



Auckland's Greenhouse Gas Inventory 2009-2024

Shanju Xie

September 2026

Technical Report 2026/8





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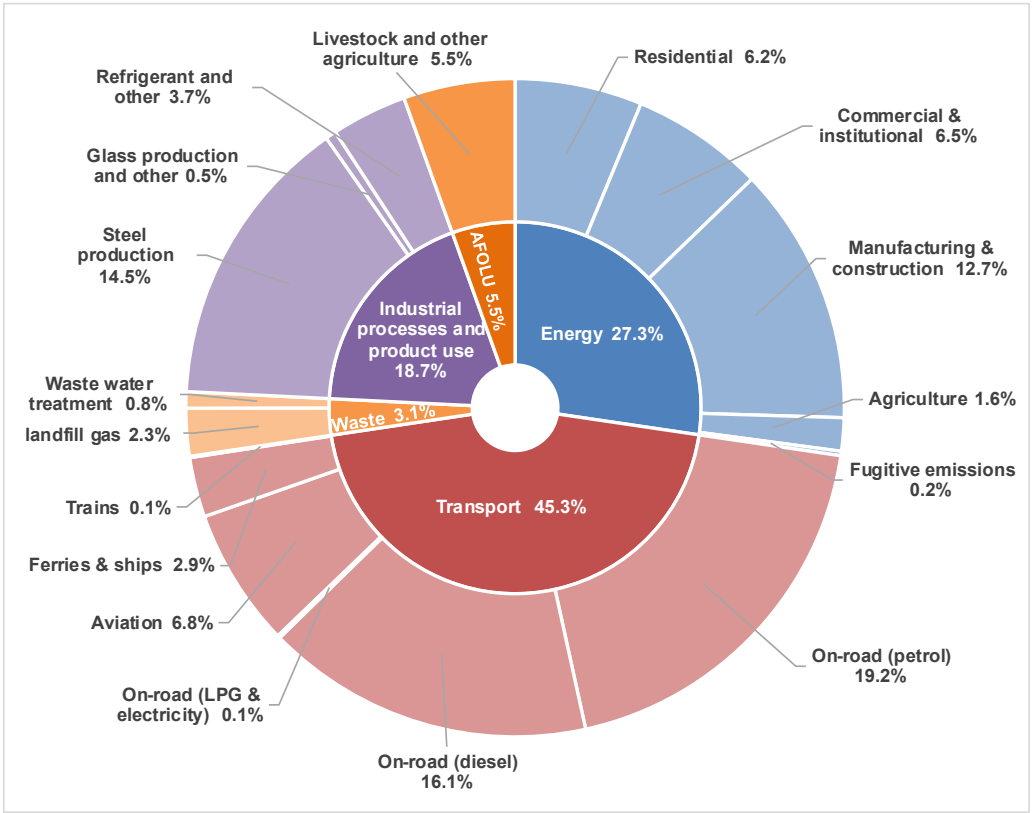
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Executive summary

A greenhouse gas inventory identifies and quantifies major sources and sinks of greenhouse gases and trends. This provides a robust evidence base and an essential tool to evaluate Auckland’s progress toward the goal of halving emissions by 2030 set by *Te-Tāruke-ā-Tāwhiri: Auckland's Climate Plan*, frame mitigation actions and inform future policy development. This inventory reports greenhouse gas emissions and carbon removals within the Auckland region for the calendar years from 2009 to 2024. Emissions from major sources in 2024 are presented alongside a comparison of changes from 2023 (previous year), from 2016 (baseline year) and then 2009 (first year of emissions reported).

Transport was the dominant source

In 2024, Auckland’s gross emissions were 10,515 kilo-tonnes of carbon dioxide equivalent (kt CO₂e) and when land and harvested wood products (HWP) were included, net emissions were 9,887 kt CO₂e. Transport and stationary energy were the dominant sectors, accounting for 45.3% and 27.3% of gross emissions, respectively. Carbon dioxide (CO₂) contributed 86.2%, methane (CH₄) 8.3%, nitrous oxide (N₂O) 2.4% and other greenhouse gases 3.1%.



Gross emissions percentages in 2024 by sector and source (Figure 3-1)

Trends of gross emissions were largely influenced by transport and energy

Changes between 2023 and 2024

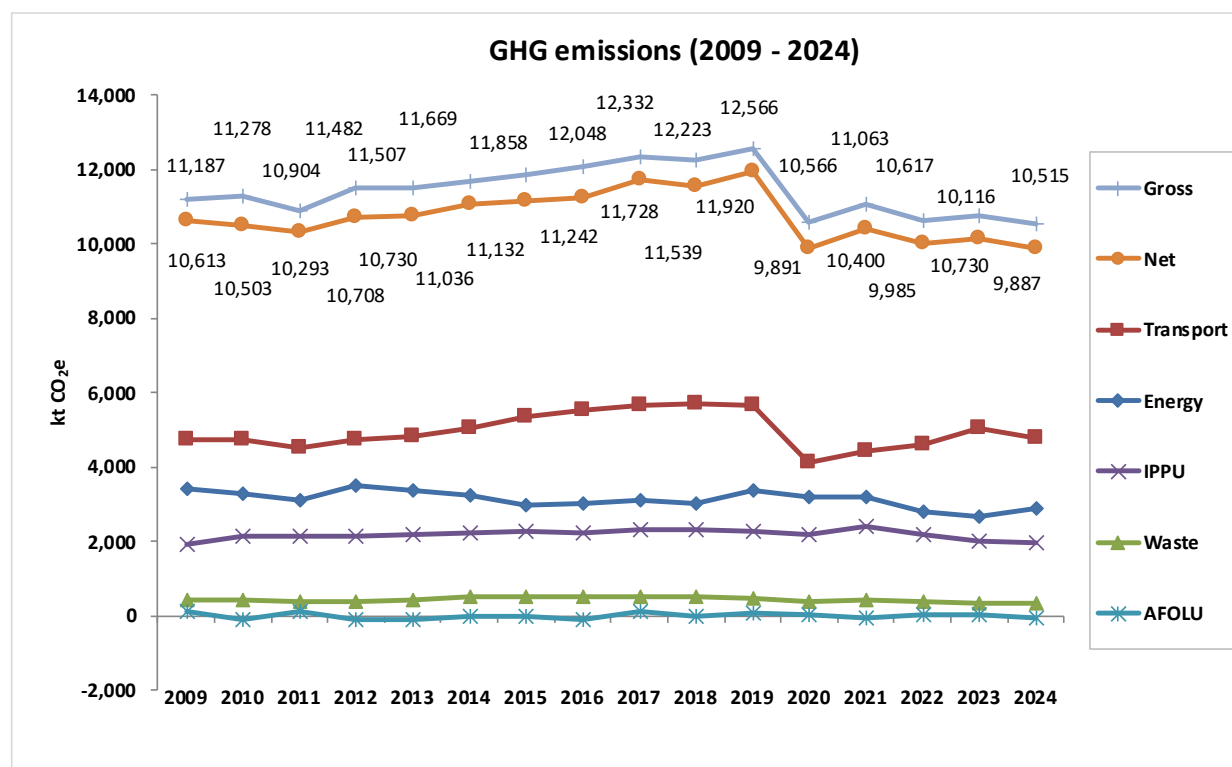
Between 2023 and 2024, emissions decreased by 2.0% and 2.3% for gross and net emissions to 10,515 kt CO₂e and 9,887 kt CO₂e, respectively. This is driven by decreased emissions from transport and other sources, partially offset by increased emissions from energy.

Comparison between baseline year 2016 to 2024

Between 2016 (baseline year) and 2024, emissions decreased by 12.1% and 12.7% for gross and net emissions to 10,515 kt CO₂e and 9,887 kt CO₂e, respectively. The drop was largely due to decreased emissions from transport and other sources. To halve 2016 emissions by 2030, further sustained decreases are needed over the remainder of the decade. A reduction of 42.7% and 43.1% of 2024 gross and net emissions is required.

Comparison between first year of reporting to 2024

Between 2009 and 2024, gross and net emissions generally increased from 2009 to 2019, markedly dropped in 2020, then rebounded in 2021 and flattened to 2024. This change was largely driven by the COVID-19 restrictions which resulted in a marked reduction in emissions from transport. Both emissions peaked in 2019. **Gross and net emissions peaked in 2019.**



Inventory improvements

This inventory has been improved by using natural gas use data from First Gas Limited and using the emissions ratio of coal and wood for residential wood emissions calculation. This covers all the natural gas supply and reflects the declined wood use for home heating over the years.

1 Introduction

The climate is changing as global average temperature rises. This increase in temperature is because of increased greenhouse gas (GHG) concentration levels in the atmosphere caused by human activities. The world must reduce GHG emissions to further limit temperature rise and the harmful impacts of associated risks such as accelerated sea level rise and more frequent extreme weather events. In early 2023, the Auckland Anniversary floods and Cyclone Gabrielle caused widespread destruction across Tāmaki Makaurau and have been identified as examples of the types of events Auckland will experience more frequently in the future. Repair and rebuild efforts are still underway to recover from these devastating extreme weather events and the costs associated with the response to these events are expected to exceed \$2.5 billion (Auckland Council, 2026).

The *Auckland Plan 2050* sets the direction for how Auckland will grow and develop over the next 30 years (Auckland Council, 2018). It responds to the key challenges we face today – high population growth, sharing prosperity among all Aucklanders, and reducing environmental damage. To address these challenges, the plan identifies six outcomes that will deliver a better Auckland: Belonging and Participation, Māori Identity and Wellbeing, Homes and Places, Transport and Access, Environment and Cultural Heritage, and Opportunity and Prosperity. The *Auckland Plan 2050* is supported by other strategies and action plans that provide detail on how these outcomes can be delivered. The *Auckland Plan 2050* monitoring framework measures progress towards the strategic direction set out in the plan, including reductions of GHG emissions.

