



Snapshot
April 2022

New Zealand's Greenhouse Gas Inventory 1990–2020

Te Rārangi Haurehu Kati Mahana a Aotearoa 1990–2020

The Greenhouse Gas Inventory is the official annual estimate of all human-generated greenhouse gas emissions and removals in New Zealand. This is a summary of the latest Inventory, which covers the years 1990–2020.

The Inventory measures New Zealand's progress against obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The Inventory adheres to the UNFCCC reporting guidelines and the international methodology guidelines set out by the Intergovernmental Panel on Climate Change (IPCC). The Inventory covers emissions from five sectors (Agriculture, Energy, Industrial Processes and Product Use (IPPU), Waste and Land Use, Land-Use Change and Forestry (LULUCF), as well as the additional information required under the Kyoto Protocol. It also includes emissions from Tokelau.

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, verified, processed and analysed.

The Inventory is the authoritative 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 reduction targets.

To learn more about how New Zealand reports and measures progress towards our targets and other emissions reporting, go to our webpage on [New Zealand's emissions reduction targets](#).

The greenhouse gases covered in the Inventory are carbon dioxide, methane, nitrous oxide and fluorinated gases.

Inventory estimates are recalculated every year

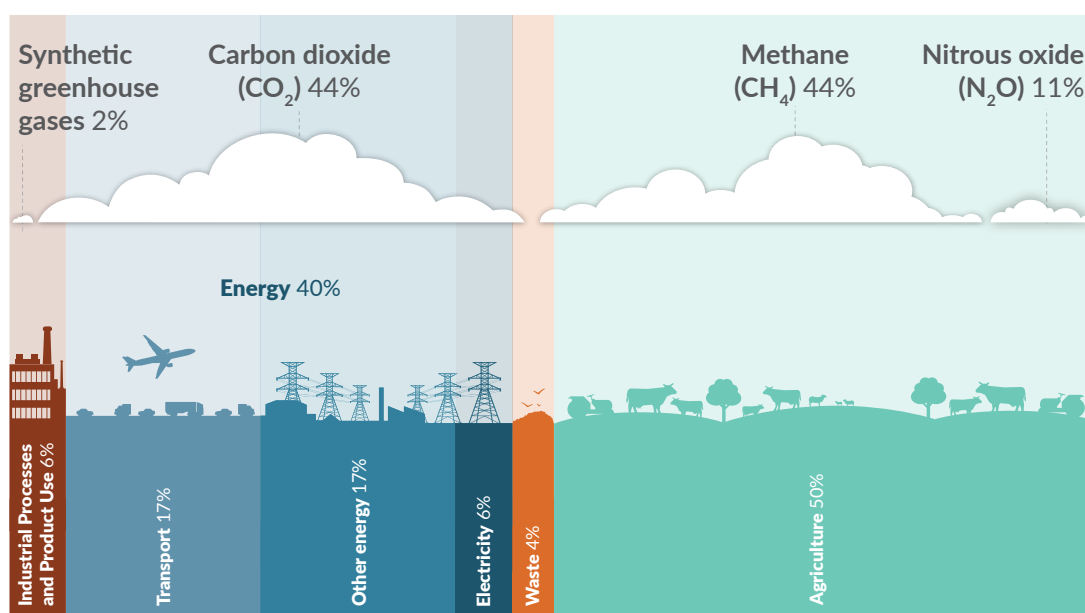
The Inventory follows a process of continuous improvement. The whole Inventory time series, from the base year (1990) to the latest year, is recalculated when the methodology or underlying data change. This means the emissions estimates are only up to date in the latest Inventory, and previous inventories 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.

The Ministry for the Environment has published information on the planned key methodological improvements being introduced into the Inventory and their estimated impact on emissions. This is available on the Ministry for the Environment's webpage: [Planned methodological improvements for Aotearoa New Zealand's Greenhouse Gas Inventory 1990–2020](#).

The inventory helps us understand how we are progressing towards our emissions reduction targets

New Zealand's Greenhouse Gas Inventory 1990–2020 provides the data on how we are tracking to meet our 2013–2020 emissions reduction target under the UNFCCC. Once it has been reviewed, the 2022 Inventory provides confirmed emissions and removals for the whole of the target period. We have released a Net Position update on how we are progressing towards this target which can be accessed on the Ministry for the Environment's webpage: [Latest update on New Zealand's 2020 net position](#).

Figure 1: Breakdown of New Zealand's gross greenhouse gas emissions by sector and gas type in 2020



Breakdown of emissions from the Agriculture, Energy, Industrial Processes and Product Use (IPPU), and Waste sectors. The Land Use, Land-Use Change and Forestry sector is not shown as it is an overall net remover of emissions. The emissions contribution from Tokelau is too small to be shown in the figure.

