In 2017, emissions from the agriculture sector decreased slightly (by 0.1 per cent) from 2016. This decrease was due to a small fall in the sheep and dairy cattle populations (0.4 per cent and 1.5 per cent respectively). This decrease was mostly offset by a 2.1 per cent increase in the population of non-dairy cattle.

Energy

1990–2017

Emissions from the energy sector in 2017 were 38.2 per cent higher than in 1990 (figure 3). Most of this increase came from road transport (an increase in emissions of 93.4 per cent), and the use of fossil fuels for manufacturing and construction. The trend shows emissions increasing up until 2008, after which there is a slight decline (figure 3).

2016–2017

Between 2016 and 2017, emissions from the energy sector increased by 5.7 per cent. The increase was primarily caused by a 6.3 per cent increase in road transport emissions. Emissions from public electricity and heat production also increased by 18.2 per cent.

This increase was largely driven by natural gas-fired generation being used to compensate for lower levels of hydro generation, influenced by 2017 being a year with prolonged periods of low rainfall and drought. The increase in these two sectors was partially offset by a decrease in emissions (18.4 per cent) from the chemicals category in the manufacturing and construction industries.

Industrial Processes and Product Use (IPPU)

1990–2017

Emissions from the IPPU sector in 2017 were 38.8 per cent higher than in 1990 (figure 3). The increase was mainly caused by phasing out ozone-depleting compounds under the Montreal Protocol and replacing them with hydrofluorocarbons (HFCs) in refrigeration and air conditioning. It was also due to increased use of household and commercial air conditioning in New Zealand. In addition, carbon dioxide emissions from mineral, chemical and metals production have gradually increased due to the growth in production.

2016–2017

Between 2016 and 2017, emissions from IPPU decreased by 0.4 per cent. This change was largely driven by an increase in emissions from the metal industry (2.8 per cent) which was offset by a decrease in emissions from the mineral industry (7.9 per cent).

Waste

1990–2017

In 2017, waste sector emissions were 2.1 per cent above 1990 levels. Annual emissions increased between 1990 and 2002 because of the ongoing growth in population and economic activity, but showed a general downward trend since 2005. This is mainly due to ongoing improvements in managing solid waste disposal at municipal landfills, particularly in landfill gas recovery.

2016–2017

Waste emissions in 2017 were 0.2 per cent higher than emissions in 2016. This is largely due to a reduction in methane recovery rates from solid waste disposal.

Land Use, Land-Use Change and Forestry (LULUCF)

There are two ways of calculating emissions and removals from the LULUCF sector. The first is used for reporting net emissions under the UNFCCC.

The second way is to report on only a subset of LULUCF emissions and removals in accordance with accounting rules under the Kyoto Protocol. This method is used to track emissions towards our 2020 emissions reduction target. This estimate is referred to as net target emissions.

LULUCF reporting under the UNFCCC

1990–2017

In 2017, the LULUCF sector was a net carbon sink*, with net removals of 24.0 Mt CO_2-e. Emissions from the LULUCF sector in 2017 were 23.1 per cent higher than they were in 1990 as the harvest rate of planted forests was greater in 2017 than it was in 1990 (figure 4). Yearly fluctuations in emissions and removals from LULUCF are mainly driven by harvesting and deforestation in production forests, and historically variable rates of new forest plantings.