The council approved *Te-Tāruke-ā-Tāwhiri: Auckland's Climate Plan* in July 2020 (Auckland Council, 2020). This plan sets a direction, underpinned by cross-sector actions, for delivering on Auckland's emissions reduction goals and increasing the region's resilience to climate change impacts. The plan sets the goal of net zero emissions by 2050 with an interim emissions reduction goal of 50 per cent by 2030 (against a 2016 baseline). Both goals are consistent with New Zealand national ambition. They contribute to the global effort, under the Paris Agreement, to limit global average temperature increase to 1.5 degrees Celsius above pre-industrial levels.

An emissions inventory provided at a suitable frequency identifies and quantifies the most recent sources and sinks of GHGs and trends. This provides a robust evidence base and an essential tool to evaluate Auckland's progress, frame mitigation actions and inform future policy development. In addition, it provides input to the state of Auckland's environment reporting and *Te-Tāruke-ā-Tāwhiri: Auckland's Climate Plan's* annual progress report.

2 Methodology – the GPC

2.1 Guidance

Various methods have been used over the years to develop GHG inventories for cities across the world. The use of these different methods makes it difficult for comparisons between cities internationally (and in some cases nationally), raises questions around data quality, and limits the ability to aggregate GHG emissions data. To respond to this challenge and offer a robust and clear framework that builds on existing methodologies, the World Resources Institute (WRI), C40 Cities Climate Leadership Group (C40), and Local Governments for Sustainability (ICLEI) collaboratively developed the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (the GPC). The GPC offers a robust, transparent and globally accepted framework to consistently identify, calculate and maintain accurate, credible and comparable emissions accounting and reporting practices for cities' GHGs.

The GPC recommends an annual update of inventories, as it provides a robust evidence base to evaluate impacts of mitigation actions and progress to achieve net zero emissions by 2050.

Auckland's GHG inventories have been published since the year 2009. All annual GHG inventories prepared for Auckland have been reviewed by C40 and were included in the C40 emissions database (C40, 2025).

This inventory was prepared using the GPC version 1.1 (WRI et al., 2021) for the period from 2009 to 2024, with input from *New Zealand's Greenhouse Gas Inventory 1990-2024* (MfE, 2026a). This inventory was prepared with the most up-to-date information available at the time and in line with the recommendations of the GPC. Updates of activity data, emission factors and methodology have been made for this inventory. Previously reported emissions from 2009 to 2023 (Xie, 2025) have been recalculated and superseded.

The land under the jurisdiction of Auckland Council is the geographic boundary of this inventory. Each emission year covers the calendar year from January to December. However, if calendar year data is unavailable, other types of annual data are used, e.g., financial year from July to June.

This report considers all seven gases required by the GPC: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆) and nitrogen trifluoride (NF₃). NF₃ emissions are zero since they do not occur in New Zealand (MfE, 2026a). Emissions are reported as metric tonnes of each GHG as well as CO₂ equivalents (CO₂e). CO₂e is a term used to compare the emissions from various GHGs based upon their global warming potential (GWP) over a specific period. Individual GHGs are converted into CO₂e by multiplying the GWP values (over the 100-year time-horizon, i.e., GWP100) in the Intergovernmental Panel on Climate

Change (IPCC) Fifth Assessment Report (AR5). GWP100 values for main GHGs are listed in MfE (2026b). This is consistent with the most recent release of *New Zealand's Greenhouse Gas Inventory* (MfE, 2026a) when this report was prepared.

Emissions are allocated into three scopes (Figure 2-1). Scope 1, or “territorial”, emissions are those that physically occur within the city. Emissions that occur from the use of electricity, steam, and/or heating/cooling supplied by grids which may or may not cross city boundaries, are categorised as Scope 2 emissions. Scope 3 emissions refer to those that occur outside the city but are driven by activities taking place within the city’s boundaries. The current version of GPC requires reporting of Scope 3 emissions from a limited number of sources (transmission and distribution losses associated with grid-supplied energy, and waste disposal and treatment outside the city boundary and transboundary transportation).

Emissions are classified into five main sectors: stationary energy; transport; waste; industrial processes and product use (IPPU); agriculture, forestry, and other land use (AFOLU). As discussed above, these emissions are further allocated into three scopes: Scope 1, Scope 2 and Scope 3. An additional sector (Other Scope 3) is for all other emissions occurring outside the geographic boundary as a result of city activities. Other Scope 3 includes emissions embodied in fuels, water, food and construction materials. Reporting on Other Scope 3 is optional by the current GPC version 1.1 (WRI et al., 2021) and is not reported in this inventory due to insufficient data. Five main sectors are sub-divided into sub-sectors (see Table A-1).

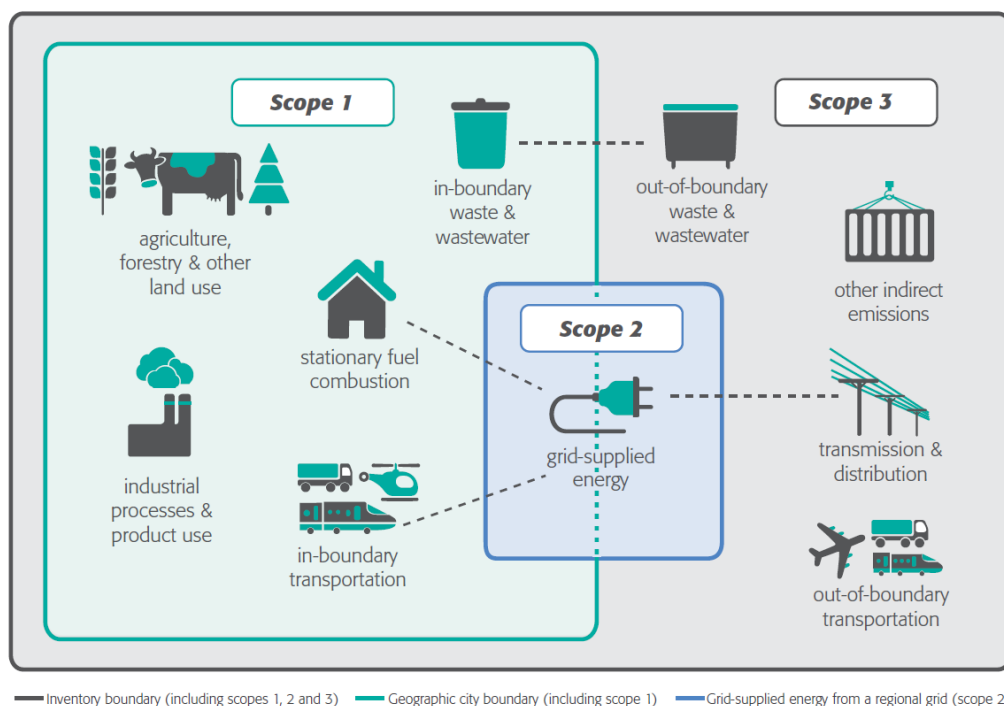


Figure 2-1 Sources and boundaries of city GHG emissions (WRI et al., 2021)

2.2 Information sources and data quality

Emissions are calculated by multiplying activity data (AD) by an emission factor (EF) associated with the activity. Activity data is a quantity of an activity that results in GHG emissions during a given period (e.g., the number of kilowatt-hours (kWh) of electricity used in a year). An emission factor is a number specific to each activity used to calculate the quantity of GHG emissions produced for each unit of that activity (e.g., CO₂ emissions in kg from the use of electricity in a kWh, kg CO₂/kWh).

Data used in the inventory is collected from a variety of sources and varies in quality, format, and completeness. For some sources, emissions data is directly provided by a third party. For others, depending on availability, activity data is either provided by data owners or estimated based on activity-related information. The detail is discussed in Chapter 4 and summarised in Table A-6. Latest available national emission factors are used in this inventory (MfE, 2026b) when this report was prepared.

It is necessary to accommodate limitations in data availability and differences in emission sources between cities. The GPC requires the use of notation keys (IE, NE, NO and C, see below) and an accompanying explanation to justify exclusion or partial accounting of GHG emission source categories, for example, if the activity does not occur or when sufficient AD is unavailable.

- **IE** (Included Elsewhere): GHG emissions for this activity are estimated and presented in another category of the inventory. That category shall be noted in the explanation.
- **NE** (Not Estimated): Emissions occur but have not been estimated or reported; justification for exclusion shall be noted.
- **NO** (Not Occurring): An activity or process does not occur or exist within the city.
- **C** (Confidential): GHG emissions which could lead to the disclosure of confidential information and therefore cannot be reported.

The data quality for AD and EFs is assessed with a High-Medium-Low rating. High (H) rating is assigned to detailed activity data or where city/region-specific emission factors are used. Activity data that is estimated using robust assumptions or where more general emission factors are used (e.g., applied nationally) is rated as Medium (M). Low (L) is referred to highly modelled or uncertain activity data, or where default emission factors are used (e.g., those provided by IPCC guidance (IPCC, 2023)).

Under the GPC, total emissions can be reported at the BASIC or BASIC+ levels. The BASIC level covers scope 1 and scope 2 emissions from stationary energy and transport, as well as scope 1 and scope 3 emissions from waste. BASIC+ additionally includes emissions from IPPU and AFOLU and

transboundary transportation. This inventory reports at the BASIC+ level since emissions were calculated for all the sectors required by BASIC+. The City Inventory Reporting and Information System (CIRIS) (v2.5) (C40, 2023) was used in the compilation of this inventory.

New Zealand's greenhouse gas inventory reports gross emissions and net emissions (MfE, 2026a). While it is not a requirement of the GPC to report gross emissions, they are presented in this inventory for consistency with national reporting. Net emissions (i.e., total emissions) include the sum of emissions and removals from all sources while gross emissions exclude the contribution of land (section 4.2.5) and harvested wood products (HWPs) (section 4.5.3.2). This is in line with national reporting that gross emissions are reported as net emissions exclusive of the Land Use, Land Use Change and Forestry (LULUCF) sector (MfE, 2026a). For gross and net emissions reporting, AFOLU is also disaggregated into two subsets: livestock and other agriculture, and land and HWPs.