Key findings of the 2022 Inventory

In 2020

- > New Zealand's gross greenhouse gas emissions in 2020 were 78.8 million tonnes of carbon dioxide equivalent (Mt CO₂-e).
- > Gross emissions in 2020 comprised 44 per cent carbon dioxide, 44 per cent methane, 11 per cent nitrous oxide and 2 per cent fluorinated gases.¹
- > The Agriculture and Energy sectors were the two largest contributors to New Zealand's gross emissions in 2020, at 50 per cent and 40 per cent, respectively.
- > New Zealand's net emissions in 2020 were 55.5 Mt CO₂-e.
- > The Land Use, Land-Use Change and Forestry (LULUCF) sector offset 30 per cent (23.3 Mt CO₂-e) of New Zealand's gross emissions in 2020.

Gross emissions since 1990

- > Between 1990 and 2020, gross emissions increased by 21 per cent (13.6 Mt CO₂-e). This is mostly due to increased methane from growth in the dairy cattle population and carbon dioxide from road transport.
- > The Waste sector had the only overall reduction in gross emissions, with a decrease of 17 per cent (0.7 Mt CO₂-e) due to ongoing improvements in the management of landfills.

Net emissions since 1990

- > Between 1990 and 2020, net emissions increased by 26 per cent (11.5 Mt CO₂-e), due to the underlying increase in gross emissions

by 26 per cent (11.5 Mt CO₂-e), due to the underlying increase in gross emissions.

- > Since 1990, net removals from the LULUCF sector have increased by 10 per cent (2.1 Mt CO₂-e) largely due to an increase in the production of harvested wood products.

Trends between 2019 and 2020

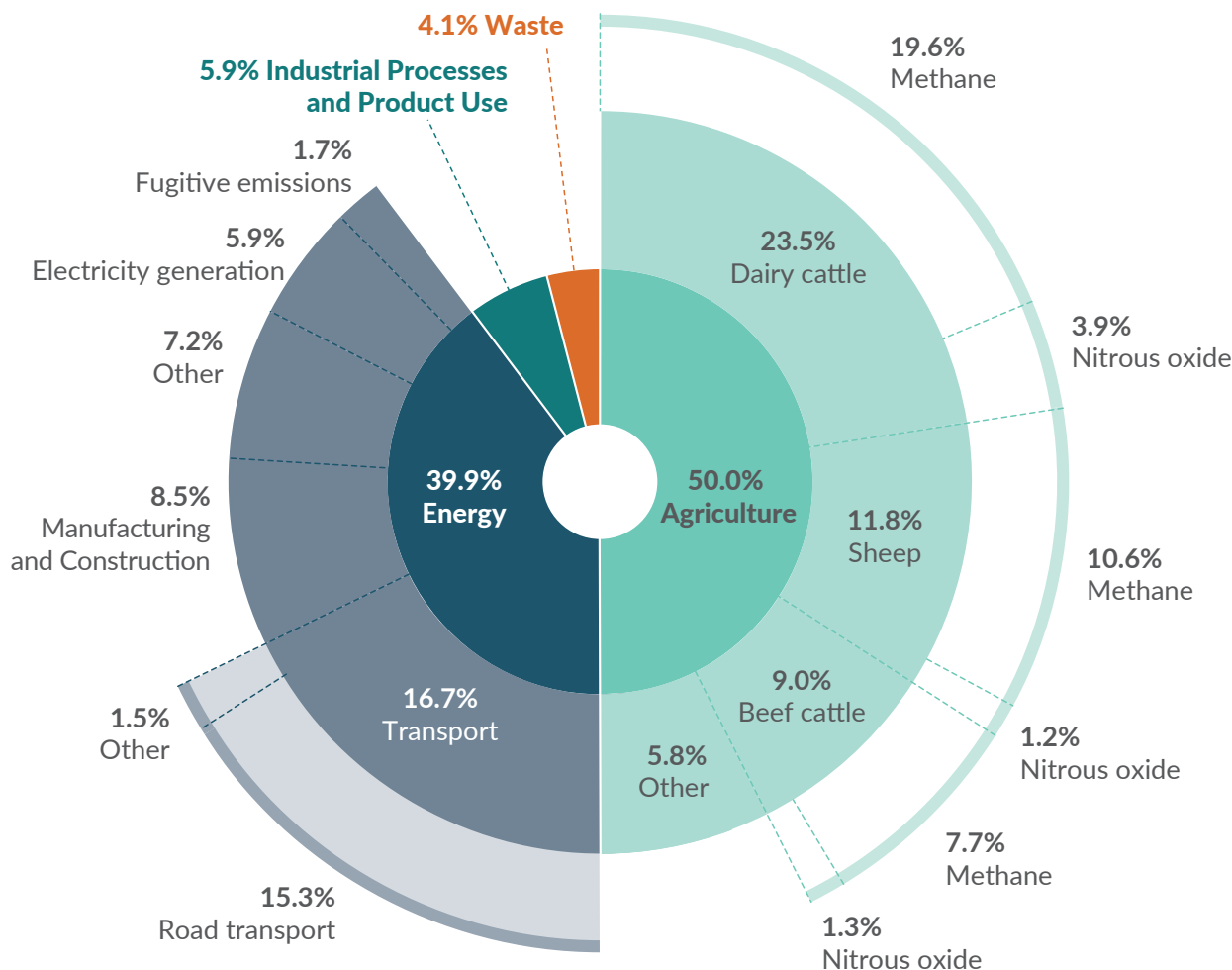
- > Gross emissions decreased by 3 per cent (2.8 Mt CO₂-e).
- > Net emissions decreased by 5 per cent (3.1 Mt CO₂-e).
- > Both changes are mainly due to decreases in fuel use from road transport, manufacturing industries and construction, and domestic aviation as a result of the COVID-19 restrictions.