2016–2017

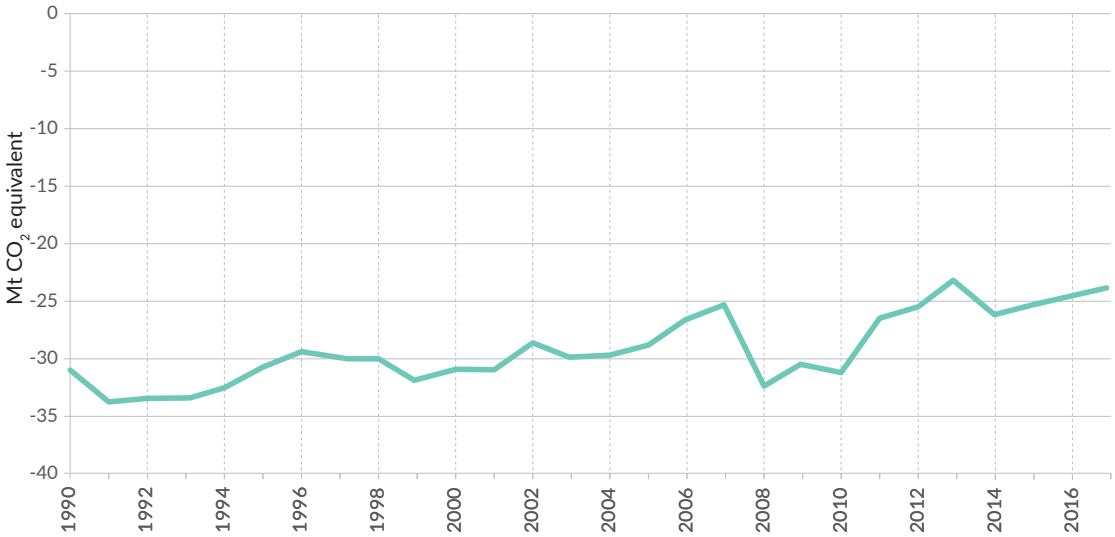
Between 2016 and 2017, net emissions from the LULUCF sector increased by 3.5 per cent. This is mainly due to large emissions from the sustainable harvest[3] of New Zealand's plantation forests.

* Definition

Carbon sink is anything that removes carbon dioxide from the atmosphere and stores it.

3 Sustainable harvest is a process whereby planted forests are harvested and subsequently replanted.

Figure 4: Net emissions from the LULUCF sector under the UNFCCC from 1990 to 2017



LULUCF reporting under the Kyoto Protocol*

For the period 2013 to 2020 New Zealand has taken a target under the UNFCCC rather than under the Kyoto Protocol. This target is to reduce emissions to 5 per cent below 1990 levels by 2020. New Zealand will apply the Kyoto Protocol framework of rules in accounting for its 2020 target under the UNFCCC.

This means New Zealand will count net removals from Article 3.3 – *Afforestation and reforestation* and *Deforestation* and Article 3.4 – *Forest management* of the Kyoto Protocol towards its target. This is a subset of emissions and removals reported for LULUCF under the UNFCCC and is used in the net position report to monitor progress towards our 2020 target (see page 7).

* Definitions

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which contains internationally binding emissions reduction targets for developed country Parties.

Afforestation is the establishment of a forest in an area where there was no forest for at least 50 years.

Reforestation is 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 and second commitment periods of the Kyoto Protocol (2008–2020), reforestation is limited to areas that were non-forest on 31 December 1989.

Deforestation is a change in land use from forest to non-forest (eg, farming) for any period of time.

Forest management is the management of forests that existed before 1990.

How New Zealand compares to other countries

Our emissions are globally small, but high per capita

New Zealand's emissions profile is different to that of most other 43 Annex I countries*. This is because nearly half of our emissions come from the agriculture sector. Typically, the agriculture sector constitutes only a small proportion of gross emissions (12.2 per cent on average in Annex I countries).[4]

The high level of agricultural production in New Zealand means we produce a lot of methane and nitrous oxide which have a greater warming effect compared with carbon dioxide. Based on the latest available inventory data for 2016, New Zealand's gross emissions ranked 24th among the Annex I countries, but our emissions per person were the seventh highest at 16.9 tonnes CO_2-e per capita (figure 5).