2.3 Updates to historic emissions

This inventory has been improved with updates to activity data, emission factors, and methodology, notably natural gas use data from First Gas Limited (2026) and using the constant ratio of coal and wood use for residential wood emissions calculation (Stats NZ, 2025a). Previous inventories only included natural gas supplied by Vector Ltd and used by the iron and steel production (Xie, 2025). Data from First Gas Limited includes all the other natural gas suppliers. With declined residential coal use, improved emissions calculation for wood reflects the declined wood use for home heating as previous inventory assumed unchanged emissions from year to year.

Historic emissions from 2009 to 2023 have been recalculated to supersede all published previous inventories. For comparison with this inventory, which has been compiled using GWP100 values from AR5, emissions of previous inventories using AR4 have been recalculated in AR5 in this report.

Compared to the 2016 inventory, improvements to data sources and the methodology result in higher or lower emissions from many sources. Overall, this inventory reports 5.1% and 9.5% higher gross and net emissions respectively in 2016 (Tables A-2 and A-4).

Compared to the previous 2023 inventory, this results in 1.7% and 1.8% lower gross and net emissions respectively in 2023 (Tables A-3 and A-5). This inventory reports the same trend for gross and net emissions as previous inventory (Figure A-1).

3 Key findings

3.1 Emissions and sources (2024)

In 2024, Auckland's net GHG emissions were 9,887 kt CO₂e (BASIC+ emissions in Table 3-1). Blank cells in Table 3-1 indicate that emissions occur but have not been estimated or reported, or that an activity or process does not occur or exist within the city. Table 3-2 illustrates the GPC reporting requirements. As discussed earlier, reporting on Other Scope 3 is optional and not reported due to insufficient data.

Table 3-1 Emissions summary for 2024 (in the GPC format)*

GHG Emissions Source (By Sector)		Total GHGs (metric tonnes CO ₂ e)				
		Scope 1	Scope 2	Scope 3	BASIC	BASIC+
STATIONARY ENERGY	Energy use (all emissions except I.4.4)	1,831,282	969,191	73,385	2,800,473	2,873,858
	Energy generation supplied to the grid (I.4.4)	20				
TRANSPORTATION	(all II emissions)	3,744,250	15,998	1,003,480	3,760,248	4,763,727
WASTE	Waste generated in the city (III.X.1 and III.X.2)	256,911		73,988	330,899	330,899
	Waste generated outside city (III.X.3)					
IPPU	(all IV emissions)	1,970,189				1,970,189
AFOLU	(all V emissions)	-52,143				-52,143
OTHER SCOPE 3	(all VI emissions)					
TOTAL		7,750,509	985,188	1,150,852	6,891,620	9,886,531

* See Table 3-2 for the meaning of cell colours

Table 3-2 Emission sources covered and reported by the GPC

Source	Report
	Sources required for BASIC reporting
+	Sources required for BASIC+ reporting
	Additional scope 1 sources required for territorial reporting
	Other scope 3 sources
	Non-applicable emission sources

In 2024, Auckland gross emissions were 10,515 kt CO₂e. Figure 3-1 shows gross emissions by sector, sub-sector and source. More detailed emissions data is also presented Table A-1. Transport is the dominant contributor of gross emissions (accounting for 46.6 per cent), followed by Stationary Energy (26.7 per cent), IPPU (18.3 per cent), Waste (3.1 per cent), and livestock and other agriculture (5.3 per cent).

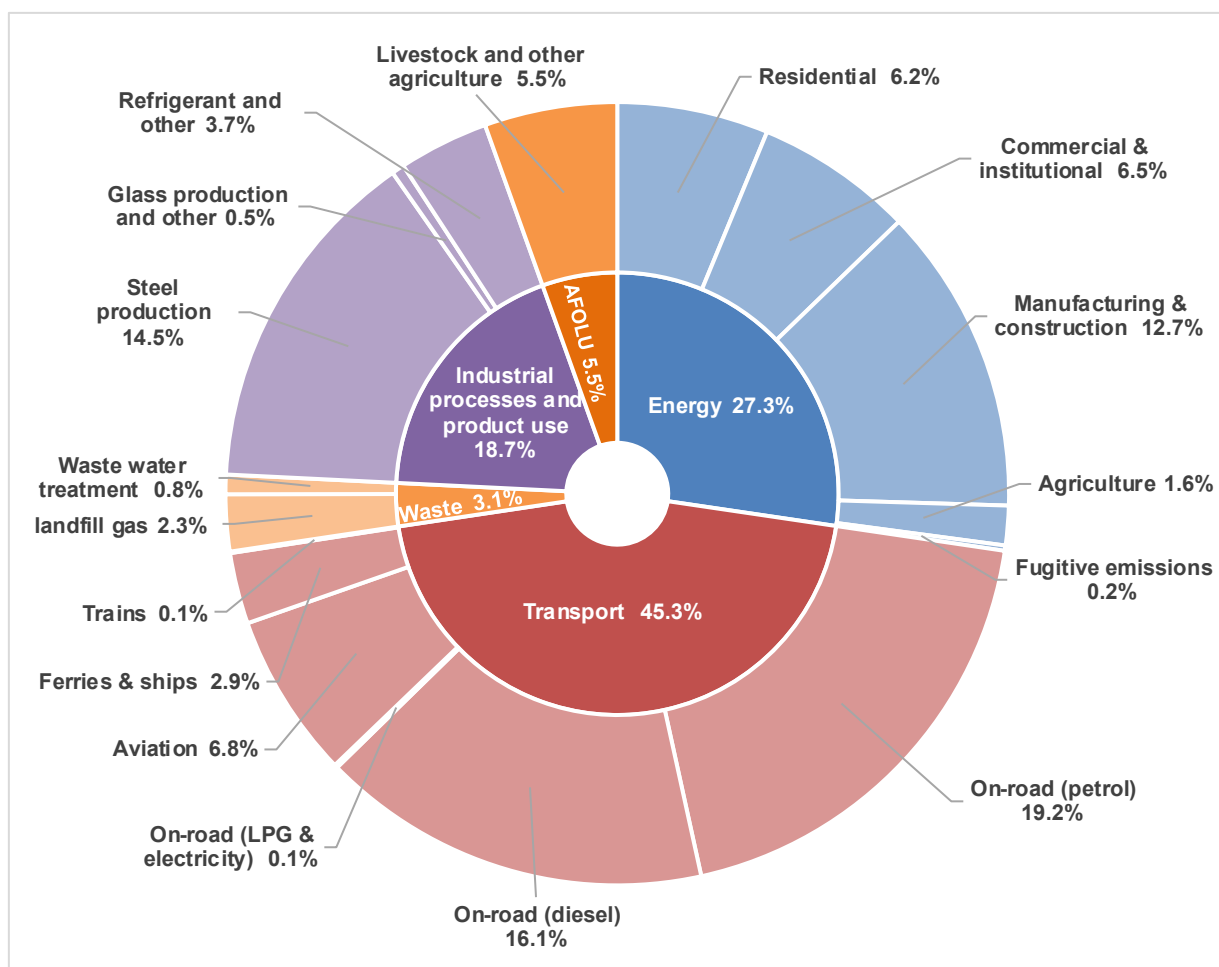


Figure 3-1 Gross emissions percentages in 2024 by sector and source

Table 3-3 shows the gross emissions by gases. Carbon dioxide is the dominant GHG, making up 86.2% of gross emissions, followed by methane at 8.3% and then a smaller proportion of other GHGs.

Table 3-3 Auckland's gross emissions by gas for 2024

GHGs	Carbon dioxide (CO ₂)	Methane (CH ₄)	Nitrous oxide (N ₂ O)	Hydrofluoro-carbons (HFCs)	Perfluoro-carbons (PFCs)	Sulphur hexafluoride (SF ₆)	Nitrogen trifluoride (NF ₃)	Gross emissions
CO ₂ e (kt)	9,067	872	248	324	0	4	None	10,515
% of gross emissions	86.2%	8.3%	2.4%	3.1%	0.0%	<0.1%	None	100.0%

3.2 Trends

This section discusses trends in emissions from various sectors between 2009 (first inventory year) and 2024 (current year), the impacts of COVID-19 restrictions on recent emissions, as well as changes between 2016 (baseline year) and 2024, and 2023 (last year) and 2024.

3.2.1 Between 2009 and 2024

Gross and net emissions generally increased from 2009 to 2019, showed a marked drop in 2020, then rebounded in 2021 and flattened to 2024 (Figure 3-2). These trends were largely driven by transport and energy sectors (Figure 3-3). Gross and net emissions peaked in 2019.

The marked drop from 2019 to 2020 was largely due to reduced emissions from transport during COVID-19 restrictions (discussed later in this section).

There was an increase in emissions from Transport. Energy showed a gradual decrease in emissions driven by emissions from electricity generation. In 2012, 2019 and 2024, emissions from energy are slightly higher (Figure 3-2). This is due to lower-than-normal rainfall leading to lower hydro generation and an increase in gas and coal generation. Emissions from IPPU gradually increased due to industrial product use, while emissions from waste and AFOLU were reduced.