Further impacts from COVID-19 restrictions

- > COVID-19 restrictions have also reduced emissions from the IPPU sector due to plant shutdowns and decreased production, as well as declines in emissions from domestic shipping in Tokelau.
- > While overall LULUCF removals increased, they decreased in the harvested wood products category as production was reduced due to disruptions in processing and logistics.
- > There were no discernible impacts on the Agriculture and Waste sector emissions from the COVID-19 restrictions.

¹ Percentages may not add to 100 due to rounding.

Figure 2: Gross greenhouse gas emissions in 2020 by sector, sub-category and gas type



Breakdown of emissions by sector (Agriculture, Energy, Industrial Processes and Product Use (IPPU), and Waste), and sub-category, and greenhouse gas by type. The emissions contribution from Tokelau is too small to be shown in the figure.

This snapshot summarises the latest Inventory (submitted to the UNFCCC in April 2022), which covers data of the years 1990–2020, including:

- > key findings
- > New Zealand’s emissions profile in 2020
- > New Zealand’s gross and net emissions
- > emissions trends by sector
- > how New Zealand compares to other countries.

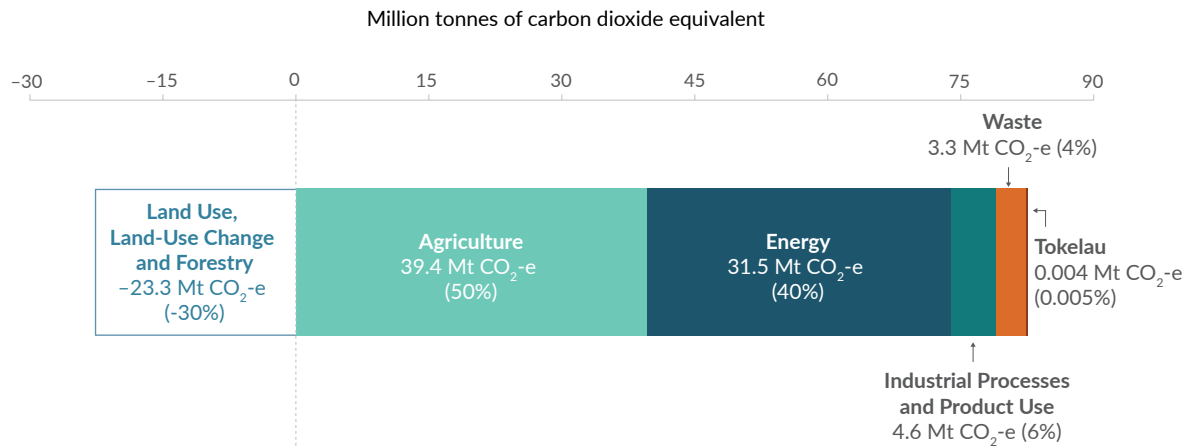
> **Links to Inventory publications (released April 2022) and Emissions Tracker**

- > **Full report – New Zealand’s Greenhouse Gas Inventory 1990-2020** – Access the latest Inventory publication, including supporting tables and files.
- > **Interactive Greenhouse Gas Emissions Tracker** – Use the interactive tool to access and manipulate data from the latest Inventory to see how New Zealand’s emissions have changed over time.
- > **Net position** – The net position is used to track progress towards our 2020 emissions reduction target for the period 2013–2020.

New Zealand's emissions profile in 2020

New Zealand's greenhouse gas (GHG) emissions and removals in 2020 from each sector is shown in Figure 3. Tokelau is an overseas dependant territory. All emissions from Tokelau are reported together in the Other sector in the Inventory.

Figure 3: Breakdown of New Zealand's emissions (in million tonnes of carbon dioxide equivalent, Mt CO₂-e) by sector in 2020



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

New Zealand's gross and net emissions

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

- > Agriculture (eg, livestock digestive systems, fertiliser and manure)
- > Energy (eg, road transport and electricity production)
- > Industrial Processes and Product Use (IPPU) (eg, production of metals and chemicals, and use of refrigerants)
- > Waste (eg, landfills)
- > Land Use, Land-Use Change and Forestry (LULUCF). The LULUCF sector keeps track of GHGs 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 land-use change, and is the only sector where both emissions and removals of carbon dioxide occur

