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 1990–2016. For background information on the inventory, see the last page of this snapshot.

The full inventory report is available on our website.

The interactive emissions tracker provides the latest inventory data in a user-friendly format.

### Key points

- New Zealand’s gross emissions have increased 19.6 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 2015 and 2016, gross emissions decreased by 2.4 per cent, mainly from a decrease in the use of coal and gas and a decline in the number of sheep.
- The Agriculture and Energy sectors were the two largest contributors to New Zealand’s gross emissions, at 49.2 per cent and 39.8 per cent respectively (figure 1).
- The Land Use, Land-Use Change and Forestry (LULUCF) sector offsets nearly one third of New Zealand’s gross emissions (figure 1).
- Net emissions have increased by 54.2 per cent since 1990 due the influence of forestry harvesting cycles and the underlying increase in gross emissions (figure 2).
- In 2016, approximately 5099 hectares of new forest was planted and 4945 hectares deforested.

### Figure 1: New Zealand’s emissions profile in 2016.

This graph shows how much each sector contributed to our greenhouse gas emissions.

- **LULUCF**: 
  - 38.7 Mt CO\(_2\)-e
  - (49%)
  - \(-22.8\) Mt CO\(_2\)-e
  - (offsets 29% of gross emissions)

- **Energy**: 
  - 31.3 Mt CO\(_2\)-e
  - (40%)

- **Agriculture**: 
  - 37.7 Mt CO\(_2\)-e
  - (49%)

- **Waste**: 
  - 3.8 Mt CO\(_2\)-e
  - (5%)

- **Industrial Processes and Product Use**: 
  - 4.9 Mt CO\(_2\)-e
  - (6%)

Note: The Land Use, Land-Use Change and Forestry (LULUCF) sector removes more carbon dioxide than it emits, so the net emissions from this sector are expressed as a negative number.
New Zealand’s gross and net emissions

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

- Agriculture (eg, methane from livestock digestive systems 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, methane from landfills)
- Land Use, Land-Use Change and Forestry (LULUCF): The LULUCF sector keeps track of greenhouse gases from land use (eg, for forests, crops and pasture). This is separate from the livestock emissions reported in the Agriculture sector. It covers our use of soil, trees, plants, biomass and timber and is the only sector where carbon dioxide is removed from the atmosphere.

Gross emissions are the total emissions from the Agriculture, Energy, IPPU and Waste sectors.

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 2016](image)

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

New Zealand’s gross greenhouse gas emissions were 78.7 million tonnes of carbon dioxide equivalent (Mt CO₂-e) in 2016. This is a 2.4 per cent decrease from 2015 emissions, mainly caused by a decrease in the use of coal and gas and a decline in the number of sheep.

The Agriculture and Energy sectors contributed the most to New Zealand’s emissions at 49.2 per cent and 39.8 per cent of gross emissions in 2016 respectively (figure 1). Emissions from road transport, which are included in the Energy sector, make up 17.3 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 (43.8 per cent in 2016), largely from the Energy and IPPU sectors.

Since 1990, New Zealand’s gross emissions have increased by 19.6 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)
- agricultural soils (nitrous oxide)
- industrial and household refrigeration and air-conditioning systems (fluorinated gases).

**Definition**

Carbon dioxide equivalent (CO₂-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. CO₂-e is used for describing different greenhouse gases in a common unit, which allows them to be reported consistently.

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1 The 1990-2016 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.
Net emissions are influenced by forest planting cycles

Net emissions include gross emissions combined with the removals from the LULUCF sector. Forests remove carbon dioxide from the atmosphere as they grow and store carbon. 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 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 5099 hectares of new forest was planted and 4945 hectares deforested in 2016.

New Zealand’s net emissions under the United Nations Framework Convention on Climate Change (UNFCCC) were 56.0 Mt CO₂-e in 2016. This is calculated by subtracting 22.8 Mt CO₂-e of net removals from the LULUCF sector from gross emissions of 78.7 Mt CO₂-e.² Net emissions have increased by 54.2 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 28.9 per cent of New Zealand’s gross emissions in 2016 (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 2016**

Agriculture

**1990–2016**

Between 1990 and 2016, emissions from the Agriculture sector increased by 12.0 per cent (figure 3). This is primarily due to the national dairy herd nearly doubling in size since 1990 and an increase of over 600 per cent in the application of nitrogen-containing fertiliser during the same period.

A decrease of 52.3 per cent in the sheep population and a decrease of 23.1 per cent in the non-dairy cattle population since 1990 have partially offset these increases.

**2015–2016**

In 2016, emissions from the Agriculture sector decreased slightly (1.0 per cent) from 2015. This is mainly because of a decline in the number of sheep that resulted in a 3.3 per cent decrease in emissions from sheep.

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² Note that the net emissions figure here is calculated from unrounded values.
Energy

1990–2016

Emissions from the Energy sector in 2016 were 31.6 per cent greater than in 1990 (figure 3). Most of this increase since 1990 came from road transport (an increase in emissions of 82.1 per cent), and manufacturing using fossil fuels. The trend shows emissions increasing up until 2008, after which there is a slight decline (figure 3).