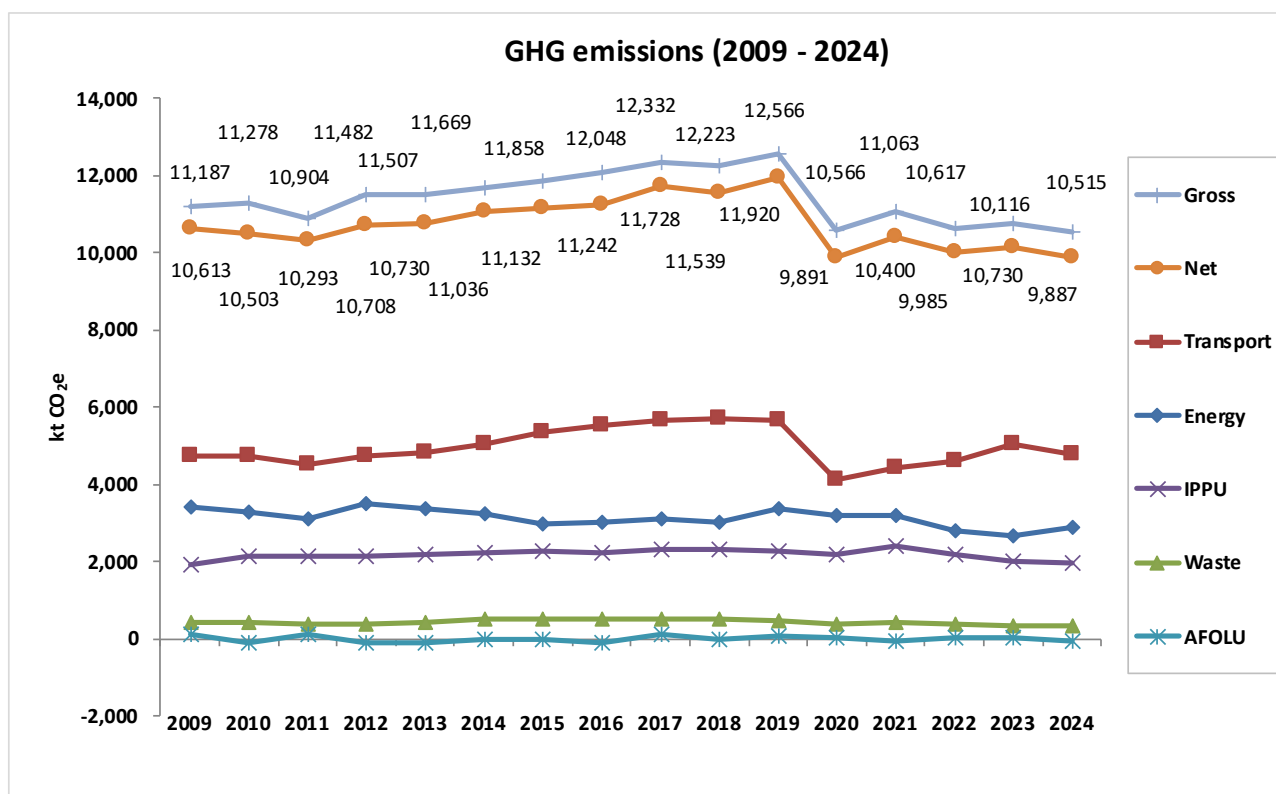


Figure 3-2 Auckland's GHG emissions from 2009 to 2024

3.2.1.1 Reduced emissions during COVID-19 restrictions

From pre-pandemic levels in 2019, emissions in 2020 decreased by 2,000 kt CO₂e (15.9 per cent) for gross emissions and 2,029 kt CO₂e (17.0 per cent) for net emissions. This was largely driven by reduced emissions from transport during COVID-19 restrictions (Figure 3-3). Emissions were lower from all sources (i.e., energy, transport, waste, IPPU, livestock and other agriculture, and land and HWPs).

After rebounding in 2021, emissions flattened to 2024. Gross and net emissions in 2024 were at a similar level to 2020, with higher emissions from transport and Land and HWPs offset by other sectors (Figure 3-3).

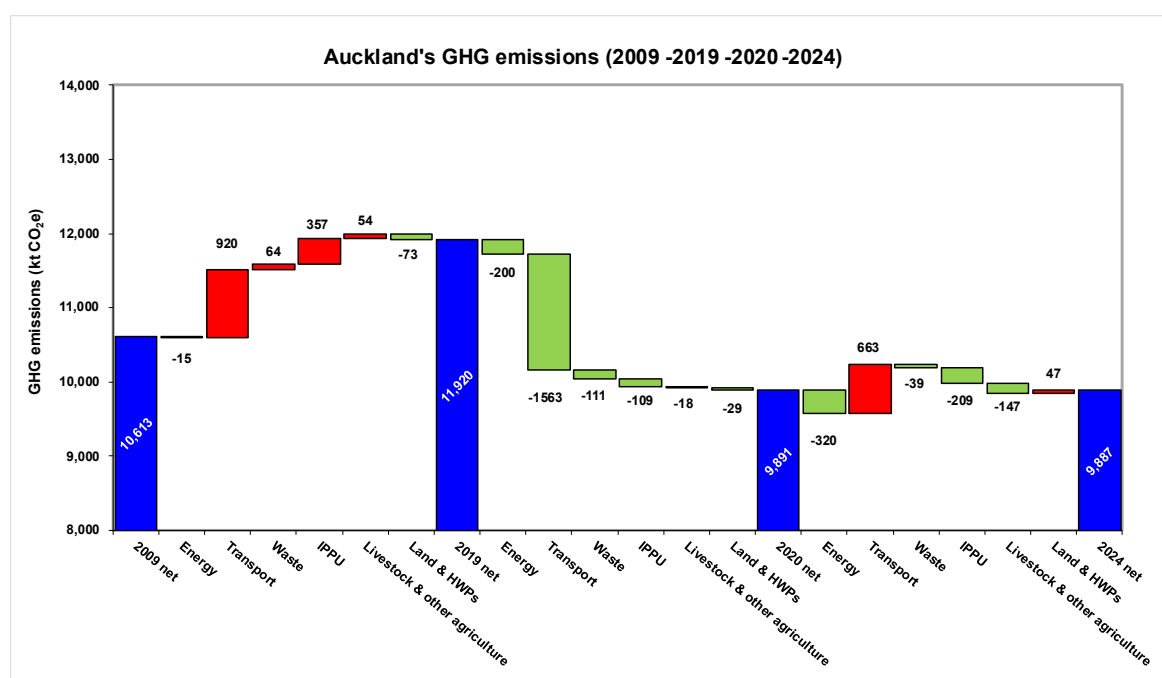


Figure 3-3 Auckland's GHG emissions between 2009, 2019, 2020 and 2024

3.2.2 Between 2016 and 2024

Between 2016 and 2024, emissions decreased by 1,355 kt CO₂e (12.1 per cent) for gross and 1,533 kt CO₂e (12.7 per cent) for net emissions (Table 3-4). The drop in emissions was due to COVID-19 restrictions. Emissions were lower from energy, transport, waste, IPPU, and livestock and other agriculture; and higher from land and HWPs. Decreased forest land area resulted in less carbon sequestration, therefore, an increase in emissions from land and HWPs, and AFOLU. To halve 2016

emissions by 2030, substantial and sustained decreases are required over the remainder of the decade. A reduction of 4,491 kt CO₂e (42.7 per cent) and 4,266 kt CO₂e (43.1 per cent) of 2024 gross and net emissions is required.

Table 3-4 Auckland's emissions from 2016 to 2024

Sector	2016	2024	Change (2016-2024)			Per cent of gross		Change (2023-2024)		
	ktCO ₂ e	ktCO ₂ e	ktCO ₂ e	%		2016	2024	ktCO ₂ e	%	
Energy	3,023	2,874	-149	-4.9%	↓	25.1%	27.3%	192	7.2%	↑
Transport	5,537	4,764	-774	-14.0%	↓	46.0%	45.3%	-261	-5.2%	↓
Waste	508	331	-177	-34.8%	↓	4.2%	3.1%	-31	-8.5%	↓
IPPU	2,250	1,970	-280	-12.4%	↓	18.7%	18.7%	-26	-1.3%	↓
Livestock & other agriculture	730	576	-154	-21.1%	↓	6.1%	5.5%	-90	-13.5%	↓
Gross	12,048	10,515	-1,533	-12.7%	↓	100.0%	100.0%	-215	-2.0%	↓
Land & HWPs	-807	-628	178	22.1%	↑	-6.7%	-6.0%	-14	-2.3%	↓
AFOLU	-76	-52	24	31.5%	↑	-0.6%	-0.5%	-104	-199.8%	↓
Net	11,242	9,887	-1,355	-12.1%	↓	N/A	N/A	-230	-2.3%	↓

3.2.3 Between 2023 and 2024

Between 2023 and 2024, emissions decreased by 215 kt CO₂e (2.0 per cent) for gross and 230 kt CO₂e (2.3 per cent) for net emissions (Table 3-4). This is driven by decreased emissions from transport and other sources, partially offset by increased emissions from energy. Reduced petrol and diesel sales resulted in decreased emissions from transport. Increased emissions from energy were due to higher emissions from electricity generation.

4 Sector analysis

4.1 Stationary energy

Emissions from stationary energy come from energy consumption in buildings (e.g., natural gas for cooking at homes, electricity for heating at offices) and from non-mobile equipment and machinery, as well as fugitive emissions released in the process of generating, delivering, and consuming energy (such as electricity or gas). These emissions are split into the following sub-sectors: residential buildings; commercial and institutional buildings and facilities; manufacturing industries and construction; and agriculture, forestry, and fishing activities.

Scope 1 emissions are all direct emissions from burning fuel (oil, gas, liquefied petroleum gas (LPG), wood and coal) and fugitive emissions from delivering and distributing natural gas within city boundary. Scope 2 emissions are those associated with consumption of grid-supplied electricity which is generated within or outside Auckland. Scope 3 emissions are from distribution losses from grid-supplied electricity. GHGs in this sector are CO₂, CH₄ and N₂O.

Emissions from stationary energy are summarised in Figure 4-1. In 2024, total emissions were 2,874 kt CO₂e, with majority (63.8 %) of emissions from electricity and natural gas, followed by coal (25.0 per cent), LPG (10.3 per cent), diesel (0.8 per cent), and wood (0.1 per cent). Emissions from electricity, mainly from burning coal and natural gas to generate electricity, all occurred outside of Auckland.