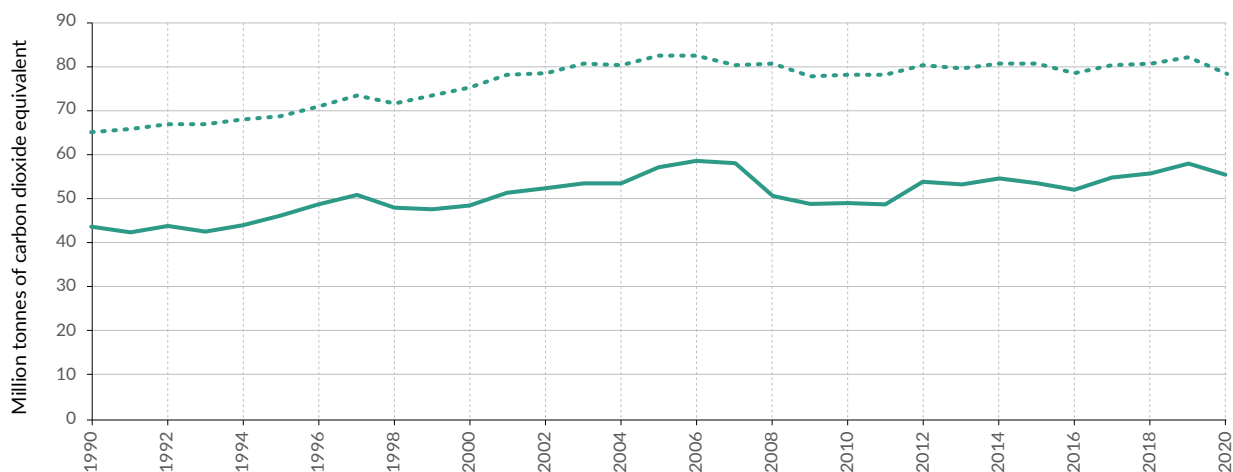
- > New Zealand's 'Other' sector, Tokelau.

Gross emissions are New Zealand's total emissions from the Agriculture, Energy, IPPU and Waste sectors.

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

Tokelau does not report LULUCF emissions, therefore, gross and net emissions for Tokelau are the same.

Figure 4: New Zealand's gross and net emissions (in Mt CO₂-e) from 1990 to 2020



Gross emissions exclude the Land Use, Land-Use Change and Forestry (LULUCF) sector. Net emissions include the LULUCF sector.

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

New Zealand's gross greenhouse gas emissions were 78.8 million tonnes of carbon dioxide equivalent Mt CO₂-e*, in 2020. This is a 3 per cent decrease from 2019 emissions, primarily caused by decreases in fuel use from road transport, manufacturing and construction, and domestic aviation resulting from COVID-19 restrictions.

The Agriculture and Energy sectors contributed the most to New Zealand's emissions at 50 per cent and 40 per cent of gross emissions in 2020, respectively (Figure 1). Emissions from road transport made up 15 per cent of gross emissions.

Together, methane and nitrous oxide, largely from agricultural sources, made up over half of our gross emissions (44 and 11 per cent, respectively) on a CO₂-e basis. The remaining emissions consisted mostly of carbon dioxide (44 per cent), largely from the Energy and IPPU sectors.

Since 1990, New Zealand's gross emissions have increased by 21 per cent. The five emission sources that contributed the most to this increase, in decreasing order of magnitude were:

- > enteric fermentation due to an increase in the dairy cattle population (methane)
- > fuel use in road transport due to traffic growth (carbon dioxide)
- > agricultural soils from increased fertiliser use (nitrous oxide)
- > fuel use in manufacturing industries and construction from increased production due to economic growth (carbon dioxide)
- > industrial and household refrigeration and air conditioning systems from increased use of hydrofluorocarbon-based refrigerants (fluorinated gases) that replaced ozone-depleting substances.

Forest planting cycles influence net emissions

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 41,111 hectares of new forest were planted and 2,506 hectares were deforested in 2020.

New Zealand's net emissions, as reported to the UNFCCC, were 55.4 Mt CO₂-e in 2020. This is calculated by subtracting the 23.6 Mt CO₂-e of net removals that occurred in the LULUCF sector, from gross emissions of 78.8 Mt CO₂-e. Net emissions have increased by 26 per cent compared with 1990 levels.

Under the UNFCCC reporting rules, net emissions from the LULUCF sector offset 30 per cent of New Zealand's gross emissions in 2020 (Figure 3). This is a small decrease from 1990 when the LULUCF sector offset 33 per cent of New Zealand's gross emissions (Figure 4). This change is mainly the result of an increase in gross emissions between 1990 and 2020.

