



Snapshot
April 2020

New Zealand's Greenhouse Gas Inventory 1990–2018

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 1990–2018. For background information on the inventory, see the last page of this snapshot.

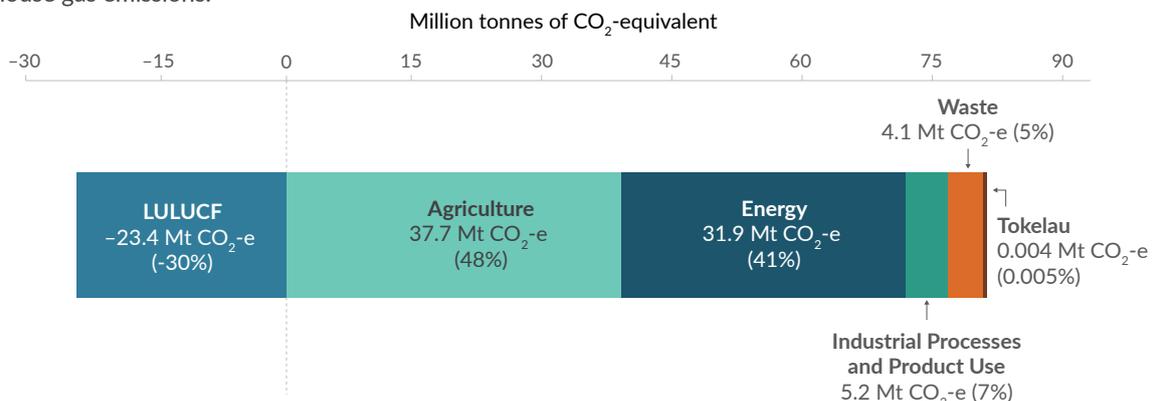
The **full inventory report** is available on our website at www.mfe.govt.nz/publications/climate-change/new-zealands-greenhouse-gas-inventory-1990-2018.

The **interactive emissions tracker** (available at 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 greenhouse gas emissions in 2018 were 78.9 million tonnes of carbon dioxide equivalent (Mt CO₂-e).
- > Gross emissions in 2018 were comprised of 44 per cent carbon dioxide, 43 per cent methane, 10 per cent nitrous oxide and 2 per cent fluorinated gases.
- > Between 1990 and 2018, gross emissions increased by 24 per cent (15.3 Mt CO₂-e). This increase is mostly due to increases in methane from dairy cattle digestive systems and carbon dioxide from road transport.
- > The Agriculture and Energy sectors were the two largest contributors to New Zealand's gross emissions in 2018, at 48 per cent and 41 per cent, respectively (figure 1).
- > The Land Use, Land-Use Change and Forestry (LULUCF) sector offset 30 per cent of New Zealand's gross emissions in 2018 (figure 1).
- > New Zealand's net emissions in 2018 were 55.5 Mt CO₂-e. Between 1990 and 2018, net emissions increased 57 per cent (20.2 Mt CO₂-e). This increase is mostly due to the underlying increase in gross emissions and the increased volume of timber harvested from New Zealand's plantation forest estate in 2018 compared with 1990.
- > Gross emissions in 2018 were 1 per cent lower than 2017 levels and net emissions were 3 per cent lower. This is mainly due to a decline in emissions from manufacturing and construction, and public electricity and heat production; and a reduced rate of deforestation and an increase in the production of harvested wood products.

Figure 1: New Zealand's emissions profile in 2018. This graph shows how much each sector¹ contributed to New Zealand's 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 Tokelau is an overseas dependent territory. 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 six 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, livestock digestive systems, fertiliser and manure)
- > Waste (eg, 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).