For sub-sector distribution, almost half (46.5 per cent) of emissions came from manufacturing industries and construction, followed by 23.9 per cent from commercial and institutional buildings and facilities; 22.9 per cent from residential buildings; 6.0 per cent from agriculture, forestry, and fishing activities; and 0.2 per cent from natural gas transport and distribution (T&D) losses (i.e., fugitive emissions).

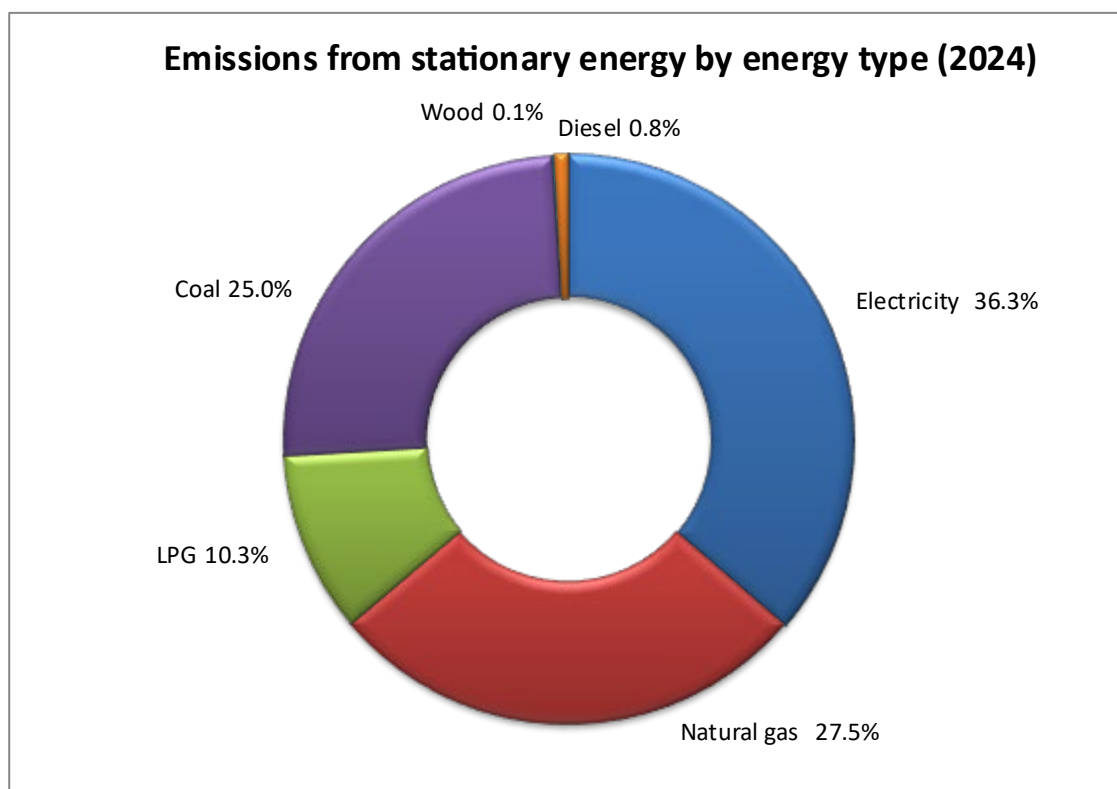


Figure 4-1 Emissions from stationary energy by energy type for 2024

4.1.1 Scope 1: emissions from fuel combustion

Scope 1 emissions are calculated based on consumption data for each of the fuel types in Auckland (natural gas, LPG, coal, wood, petrol, diesel and fuel oil).

The total amount of natural gas supply in Auckland was provided by First Gas Limited (2026). Its allocation to sub-sectors was based on Vector Ltd (2025) and Stats NZ's emissions data for Auckland (Stats NZ, 2025a). Emissions from gas use at Otahuhu and Southdown power stations were not included in total emissions since generated electricity was supplied to national electric grids. The two stations ceased operation from 2016.

Emissions (total and sub-sectors) from LPG, diesel and solid fuels (coal and wood) were based on Stats NZ's data for Auckland (Stats NZ, 2025a) and industrial emissions data (Atkins, 2018; EECA, 2024; EECA, 2025b). The ratio of emissions from coal and wood for residential sources was based on Auckland air emissions inventory (Metcalf, et. al., 2018). CO₂ emissions from wood burning were reported as biogenic, which were not included in total emissions in line with GPC guidelines. CH₄ and N₂O emissions from wood burning were included in total emissions.

CO₂ (biogenic), CH₄ and N₂O emissions from landfill gas combustion for electricity or heat in 2016 were sourced from the air emissions inventory (Crimmins, 2018). The emissions were small and

assumed unchanged for other years. Emissions from landfill gas flaring were reported in the Waste sector (section 4.3).

4.1.2 Scope 2: emissions from consumption of grid-supplied electricity

The GPC covers emissions from consumption of grid-supplied electricity, steam, heating and cooling in the city under Scope 2. There is no grid supply of heating or cooling from outside Auckland and therefore only emissions associated with grid-supplied electricity are reported.

Electricity consumption was sourced from various organisations (Vector Ltd, 2025; Counties Energy Ltd, 2026; NZEA, 2024). Electricity consumption by the residential sub-sector was sourced from (NZEA, 2025). Allocation into other sub-sectors was based on the Energy End-Use Database (EECA, 2025a). Electric passenger trains went into service from 2014 and gradually replaced all diesel trains from 2023. Emissions from electricity consumption by trains and vehicles were reported in the Transport sector.

4.1.3 Scope 3: distribution losses from grid-supplied energy

Scope 3 emissions include transmission and distribution losses from the use of grid-supplied electricity.

4.2 Transport

Emissions from transport come from directly combusting fuel or indirectly consuming grid-delivered electricity to transport vehicles and mobile equipment or machinery. For transport occurring within the Auckland region, emissions from combustion of fuels are reported in Scope 1 and emissions from grid-supplied electricity used for transporting vehicles (e.g. electric vehicles, electric trains) are included in Scope 2. Scope 3 reports the emissions from a portion of transboundary journeys occurring outside the Auckland region, and transmission and distribution losses from grid-supplied electricity. The emissions are calculated for on-road vehicles, railways, water transport and aviation, respectively. The gases reported in this sector are CO₂, CH₄ and N₂O.

Emissions from transport are summarised in Figure 4-2. In 2024, on-road transport accounted for 78.3 per cent of total 4,764 kt CO₂e emissions from transport (Figure 4-2). Contributions from other sources were 15.1 per cent from aviation, 6.5 per cent from ferries and ships, and 0.1 per cent from trains.

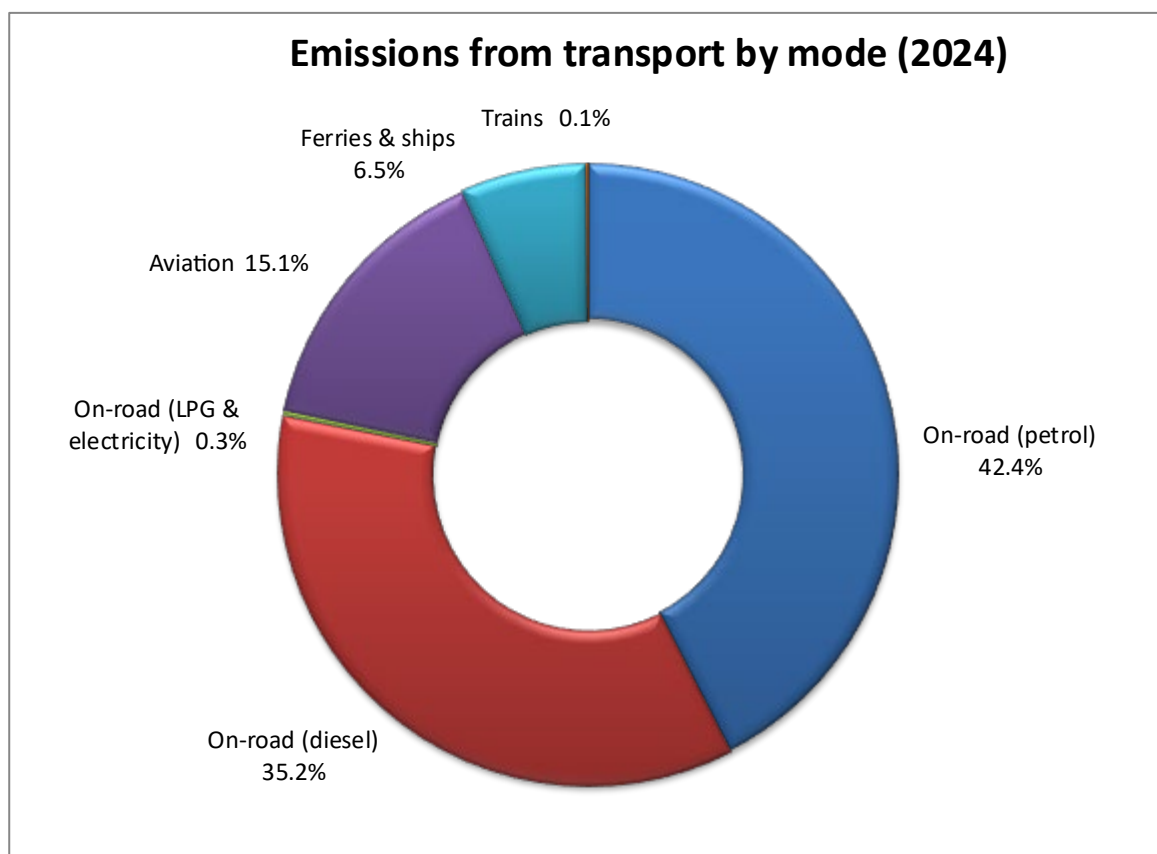


Figure 4-2 Emissions from transport by mode for 2024

4.2.1 On-road transport

Petrol and diesel sales within Auckland region are provided by Auckland Transport and based on the local authority fuel tax reports (Auckland Transport, 2025). The data was used to calculate emissions from on-road transport. The results were included in Scope 1 emissions.