* Definition

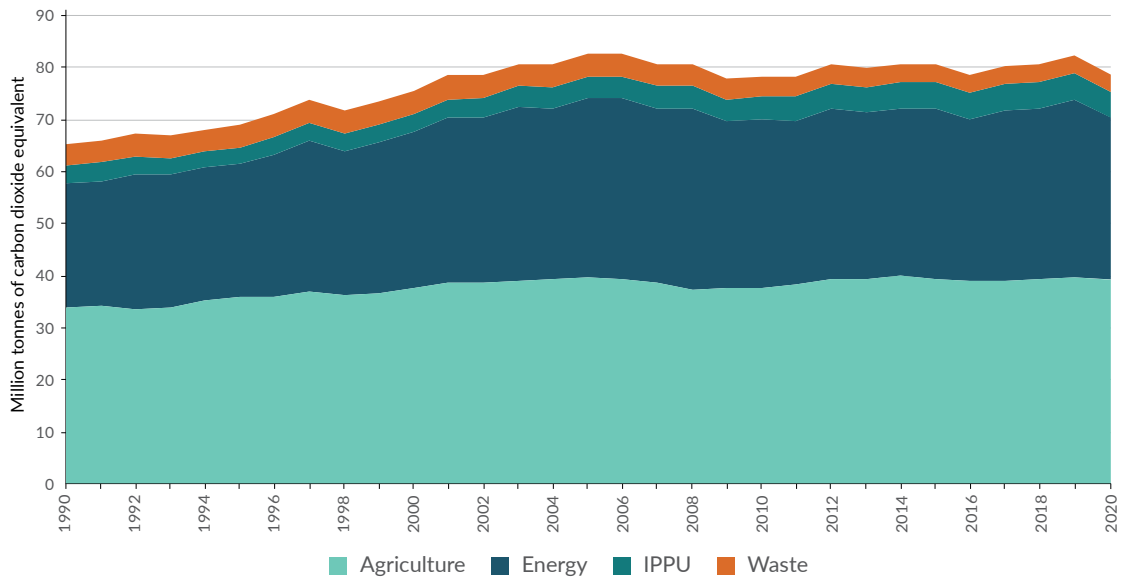
Carbon dioxide equivalent (CO₂-e) is a measure for comparing different GHGs based on the heating effect of each gas relative to an equivalent amount of carbon dioxide. CO₂-e is used for expressing emissions of different GHGs in a common unit, which allows them to be reported and compared consistently.

As per the international reporting guidelines, the 1990–2020 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](#).

From 2023, the Inventory will use 100-year global warming potential values from the IPCC fifth assessment report, as stipulated in the guidelines for GHG inventory reporting under the Paris Agreement.

Emissions trends by sector

Figure 5: New Zealand's gross greenhouse gas emissions (in Mt CO₂-e): trends by sector, excluding LULUCF, from 1990 to 2020



The emissions contribution from Tokelau is too small to be shown in the figure.

Figure 6: New Zealand's gross greenhouse gas emissions (in Mt CO₂-e): absolute change by sector from 1990 to 2020

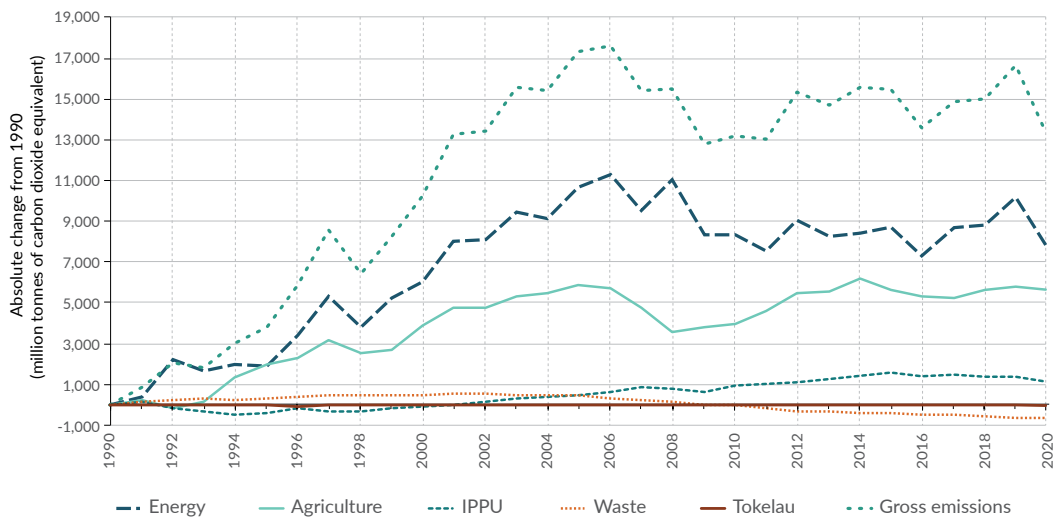
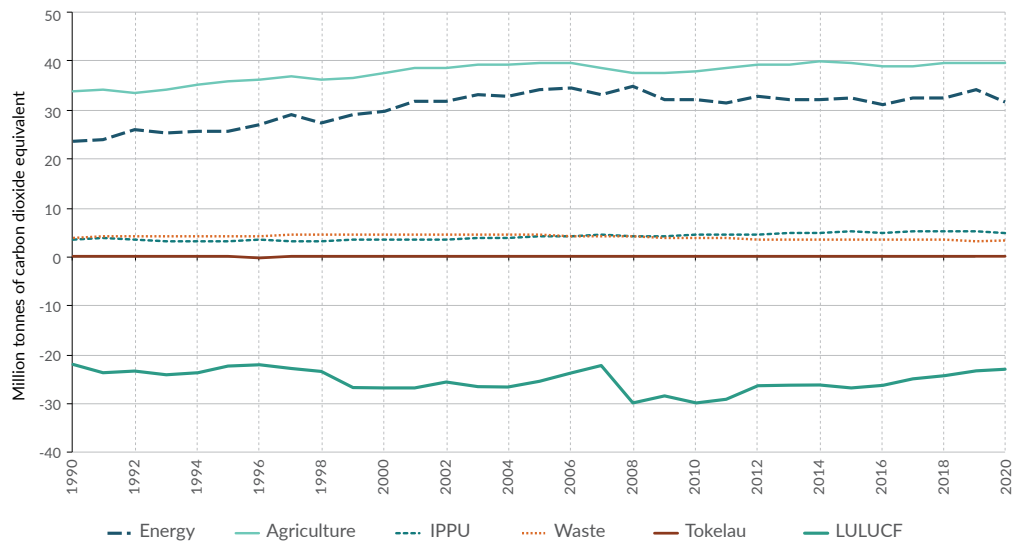