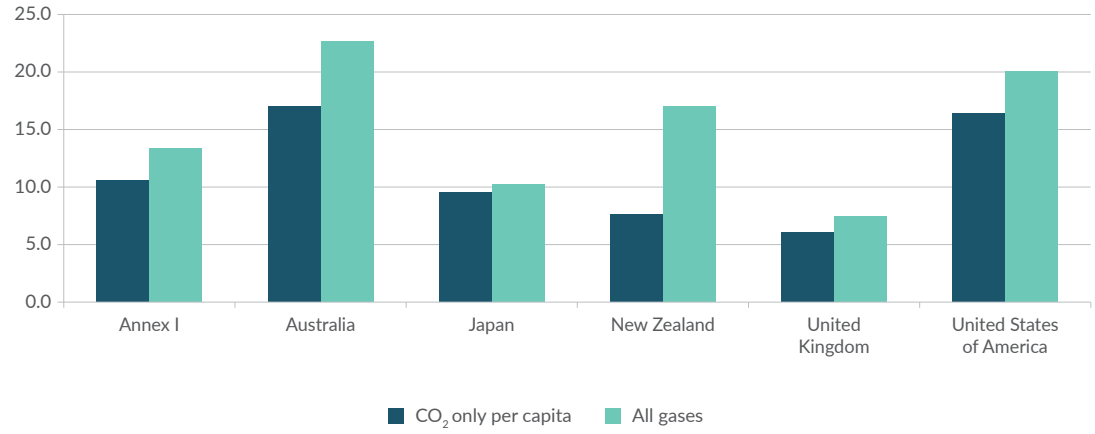
* Definition

Annex I to the UNFCCC lists the industrialised countries that were members of the Organisation for Economic Co-operation and Development (OECD) in 1992 (the year the UNFCCC was agreed), and countries with economies in transition at the time. Countries listed in Annex I that are Parties to the UNFCCC are required to report regularly on their climate change data, policies and measures, including (if appropriate) issues governed by the Kyoto Protocol.

New Zealand's gross carbon dioxide emissions in 2016 were 7.4 tonnes CO_2 per capita, which is below the Annex I average of 7.8 (figure 5). This reflects our high proportion of electricity generation from renewable sources. In 2017, the share of electricity generated from renewable energy sources in New Zealand was 81.9 per cent.

New Zealand's gross emissions contributed approximately 0.17 per cent of the world's gross emissions.[5] However, our gross emissions have increased since 1990, whereas in many other Annex I countries (eg, the UK and Germany) emissions are now below 1990 levels.

Figure 5: International comparisons for per capita emissions in 2016[6]



4 All emissions data in this section is from **UNFCCC Data Interface** (2018). Annex I data in these comparisons count the members of the European Union (EU) separately, and exclude the EU as a whole. Note that the comparison is made with Annex I countries because these countries all use the same methodologies to report their emissions.

5 Climate Watch (data for 2014): **https://www.wri.org/resources/data-sets/cait-historical-emissions-data-countries-us-states-unfccc**

6 Population data from **UN Population Division** (2017): **https://population.un.org/wpp/Download/Standard/Population/**

New Zealand's progress towards our 2020 target

The inventory data are used to monitor progress towards our 2020 emissions reduction target, to reduce greenhouse gas emissions to 5 per cent below 1990.[7] Our progress towards this target is contained in the Ministry for the Environment's **2020 Net Position Report**, which is updated when a new inventory is published.

The net position shows that New Zealand is projected to meet its 2020 target and have a surplus of units (figure 6). New Zealand's net position is composed of:

> a carbon budget of 509.8 million units
> projected carbon dioxide removals from forestry and land-use activities included in the Kyoto Protocol corresponding to 108.0 million units
> a surplus of 123.7 million units from the first commitment period of the Kyoto Protocol (2008–2012).

This net position shows that an estimated 27.0 million of these units will be needed to meet the 2020 target.