Emissions from LPG and electricity use for on road transport in Auckland were calculated by porting the national data. LPG and electricity use for New Zealand was sourced from Ministry of Transport (MoT, 2024a). The vehicle fleet for Auckland and New Zealand was also sourced from Ministry of Transport (MoT, 2026b). The ratio of LPG and electric vehicle fleet in Auckland to New Zealand was used to portion New Zealand's consumptions for Auckland.

4.2.2 Railways

Rail is for the mass transit of commuters within the region (managed by Auckland Transport) and for moving freight within or to and from Auckland (managed by KiwiRail). Diesel and electricity consumption for passenger trains was provided by Auckland Transport (2025). Diesel use by freight trains was calculated by freight carried (in tonnes-km) multiplied by fuel burn rate (in litres per t-km)

(MfE, 2026b). Rail freight was estimated based on rail tonnage data from the Freight Information Gathering System (FIGS) (MoT, 2026c) for 2012-2024. The data for 2009 to 2011 was estimated by scaling the national total.

4.2.3 Water transport

Emissions from diesel consumption on ferries were provided by Auckland Transport (2025) and reported in Scope 1.

Auckland Transport provided the total amount of fuel oil used to refuel ships at Auckland shipping ports from 2012 to 2024. Average ratio of fuel oil consumption in Auckland to the national total over the period of 2012 to 2017 was used to estimate consumption for 2009-2011.

Emissions from shipping were reported in Scope 3. Export data at NZ shipping ports in tonnage was extracted from the Freight Information Gathering System (FIGS) (MoT, 2026c). This data was used to portion goods of total export at Auckland shipping ports, to estimate shipping emissions attributable to Auckland.

4.2.4 Aviation

Aviation activities in Auckland are dominated by domestic and international flights at Auckland Airport. Other activities include local helicopter, light aircraft, sightseeing and training flights at three other airports in Auckland (Ardmore Airport, North Shore Aerodrome and the military airbase at Whenuapai). Emissions from other activities are small and not reported. For example, New Zealand search and rescue sector reported an emission of only 1.4 kt CO₂e from helicopters and fixed-wing aircrafts between June 2021 and July 2022 (Lumen, 2023). Emissions from grid-supplied energy consumed by aircraft charging at airports were included in Scope 2 of Stationary Energy (section 4.1.2). Emissions from departing flights at Auckland Airport were reported in Scope 3. The proportion of Scope 3 emissions attributable to Auckland was calculated based on the proportion of departure passengers who were Auckland residents. International and domestic departures were estimated from data from Stats NZ (2025b) and Auckland Airport (2026). The Joint User Hydrant Installation (JUHI) Depot provided aviation fuel consumption at Auckland Airport.

4.2.5 Off-road transport

Emissions from off-road transport are those from off-road vehicles designed or adapted for travel on unpaved terrain, including terrain vehicles, landscaping and construction equipment, tractors, bulldozers, and other off-road recreational vehicles. Due to lack of data, these emissions are not reported in this section but are included in Stationary Energy (section 4.1).

4.3 Waste

Emissions are generated from the processing and disposal of solid waste and wastewater treatment, predominantly CH₄ with smaller contributions from N₂O and CO₂. Emissions from waste treated inside Auckland are reported in Scope 1 and emissions from waste generated in Auckland but treated outside Auckland are included in Scope 3. Emissions from grid-supplied electricity used in waste treatment facilities are reported in Scope 2 in Stationary Energy.

Emissions from waste, generated from the processing and disposal of solid waste and wastewater treatment, are summarised in Table A-1. The waste sector emitted 331 kt CO₂e, with 74.4 per cent from solid waste sources and 25.6 per cent from wastewater treatment.

4.3.1 Solid waste

The council's waste team provided emissions for all five landfills receiving Auckland's waste (Claris, Puwera, Redvale, Whitford, and Hampton) (Auckland Council, 2023). The team also provided emissions from food scraps processed at Reporoa Organics Processing Facility. Waste composition was estimated with data of these landfills. Emissions calculation was based on the national guidance (MfE, 2026b).

A small amount of CO₂ (biogenic), CH₄ and N₂O are emitted from landfill gas flaring. Emissions for 2016 were sourced from the air emissions inventory (Crimmins, 2018). Emissions for other years were assumed unchanged. Emissions from farm fills and rural waste were provided by Stats NZ (2025b).

4.3.2 Wastewater treatment and discharge

Watercare Services Ltd is the water and wastewater service provider for Auckland. Auckland's wastewater is transported through a public wastewater network to wastewater treatment plants. The majority of Auckland's wastewater is treated at the Mangere or Rosedale treatment plants. Emissions from wastewater treatment and discharge in Auckland were sourced from Watercare's carbon footprint reporting (Watercare Services Ltd, 2025).

4.4 Industrial processes and product use (IPPU)

Emissions from non-energy related industrial processes and product use are assessed and reported in the IPPU sector. Emissions (CO₂, N₂O, HFCs, PFCs and SF₆) are reported in Scope 1.

Emissions from IPPU are summarised in Table A-1. Most emissions came from Industrial Processes (1,579 kt CO₂e, 80.2 per cent) and followed by Industrial Product Use (391 kt CO₂e, 19.8 per cent).

4.4.1 Industrial processes

In New Zealand, all the iron and steel production (mainly from New Zealand Steel Ltd) is in Auckland. *New Zealand's Greenhouse Gas Inventory* reports its emissions in the categories of “Iron and Steel Production” (MfE, 2026a). Production of steel and iron results in CO₂ emissions. Other industrial processes include the glass production from Visy Glass Operations (NZ) Limited. Total emissions from industrial processes were provided by Stats NZ (2025a) or sourced from MfE (2026a).

4.4.2 Industrial product use

GHGs are emitted from lubricants and paraffin waxes used in non-energy products, fluorinated gases used in electronics production, and fluorinated gases used as substitutes for ozone depleting substances. Total CO₂e emissions from industrial product use were provided by Stats NZ (2025a). The reported proportion of CO₂, N₂O, HFCs, PFCs and SF₆ was the same as in *New Zealand's Greenhouse Gas Inventory* (MfE, 2026a).

4.5 Agriculture, forestry and other land use (AFOLU)

AFOLU activities are divided into three categories: livestock, land, and aggregate sources and non-CO₂ emission sources on land. GHGs consist of CH₄, N₂O and CO₂, and are reported as Scope 1 emissions. As discussed in section 2.2, to assist the reporting of gross and net emissions, AFOLU is also disaggregated into two subsets: livestock and other agriculture, and land and HWP.

Emissions from the AFOLU sector are summarised in Table A-1. Emissions from livestock and other agriculture were 576 kt CO₂e. Emissions from land and HWP was –628 kt CO₂e, resulting in AFOLU emissions of -52 kt CO₂e. The removal is expressed as a negative value to clarify that the value is a removal and not an emission.

4.5.1 Livestock

CH₄ is produced in digestive processes of livestock (enteric fermentation) and through management of their manure. N₂O is also emitted from the manure management system (i.e., direct and indirect N₂O emissions from manure management). The number of livestock (dairy cattle, non-dairy cattle, sheep, deer, pig, goat and horse) in Auckland was sourced from Stats NZ (2024b). In 2024, emissions from livestock were 500 kt CO₂e.

4.5.2 Land

Land use is divided into six broad categories: forest land, cropland, grassland, wetlands, settlements and other. Emissions and removals are calculated from the changes in ecosystem carbon stocks for both land remaining in a land use category and land converted to another land use category. The calculation was undertaken by Ministry for the Environment based on *New Zealand's Greenhouse*

Gas Inventory methodologies for 2009-2023. There were some assumptions, including partitioning the Land Use and Carbon Analysis System (LUCAS) New Zealand Land Use Map (LUM) into region, with some Auckland specific input, e.g., the area of tall natural forest. The calculated ratio of Auckland to NZ was applied to estimate Auckland LULUCF data based on *New Zealand's Greenhouse Gas Inventory 1990-2024* (MfE, 2026a). In 2024, emissions from livestock were -451 kt CO₂e.

4.5.3 Aggregate sources and non-CO₂ emission sources on land

Aggregate sources and non-CO₂ emission sources on land include other agriculture (liming, urea application; direct and indirect N₂O from managed soils) and HWPs.

4.5.3.1 Other agriculture

Emissions from liming and urea application were estimated based on national emissions (MfE, 2026a) allocated to Auckland based on the proportion of all fertilisers used to the national total (Stats NZ, 2025b). Direct and indirect N₂O from managed soils were calculated based on the number of livestock. In 2024, emissions from livestock were 76 kt CO₂e.

4.5.3.2 Harvested wood products (HWPs)

HWPs include all wood material that leaves harvest sites and constitutes a carbon reservoir (the time carbon is held in products will vary depending on the product and its uses). As for the land sub-sector, changes of carbon stocks in the harvested wood products pool were provided by Ministry for the Environment. The calculation was based on *New Zealand's Greenhouse Gas Inventory* methodologies for 2009-2023 using the regional harvested area proportion as a proxy to apportion national roundwood production, wood product outputs, and exported logs to the Auckland region. As mentioned in the section 4.5.2, the calculated ratio of Auckland to NZ was applied to estimate Auckland HWPs data based on *New Zealand's Greenhouse Gas Inventory 1990-2024* (MfE, 2026a). In 2024, emissions from HPWs were -178 kt CO₂e.

Overall, emissions from the AFOLU sector are shown from 2009 to 2024 in Figure 4-3.