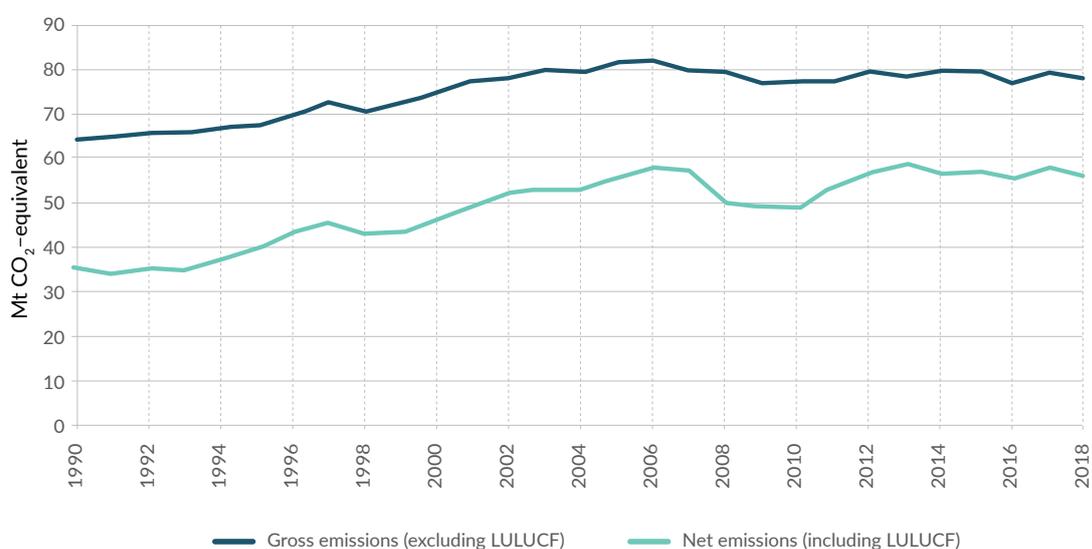
This is separate from the livestock emissions reported in the Agriculture sector. It covers changes that occur in soils and vegetation from land management, and is the only sector where both emissions and removals of carbon dioxide occur

- > New Zealand's 'Other' sector, Tokelau.

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 2018



Gross emissions are dominated by emissions from the Agriculture and Energy sectors

New Zealand's gross greenhouse gas emissions were 78.9 million tonnes of carbon dioxide equivalent* (Mt CO₂-e) in 2018. This is a 1 per cent decrease from 2017 emissions, primarily caused by a decline in emissions from manufacturing and construction, which are reported in the Energy sector.

The Agriculture and Energy sectors contributed the most to New Zealand's emissions at 47.8 per cent and 40.5 per cent of gross emissions in 2018, respectively (figure 1). Emissions from road transport made up 19.1 per cent of gross emissions.

Together, methane and nitrous oxide, largely from agricultural sources, made up over half of our gross emissions (43.5 and 9.6 per cent, respectively). The remaining emissions consisted mostly of carbon dioxide (44.5 per cent in 2018), largely from the Energy and IPPU sectors.

Since 1990, New Zealand's gross emissions have increased by 24.0 per cent. The five emission sources that contributed the most to this increase were:

- > enteric fermentation from dairy cattle (methane from livestock digestive systems)
- > fuel use in road transport (carbon dioxide)
- > agricultural soils from increased fertiliser use (nitrous oxide)
- > industrial and household refrigeration and air-conditioning systems as a result of the phase out of ozone-depleting substances resulting in increased use of hydrofluorocarbon-based refrigerants (fluorinated gases)²
- > fuel use in manufacturing industries and construction from increased production due to economic growth (carbon dioxide).

2 Fluorinated gases comprise sulphur hexafluoride (SF₆), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

* Definition

Carbon dioxide equivalent (CO₂-e) is a measure for comparing different greenhouse gases based on the heating effect of each gas relative to an equivalent amount of carbon dioxide.³ CO₂-e is used for expressing emissions of different greenhouse gases in a common unit, which allows them to be reported and compared consistently.

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.