Figure 7: New Zealand's greenhouse gas emissions (in Mt CO₂-e): trends by sector from 1990 to 2020



Agriculture

1990–2020

Between 1990 and 2020, emissions from the Agriculture sector increased by 17 per cent (Figures 5 and 7). This is primarily due to an 80 per cent increase in the national dairy herd since 1990 and an increase in the application of synthetic nitrogen fertiliser by approximately 693 per cent since 1990. These increases have been partially offset by decreases in the populations of sheep, beef cattle and deer by 55, 15 and 15 per cent, respectively, since 1990.

2019–2020

In 2020, emissions from the Agriculture sector decreased slightly (by around 0.2 per cent). This decrease was mainly due to a reduction in the sheep population, as well as decreases in the use of lime and urea fertiliser. Emissions from other sources rose, such as inorganic fertiliser, and beef and dairy cattle, but these increases were not enough to offset the overall decrease in agricultural emissions. COVID-19 restrictions did not have any discernible impacts on emissions from the Agriculture sector in 2020.

Energy

1990–2020

Emissions from the Energy sector in 2020 were 32 per cent higher than in 1990 (Figures 5 and 7). Most of this increase came from road transport (an increase in emissions of 76 per cent), and the use of fossil fuels for food, electricity and heat production. The trend shows emissions increasing until 2008, after which they are relatively stable (Figures 5 and 7).

2019–2020

Between 2019 and 2020, emissions from the Energy sector decreased by 7 per cent. This decrease was primarily due to impacts from COVID-19 restrictions which were felt across the Energy sector. This saw decreases in emissions from road transport and domestic aviation, which decreased by 1,093 kt CO₂-e (8 per cent) and 315.3 kt CO₂-e (31 per cent), respectively. This occurred alongside a decrease in emissions from manufacturing and construction of 847.6 kt CO₂-e (11 per cent). The decrease was partially offset by increases in emissions from electricity and heating.

Industrial Processes and Product Use (IPPU)

1990–2020

Emissions from the IPPU sector in 2020 were 29 per cent higher than in 1990 (Figures 5 and 7). The increase was mainly caused by phasing out ozone-depleting substances under the Montreal Protocol and replacing them with hydrofluorocarbons 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 metal production have gradually increased due to the growth in output.

2019–2020

Between 2019 and 2020, emissions from IPPU decreased by 5 per cent. This was the result of a significant decrease in emissions from the metal industry and smaller decreases in other categories, due to COVID-19-related plant shutdowns and consequent decreased production.

Waste

1990–2020

In 2020, Waste sector emissions were 17 per cent below 1990 levels. Annual emissions increased between 1990 and 2002 because of the ongoing growth in population and economic activity, and have declined steadily since 2004. This decline is mainly due to ongoing improvements in managing solid waste disposal at municipal landfills, particularly in landfill gas recovery.

2019–2020

Waste sector emissions in 2020 were 43.8 kt CO₂-e (1 per cent) lower than in 2019. This decrease is largely the result of decreases in methane emissions in the solid waste disposal category, due to changes in the composition of waste disposed to municipal landfills. The emissions from the Waste sector in 2020 did not have any discernible impacts from COVID-19 restrictions.

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 is to report on a subset of LULUCF emissions and removals in accordance with the supplementary reporting requirements of the Kyoto Protocol (KP-LULUCF). The latter 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

1990–2020

In 2020, the LULUCF sector was a net carbon sink* with net removals of 23.3 Mt CO₂-e. 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.

Removals from the LULUCF sector in 2020 were 9.8 per cent higher than they were in 1990. This change is largely due to an increase in the production of harvested wood products.