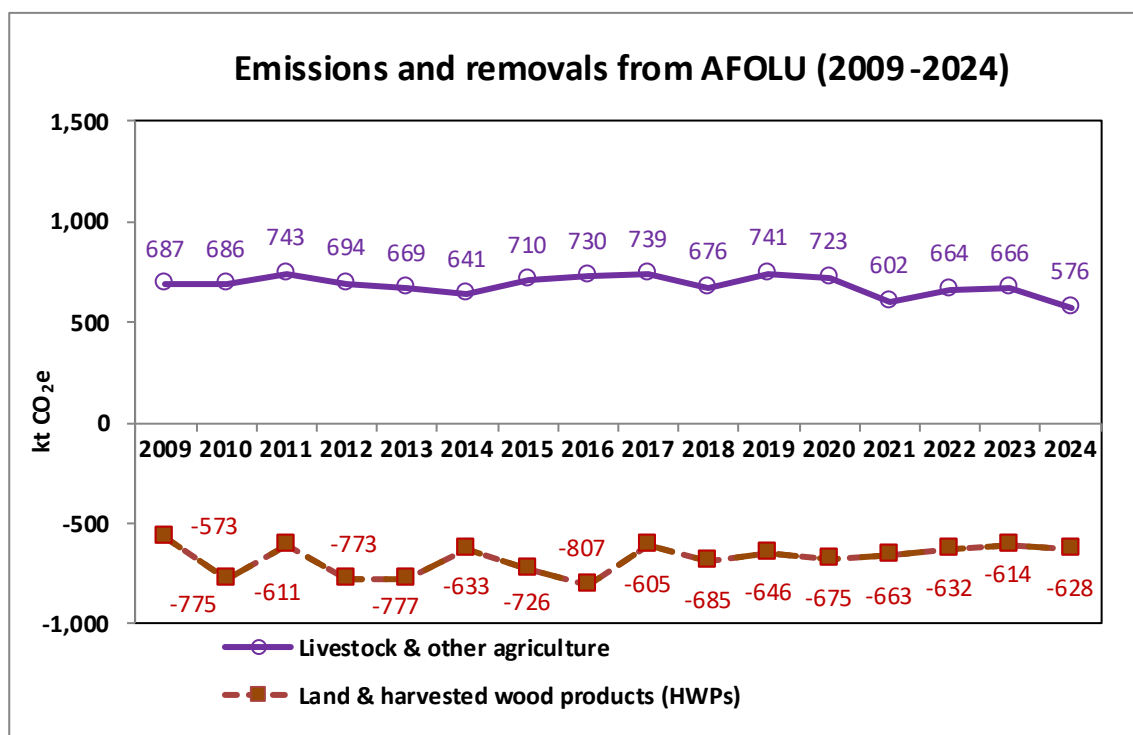


Figure 4-3 Emissions and removals from livestock and other agriculture, and land and HWPs from 2009 to 2024

5 Discussion

5.1 Emissions per capita and per unit GDP

Increased population and economic activities could result in increased emissions. Trends of emissions per capita or per unit GDP are useful indicators for tracking progress on climate actions. GDP (i.e., real GDP) is measured in 2025 prices and based on March years (Infometrics, 2025) and is therefore aligned to the closest December year (e.g., March 2025 is reported as 2024). From 2009 to 2024, Auckland's population increased from 1.4 million to 1.8 million (Stats NZ, 2026b) and GDP increased from \$NZ 135 billion to \$NZ 165 billion (Infometrics, 2026). Population, GDP and emissions are compared in Figure 5-1. In 2024, gross emissions were 5.9 t CO₂e per capita and 64 t CO₂e per million \$NZ GDP while net emissions were 5.5 t CO₂e per capita and 60 t CO₂e per million \$NZ GDP.

Figure 5-2 shows trends of emission intensity by population and GDP. The emission intensity generally decreased since 2009, suggesting Auckland's emissions have not increased as fast as population and economic growth. The marked drop in the emission intensity between 2019 and 2020 is due to COVID-19 restrictions.

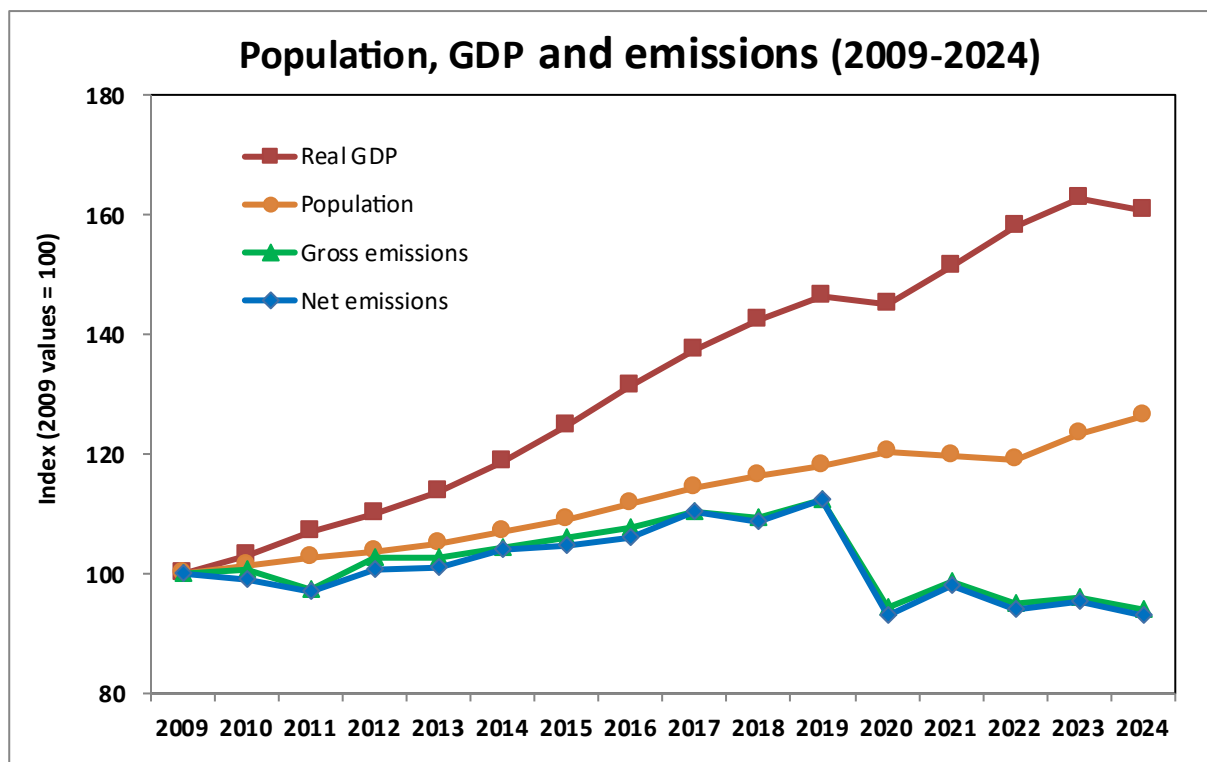


Figure 5-1 Auckland's population, GDP and GHG emissions from 2009 to 2024

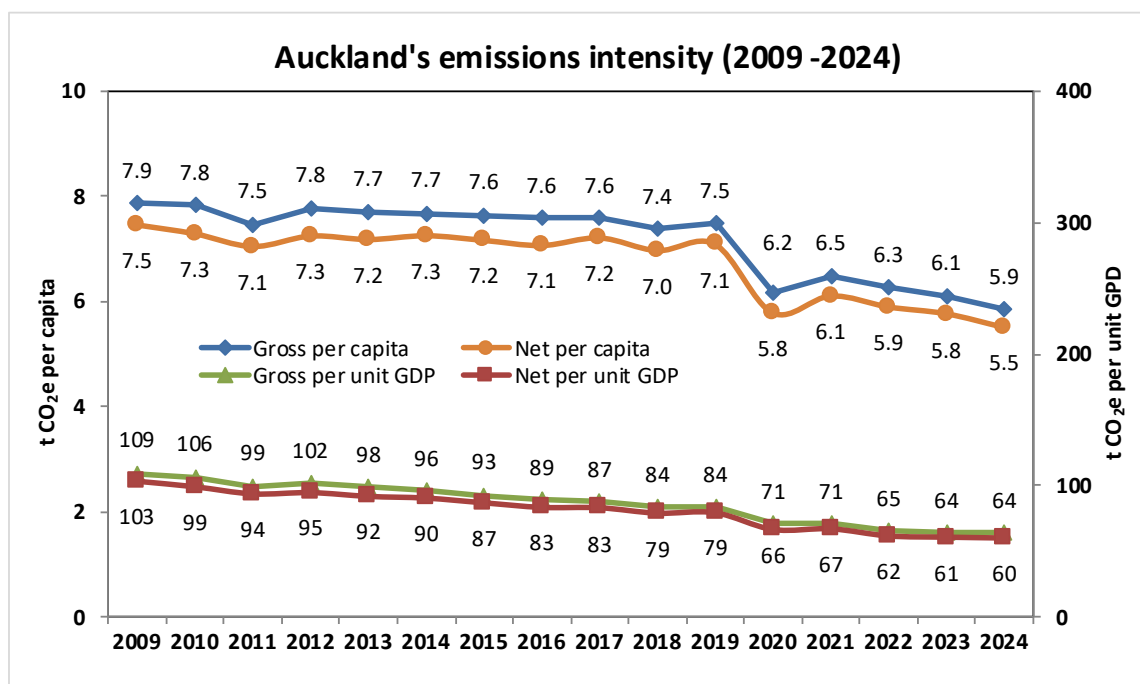


Figure 5-2 Auckland's emissions intensity from 2009 to 2024

5.2 Impact of 2016 baseline update on achieving the emission goal

The goal of net zero emissions by 2050 with an interim emissions reduction of 50 per cent by 2030 was set against a 2016 baseline which was reported in *Auckland's greenhouse gas inventory to 2016* (Xie, 2019). Gross and net emissions in 2016 in this inventory are higher than those reported in the previous 2016 inventory (Table A-4) by 585 ktCO₂e (5.1 per cent) and 976 ktCO₂e (9.5 per cent), respectively. Additional 292 kt CO₂e and 488 kt CO₂e emissions need to be reduced for halving gross and net emissions, respectively. This demonstrates the importance of maintaining an annual inventory update which reflect the latest information available. This informs the timely development and update of effective mitigation strategies, policy and actions which are necessary for Auckland to meet its goals. Figure 5-3 illustrates gross and net emissions trends, and half of 2026 emissions in 2030. Under the current trend, it is not expected to achieve the goal of net zero emissions by 2050 with an interim emissions reduction of 50 per cent by 2030.