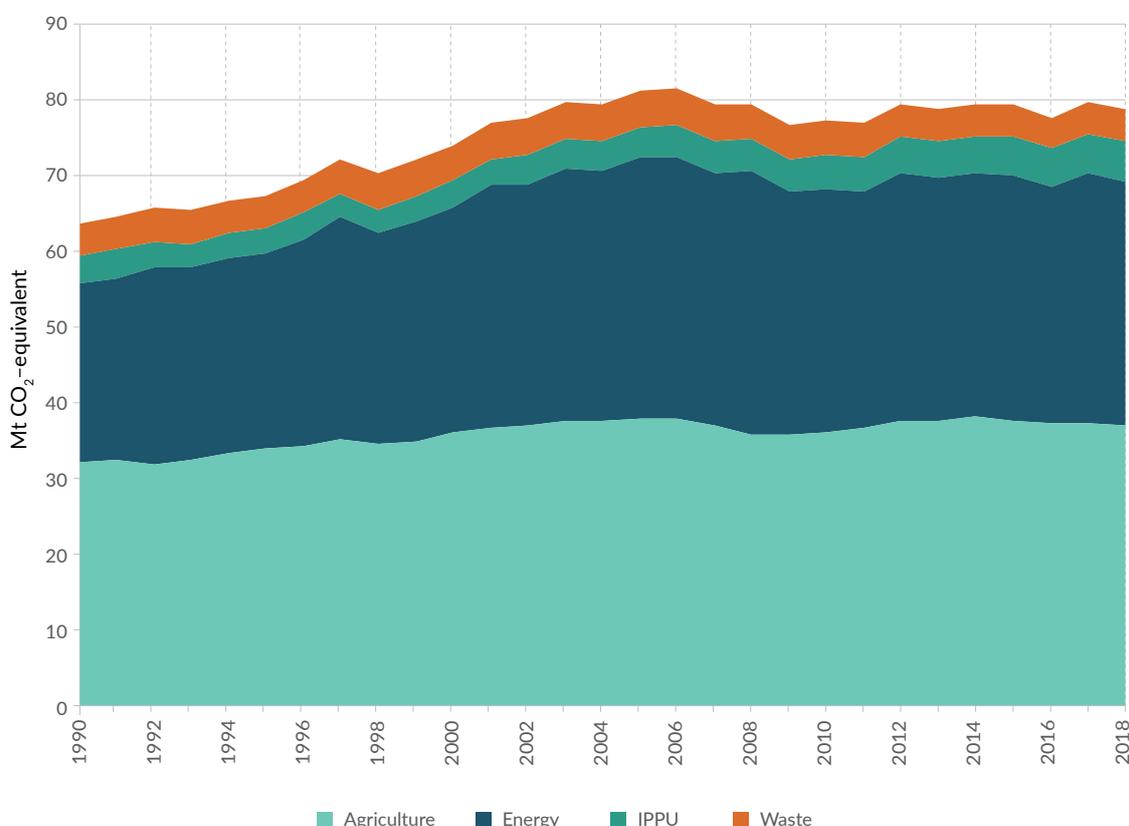
To estimate net emissions, the Ministry for the Environment and the Ministry for Primary Industries calculate the area of forest in New Zealand. According to these estimates, approximately 11,238 hectares of new forest were planted and 4061 hectares deforested in 2018.

New Zealand's net emissions under the United Nations Framework Convention on Climate Change (UNFCCC) were 55.5 Mt CO₂-e in 2018. This is calculated by subtracting the 23.4 Mt CO₂-e of net removals that occurred in the LULUCF sector from gross emissions of 78.9 Mt CO₂-e. Net emissions have increased by 57.2 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 29.7 per cent of New Zealand's gross emissions in 2018 (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 2018



Note: The emissions contribution from Tokelau is too small to be included in the figure.

³ The 1990–2018 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: unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf

Agriculture

1990–2018

Between 1990 and 2018, emissions from the Agriculture sector increased by 17.1 per cent (figure 3). This is primarily due to an 85.6 per cent increase in the national dairy herd since 1990 and an increase in the application of synthetic nitrogen fertiliser of 670 per cent since 1990.

The populations of sheep, beef cattle and deer have decreased by 52.9, 19.1 and 12.6 per cent, respectively since 1990. This decline has been partially offset by increases in the dairy cattle population.

2017–2018

In 2018, emissions from the Agriculture sector increased slightly (by around 0.7 per cent). This increase was mainly due to increased emissions from non-dairy (beef) and dairy cattle and sheep, and an increase in the application of synthetic nitrogen fertiliser.

Energy

1990–2018

Emissions from the Energy sector in 2018 were 34.3 per cent higher than in 1990 (figure 3). Most of this increase came from road transport (an increase in emissions of 101.6 per cent), and the use of fossil fuels for manufacturing and construction. The trend shows emissions increasing up until 2008, after which they show a general decline (figure 3).