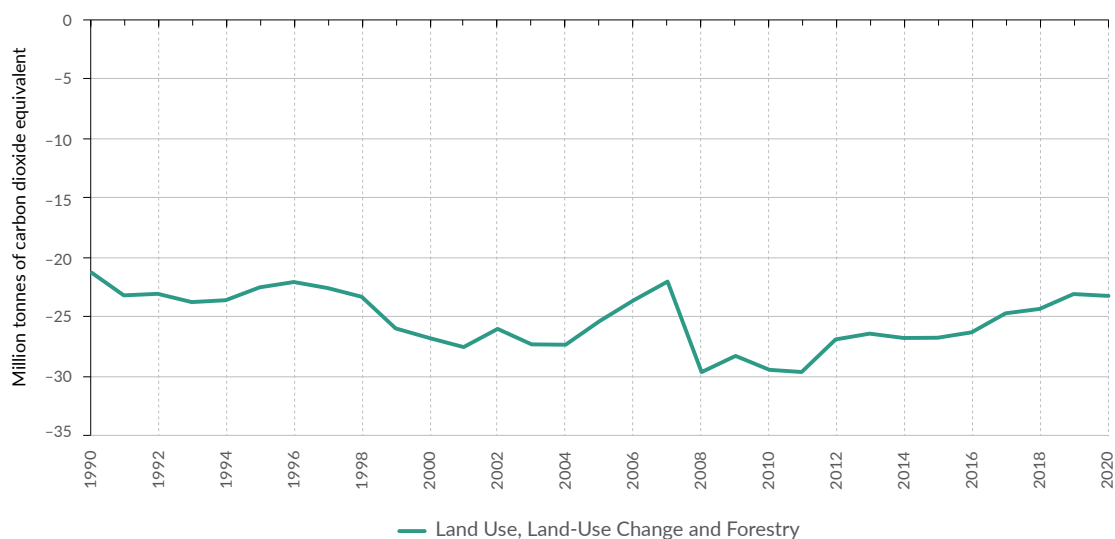
2019–2020

Between 2019 and 2020, net removals from the LULUCF sector increased by 1 per cent (23.0 to 23.3 Mt CO₂-e). This increase in removals was driven by reduced deforestation in planted forest, resulting in fewer conversions from forest land to grassland. This reduction was partially offset by the decrease in removals from harvested wood products, as production was reduced due to COVID-19-related disruptions in processing and logistics.

* Definition

A **carbon sink** is any process, activity or mechanism which removes a GHG from the atmosphere. The LULUCF sector is a net carbon sink as it removes more carbon dioxide from the atmosphere than it emits.

Figure 8: New Zealand's net greenhouse gas emissions (in Mt CO₂-e): trends in the LULUCF sector from 1990 to 2020 (under UNFCCC reporting)



The Land Use, Land-Use Change and Forestry sector net emissions are negative as removals from the atmosphere are greater than emissions.

LULUCF reporting under the Kyoto Protocol*

Although New Zealand chose to take its 2020 target under the UNFCCC rather than the Kyoto Protocol, we decided to apply the Kyoto Protocol rules in our target accounting to ensure transparency and consistency.

To report on progress towards the 2020 target, we apply the target accounting approach which uses only a subset of all emissions and removals from the LULUCF sector that include forests planted post-1989, changes in emissions and removals in pre-1990 forests that result from changes in forest management practices, and deforestation.*

We report progress towards the 2020 target in the **net position report**.

What are our biogenic methane emissions?

In 2019, the Climate Change Response (Zero Carbon) Amendment Act set into law new domestic 2050 targets including for biogenic methane. Biogenic methane refers to all methane emissions from the Agriculture and Waste sectors (as reported in the Inventory). The current targets for biogenic methane are to reduce biogenic methane emissions by 24 to 47 per cent below 2017 levels by 2050, as well as 10 per cent below 2017 levels by 2030.

* 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, as per the Doha Amendment. For further information on the Doha Amendment, go to the Ministry for the Environment's webpage on [New Zealand and the United Nations Framework Convention on Climate Change](#).

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.

All units in Mt CO₂-e using the IPCC Fourth Assessment Report's 100-year Global Warming Potential for methane (25)

	2017	2020
Gross methane (not including the LULUCF sector)	34.4	34.3
Biogenic methane	33.5	33.5
Agriculture methane	30.3	30.5
Waste methane	3.2	3.0

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 of the other 43 Annex I countries.* This is because half of New Zealand's emissions come from the Agriculture sector (50 per cent). Typically, in other Annex I countries, the Agriculture sector constitutes only a small proportion of gross emissions (13 per cent on average).

All emissions data in this section are from the **United Nations Framework Convention on Climate Change (UNFCCC) Data Interface (2020)**. 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 greenhouse gas reporting guidelines to report their emissions and removals.

The high level of agricultural production in New Zealand means methane and nitrous oxide make up a higher proportion of gross emissions. These gases have a greater warming effect compared with carbon dioxide. Based on the latest available Inventory data for 2019 for Annex 1 countries, New Zealand's gross emissions ranked 21st among the Annex I countries, but New Zealand's emissions per person were the sixth highest at 17.2 tonnes carbon dioxide equivalent (CO₂-e) per capita (Figure 9).