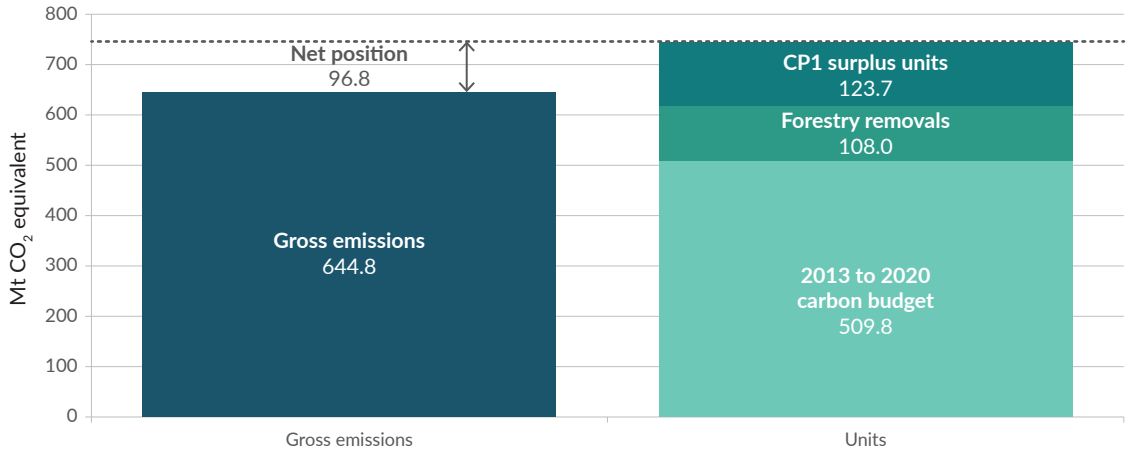
This means that while New Zealand's projected emissions are higher than our carbon budget, we are still projecting to meet the 2020 target.

* Definitions

Carbon budget is the quantity of emissions we are allowed to emit in a defined period of time.

Unit in the net position report represents one tonne of greenhouse gas emissions as carbon dioxide equivalent.

Figure 6: New Zealand's projected gross emissions and units over the 2013–2020 period



7 Note: New Zealand will report progress towards its 2030 Nationally Determined Contribution in the early 2020s.

What is New Zealand's Greenhouse Gas Inventory?

The Greenhouse Gas Inventory is the official annual estimate of all human-generated greenhouse gas emissions and removals in New Zealand. The greenhouse gases covered in the inventory include carbon dioxide, methane, nitrous oxide and fluorinated gases.

The inventory is one of New Zealand's mandatory reporting obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The inventory is produced following the UNFCCC reporting guidelines and the international methodology guidelines set out by the Intergovernmental Panel on Climate Change (IPCC).

The Ministry for the Environment is the lead agency responsible for producing the inventory, but preparing and compiling the inventory is a cross–government effort. The inventory report is submitted about 15 months after the end of the calendar year, providing time for the data to be collected, processed and analysed.

The inventory is the key source of evidence on New Zealand's greenhouse gas emissions trends

New Zealand's inventory data are used for both international and domestic reporting. The inventory informs New Zealand's policy recommendations on climate change and enables us to monitor progress towards our emissions reductions targets.

Inventory estimates are recalculated every year

The inventory follows a process of continuous improvement. When the methodology or underlying data change the whole inventory time series, from the base year (1990) to the latest year, is recalculated. This means the emissions estimates are only up to date in the latest inventory, and previous inventories are not useful for comparisons. Changes made to the inventory are often related to improvements in activity data collection, emission factors and methodology, or the identification of additional emission sources.

Acknowledgements

The Ministry for the Environment thanks the following government agencies for their contribution to the production of New Zealand's Greenhouse Gas Inventory: the Ministry of Business, Innovation and Employment, Environmental Protection Authority, Ministry of Foreign Affairs and Trade, Ministry for Primary Industries and Stats NZ.

The **complete inventory submission** is available on the Ministry for the Environment's website at **www.mfe.govt.nz/climate-change/state-of-our-atmosphere-and-climate/new-zealands-greenhouse-gas-inventory**

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