2017–2018

Between 2017 and 2018, emissions from the Energy sector decreased by 3.2 per cent. The decrease was primarily caused by a 10 per cent reduction in emissions from manufacturing and construction. There was also an 8.4 per cent decrease in public electricity and heat production emissions. This decrease was primarily due to a drop in natural gas-fired generation in response to higher levels of hydro generation. The decrease in these sectors was partially offset by an increase in emissions (2 per cent) from road transportation, which is the largest contributor to emissions from the Energy sector.

Industrial Processes and Product Use (IPPU)

1990–2018

Emissions from the IPPU sector in 2018 were 44.1 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.

2017–2018

Between 2017 and 2018, emissions from the IPPU sector increased by 0.7 per cent. This change was largely driven by an increase in emissions of HFCs (9.5 per cent), mainly used in refrigeration and air conditioning which was offset by decreases in emissions from the chemical, metal and mineral industries (14.8, 1.8 and 8.1 per cent, respectively).

Waste

1990–2018

In 2018, Waste sector emissions were 0.2 per cent above 1990 levels. Annual emissions increased between 1990 and 2002, because of the ongoing growth in population and economic activity, and have remained fairly consistent since 2005. This is mainly due to ongoing improvements in managing solid waste disposal at municipal landfills, particularly in landfill gas recovery.

2017–2018

Waste sector emissions in 2018 were 35.2 kt CO₂-e (0.9 per cent) lower than in 2017. This decrease is largely the result of decreases in CH₄ emissions in the *Solid waste disposal* category, due to an increase in CH₄ recovery and a slight reduction in farm waste.

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

There are two ways of calculating emissions and removals from the LULUCF sector. The first way 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 and removals towards New Zealand's emissions reduction target for the 2013–2020 period. This estimate is referred to as net target emissions.

LULUCF reporting under the UNFCCC

1990–2018

In 2018, the LULUCF sector was a net carbon sink,* with net removals of 23.4 Mt CO₂-e. Emissions from the LULUCF sector in 2018 were 17.3 per cent higher than they were in 1990 as the harvest rate of planted forests was greater in 2018 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.

2017–2018

Between 2017 and 2018, net emissions from the LULUCF sector decreased by 3.0 per cent (-22.7 to -23.4 Mt CO₂-e), largely due to a reduced rate of deforestation and an increase in the production of harvested wood products.

* Definition

A **Carbon sink** is anything that removes more carbon dioxide from the atmosphere than it emits.

Figure 4: Net emissions from the LULUCF sector from 1990 to 2018 (under UNFCCC reporting)



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 managed as an emissions budget across the period. 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 the activities specified in both Article 3.3 and Article 3.4 of the Kyoto Protocol, covering afforestation/reforestation/deforestation and forest management, respectively. 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. It contains internationally binding emissions reduction targets for the developed country Parties that are listed in its Annex B.

Afforestation is the establishment of a forest in an area where no forest has been 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 New Zealand's emissions come from the Agriculture sector. Typically, the Agriculture sector constitutes only a small proportion of gross emissions (12.3 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. These gases have a greater warming effect compared with carbon dioxide. Based on the latest available inventory data for 2017 for Annex 1 countries, New Zealand's gross emissions ranked 22nd among the Annex I countries, but New Zealand's emissions per person were the sixth highest at 17.2 tonnes CO₂-e per capita (figure 5).