2015–2016

The largest sources of emissions in the Energy sector in 2016 were the Road transport and Public electricity and heat production categories, contributing 43.5 per cent and 9.7 per cent of energy emissions respectively. Between 2015 and 2016, emissions from the Energy sector decreased by 3.3 per cent. This is primarily due to a 21.6 per cent decrease in coal- and gas-fired electricity generation and the simultaneous increase in hydroelectric generation.

Industrial Processes and Product Use (IPPU)

1990–2016

Emissions from the IPPU sector in 2016 were 35.4 per cent higher than in 1990 (figure 3). The increase was mainly caused by the release of hydrofluorocarbons (HFCs) from industrial and household refrigeration and air-conditioning systems. HFCs are used as a substitute for the ozone depleting chlorofluorocarbons which were phased out under the Montreal Protocol. In addition, carbon dioxide emissions from mineral, chemical and metal production have gradually increased due to increasing production.

2015–2016

Between 2015 and 2016, emissions from IPPU decreased by 8.7 per cent, largely due to the closure of a cement plant and consolidation in the New Zealand steel industry.

Waste

1990–2016

In 2016 Waste sector emissions were 0.6 per cent below 1990 levels. Annual emissions increased between 1990 and 2002 due to the growth in population and economic activity, but show a slight downward trend since 2005 (figure 3). This is mainly because of ongoing improvements in managing solid waste disposal at municipal landfills, particularly in landfill gas recovery.

2015–2016

Waste emissions in 2016 were 0.7 per cent lower than in 2015, largely due to ongoing improvements in municipal solid waste management and the continuation of a gradual reduction in the total waste disposed on farms.

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, as detailed in the inventory and in this snapshot.

The second way reports on only a subset of LULUCF emissions and removals in accordance with accounting rules under the Kyoto Protocol, and 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

1990–2016

In 2016, the LULUCF sector was a net carbon sink, with net removals of 22.8 Mt CO2-e. Emissions from the LULUCF sector in 2016 were 22.9 per cent higher than they were in 1990 as the harvest rate of planted forests has increased (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.

2015–2016

Between 2015 and 2016, net emissions from the LULUCF sector increased by 8.4 per cent. The largest change occurred in the Forest land category with a 9.2 per cent increase in net emissions.

Definition

Carbon sink is anything that removes more carbon dioxide from the atmosphere than it releases back to the atmosphere.
LULUCF reporting under the Kyoto Protocol
For the period 2013–2020, New Zealand chose not to commit to a climate change target under the Kyoto Protocol’s second commitment period. Instead under the UNFCCC New Zealand pledged to reduce emissions to 5 per cent below 1990 levels by 2020. New Zealand remains a party to the Kyoto Protocol, and applies the Kyoto Protocol framework of rules to its reporting and accounting.

In reporting against our 2020 target, New Zealand reports the emissions and removals from Afforestation, Reforestation, Deforestation, and Forest management activities under the Kyoto Protocol. 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 the removal of a forest from an area which is then converted to a non-forest use (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 unusual among the 43 Annex I countries, as nearly half of our emissions come from the Agriculture sector. Typically the Agriculture sector constitutes only a small proportion of gross emissions (12.1 per cent on average in Annex I countries).³

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. In 2015, New Zealand’s gross emissions ranked 21st among the Annex I countries, but the emissions per person were the sixth highest at 17.4 tonnes CO₂-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 carbon dioxide emissions in 2015 were 7.8 tonnes CO₂ per capita, which is below the Annex I average of 10.4 (figure 5). This reflects our high proportion of electricity generation from renewable sources. In 2016, the share of electricity generated from renewable energy sources in New Zealand was 84.8 per cent.

![Figure 5: International comparisons for per capita emissions in 2015](image)

New Zealand’s gross emissions are approximately only 0.17 per cent of the world’s gross emissions.⁵ At the same time, 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.

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³ All emissions data in this section is from UNFCCC Data Interface (2015). Annex I data in these comparisons count the members of the European Union separately, and exclude the EU as a whole.


⁵ Climate Watch (2013).
New Zealand’s progress towards our 2020 target

The inventory data are used to monitor progress towards our emissions reduction targets. New Zealand’s current (2020) target is to reduce greenhouse gas emissions to 5 per cent below 1990. Our progress towards this target is in the Ministry for the Environment’s 2020 Net Position Report, which is updated whenever there are changes in the underlying data.

The net position shows that New Zealand will 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 104.8 million units
> a surplus of 123.7 million units from the first Kyoto Protocol commitment period (2008–2012). This net position shows that an estimated 31.4 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 projected to meet the 2020 target with a surplus of 92.4 million units.

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

![Graph showing net position, CP1 surplus units, forestry removals, 2013 to 2020 carbon budget, and gross emissions]

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.

The New Zealand Government is committed to making a difference

The latest net position report shows New Zealand is on track to meet the 2020 target, but we need to do more to meet our future targets and to transition to a resilient, low emissions economy.

The New Zealand Government is committed to providing strong leadership in climate change mitigation and adaptation work. In 2018, the Government will establish an Interim Climate Change Committee and take the first steps towards a Zero Carbon Act. The Zero Carbon Bill will seek to set a new emissions reduction target for 2050, and establish an independent Climate Commission. New Zealanders will be consulted on the Bill, and the role and functions of the Climate Change Commission.
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, and 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

When the methodology or underlying data change the whole inventory time series, from the base year to the latest year, is recalculated. This means that 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.

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The complete inventory submission is available on the Ministry for the Environment’s website.