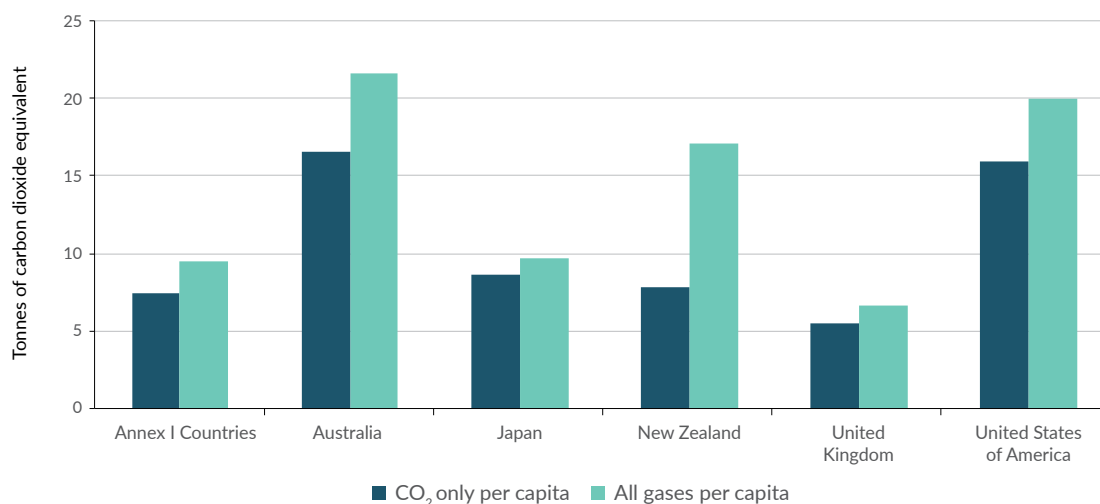
* Definition

Annex I to the UNFCCC lists the industrialised countries that were members of the Organisation for Economic Co-operation and Development (OECD) and countries with economies in transition in 1992 (the year in which the UNFCCC was agreed). 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.

The latest Annex 1 emissions are from 2019, from inventories released in 2021. New Zealand's gross carbon dioxide emissions in 2019 were 7.8 tonnes per capita, which is close to the Annex I 2019 average of 7.5 tonnes of CO₂ per capita (Figure 9). This reflects New Zealand's high proportion of electricity generation from renewable sources. In 2020, the share of electricity generated from renewable energy sources in New Zealand was 81 per cent.

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

Figure 9: International comparisons for per capita emissions (in tonnes of CO₂-e) in 2019



Note: All emissions data in this section is from **UNFCCC Data Interface (2020)**. Annex I data in these comparisons count the members of the EU separately, and exclude the EU as a whole.

The population data used to generate Figure 9 was taken as 2019 population data from the **UN Population Division (2020)**.

Annex 1 countries (UNFCCC) are compared with Australia, Japan, New Zealand, the United Kingdom, and the United States of America. Each country shows two bars which represent 'CO₂ only per capita' and 'All gases'.

New Zealand's progress towards the international 2020 target under the UNFCCC

The Inventory data are used to monitor progress towards the international 2013–2020 emissions reduction target under the UNFCCC, to reduce greenhouse gas emissions to 5 per cent below 1990 gross GHG levels.

New Zealand will provide its final report on progress towards its 2020 target in its fifth biennial report that will be submitted to the UNFCCC in December 2022.

Progress towards New Zealand's 2020 target is contained in the Ministry for the Environment's 2020 Net Position Report, which is updated when a new Inventory is published. The latest Net Position report is available on the Ministry for the Environment webpage: [Latest update on New Zealand's 2020 net position](#).

New Zealand's progress towards Nationally Determined Contributions (NDCs) under the Paris Agreement

New Zealand will start to report progress towards its first **Nationally Determined Contribution (NDC)** for the period 2021–2030 with its Inventory report in April 2023 (this will be the first Inventory report to include data from the NDC period), together with its first biennial transparency report due to be submitted to the UNFCCC by December 2024.

For more information on New Zealand's NDC, see the Ministry for the Environment webpage: [Nationally Determined Contribution](#).

Other sources of information

New Zealand's Greenhouse Gas Inventory is the official source of information for New Zealand's greenhouse gas emissions data.

To learn more about how New Zealand reports and measures progress towards our targets and other emissions reporting, go to our webpage on [New Zealand's emissions reduction targets](#).

Other sources of data derived from the Inventory for domestic purposes include:

- > The Ministry's guidance on measuring and reporting emissions. For more information on this, and to access the latest publication of the Measuring Emissions Guide, go to our webpage on [Measuring, reporting and offsetting greenhouse gas emissions](#).
- > Stats NZ's emissions products:
 - > [Industry and household emissions \(SEEA\)](#)
 - > [Quarterly emissions](#)
 - > [Regional emissions](#)
 - > [Consumption emissions](#)

Next Inventory publication

New Zealand's Greenhouse Gas Inventory 1990–2021 will be published by 15 April 2023.



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; Stats New Zealand, and the Ministry of Climate, Oceans and Resilience, Government of Tokelau.



Te Kāwanatanga o Aotearoa
New Zealand Government

Published in April 2022 by the Ministry for the Environment, Manatū Mō Te Taiao, PO Box 10362, Wellington 6143, New Zealand
Publication number: INFO 1043