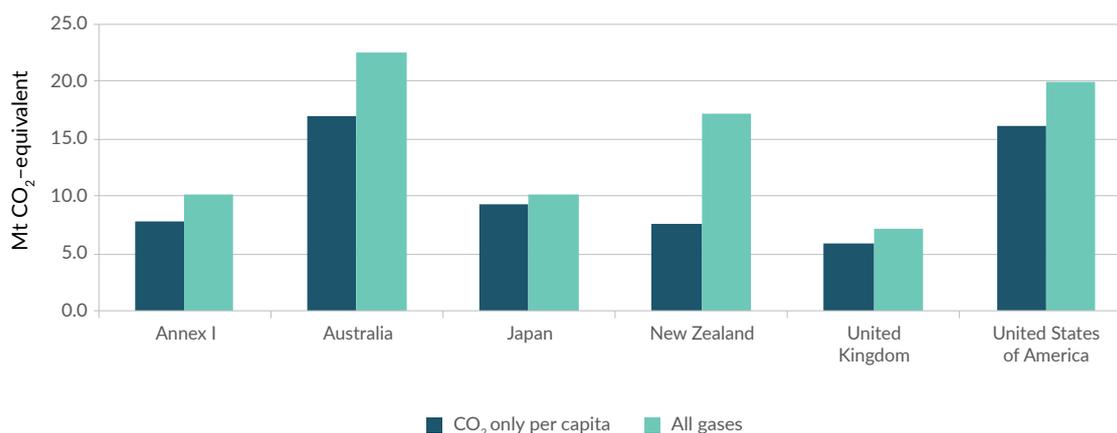
New Zealand's gross carbon dioxide emissions in 2017 were 7.7 tonnes CO₂ per capita, which is below the Annex I average of 7.9 (figure 5). This reflects New Zealand's high proportion of electricity generation from renewable sources. In 2017, the share of electricity generated from renewable energy sources 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, gross emissions have increased since 1990, whereas in many other Annex I countries (eg, the UK and Germany) emissions are now below 1990 levels.

* 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 in which 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.

Figure 5: International comparisons for per capita emissions in 2017⁶



4 All emissions data in this section are from UNFCCC Data Interface (2019). 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): www.wri.org/resources/data-sets/cait-historical-emissions-data-countries-us-states-unfccc

6 Population data from UN Population Division (2018): population.un.org/wpp/Download/Standard/Population

New Zealand's progress towards the 2020 target

The inventory data are used to monitor progress towards the 2013–2020 emissions reduction target, to reduce greenhouse gas emissions to 5 per cent below 1990 levels.⁷ 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
 - > 123.7 million units carried over from the first commitment period of the Kyoto Protocol (2008–2012).
- This net position shows that an estimated 14.6 million of these units will be needed to meet the 2020 target.

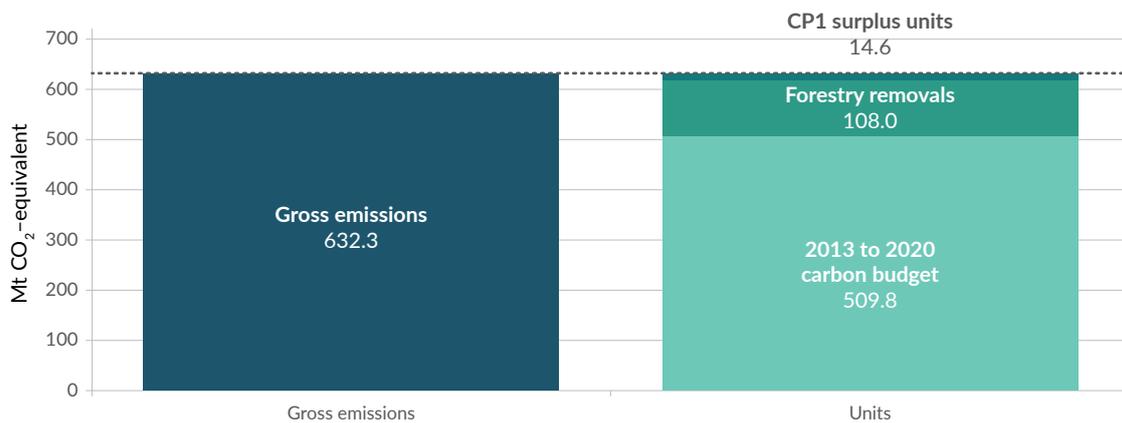
This means that while New Zealand's projected emissions are higher than the carbon budget, projections show that we will still meet the 2020 target.

* Definitions

A **Carbon budget** is the maximum quantity of emissions our targets allow us to emit over a defined period of time.

A **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 start to report progress towards its Nationally Determined Contribution for the period 2021–2030 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 UNFCCC and the Kyoto Protocol. The inventory is produced following the UNFCCC reporting guidelines and the international methodology guidelines set out by the 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 being reported on, 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 and removals 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 monitoring of progress towards 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; the Environmental Protection Authority; the Ministry of Foreign Affairs and Trade; the 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



New Zealand Government

Published in April 2020 by the Ministry for the Environment, Manatū Mō Te Taiao, PO Box 10362, Wellington 6143, New Zealand

Publication number: INFO 930