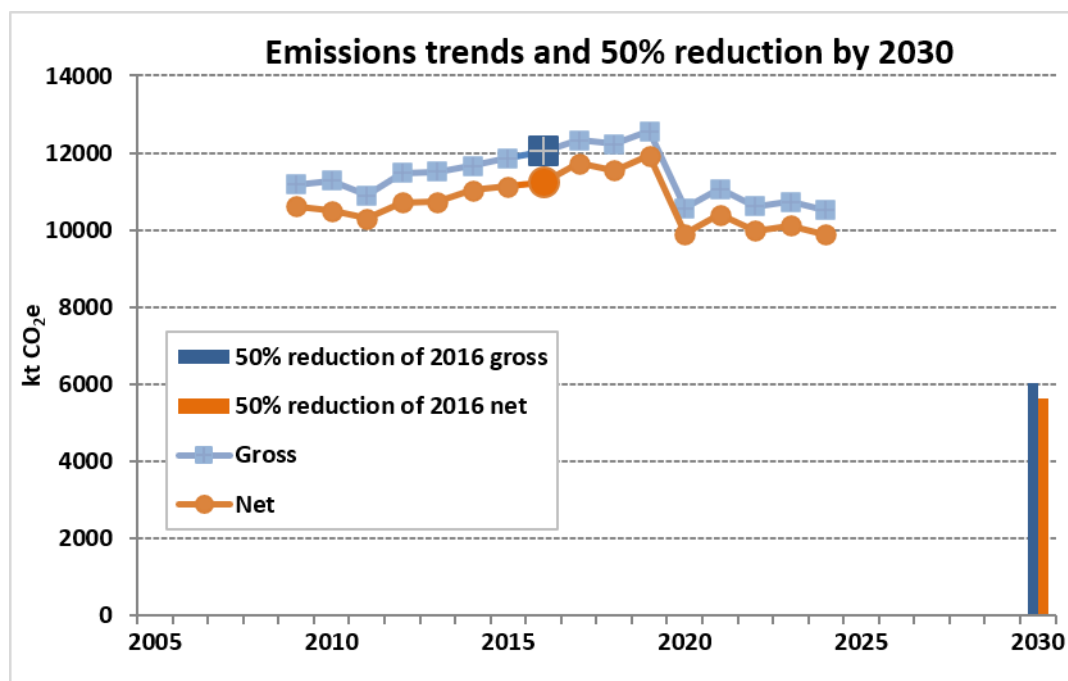


Figure 5-3 Gross and net emissions 2009-2024 and half of 2016 emissions in 2030. Emissions in baseline year (2016) are highlighted

5.3 Comparison with national inventory

Identifying differences in emissions profiles between Auckland and New Zealand helps develop mitigation actions to address major sources in Auckland. Figure 5-4 shows the emission distribution within various sectors for New Zealand and for Auckland. In 2024, New Zealand's gross emissions were dominated by agriculture (53.0%), energy (19.8%), and transport (18.1%) sectors (MfE, 2026a). Comparatively, in Auckland, transport (45.3%) was the dominant sector, followed by energy (27.3%) and IPPU (18.7%) sectors.

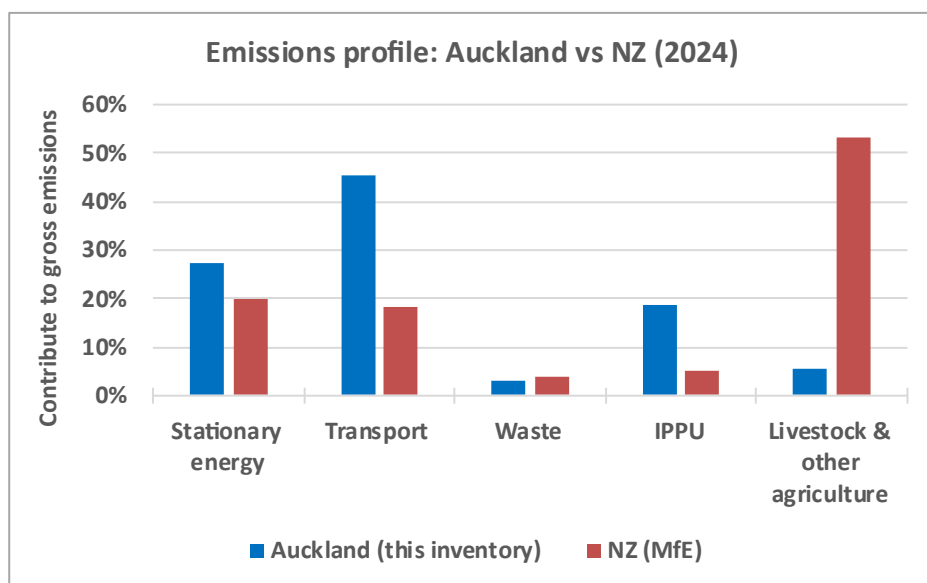


Figure 5-4 A comparison of emissions profiles between Auckland (this inventory) and NZ (MfE, 2026a)

Although the inventories have different sectoral profiles, Auckland's gross emissions largely tracked a similar trend to national emissions (MfE, 2026a) (Figure 5-5, emissions were indexed back to 2009). In Auckland, a faster increase in gross emissions between 2009 and 2019 was mainly driven by the transport sector. A bigger drop between 2019 and 2020 and a bigger rebound between 2020 and 2021 are due to the dominance of the transport sector for Auckland emissions profile. Work is ongoing to further understand Auckland's emissions trends and driving factors for evaluating progress of *Te-Tāruke-ā-Tāwhiri: Auckland's Climate Plan*.

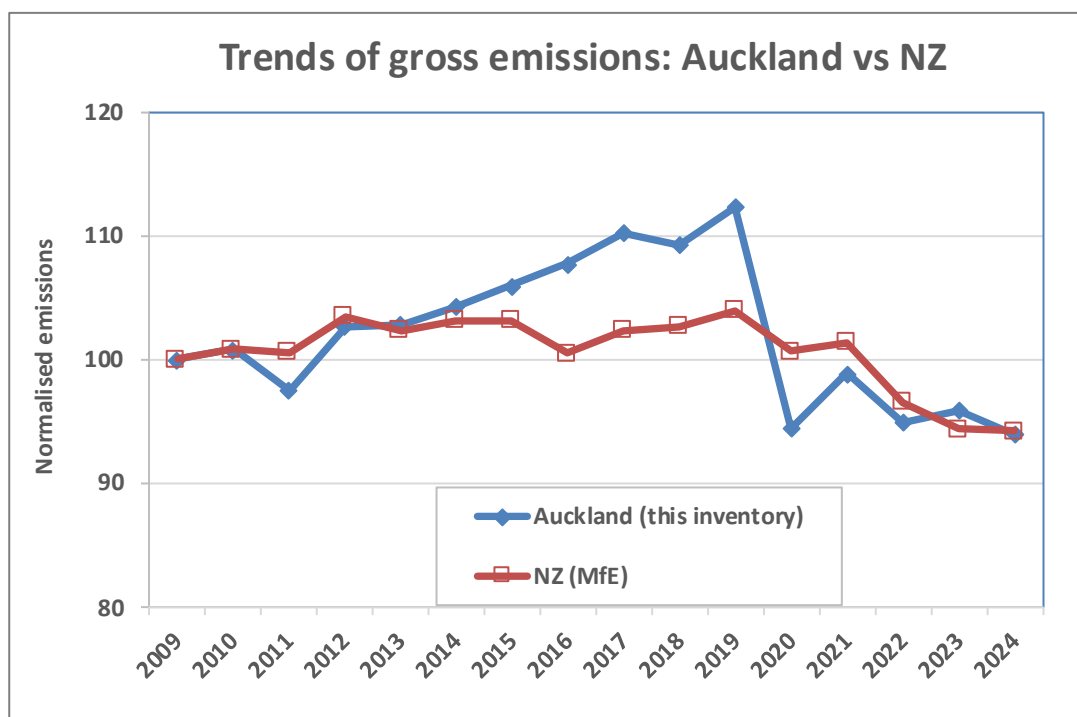


Figure 5-5 Trends of gross emissions: Auckland (this inventory) vs NZ (MfE, 2026a)

5.4 Comparison with Stats NZ regional emissions

Stats NZ (2025a) reported Auckland's GHG emissions for 2007-2024 using the United Nations System of Environmental-Economic Accounting (SEEA) framework which is designed primarily to show interactions between the environment and economy in a way consistent with the System of National Accounts. The data is suited to compare emissions between regions, with other regional datasets, such as GDP, labour market statistics or population. It can show how a region contributes to national emissions. It provides complimentary insights into Auckland's emissions, e.g. by households and industries. However, the difference in scope of the GPC and the SEEA framework leads to differences in emissions estimates. For example, the GPC reports grid-supplied electricity use in Auckland's emissions while the SEEA does not. Nevertheless, it is still useful to compare the two datasets to ensure that the differences can be justified by the difference in methodology.

Figure 5-6 presents a comparison of gross emissions in 2023 with Stats NZ data (2025a). 2023 is the most recent year with emissions disaggregated in these sectors by Stats NZ. Both datasets show a similar emissions profile. This inventory reports higher emissions from energy due to including consumption of grid-electricity and low emissions from transport due to using fuel use data for aviation. Emissions are the same or similar for other sources, i.e., waste, IPPU, livestock and other agriculture. This gives confidence that this inventory provides an accurate account of emissions in

Auckland. Based on the SEEA framework, Auckland contributed 14.9 per cent to national gross emissions in 2024 (Stats NZ, 2025a).

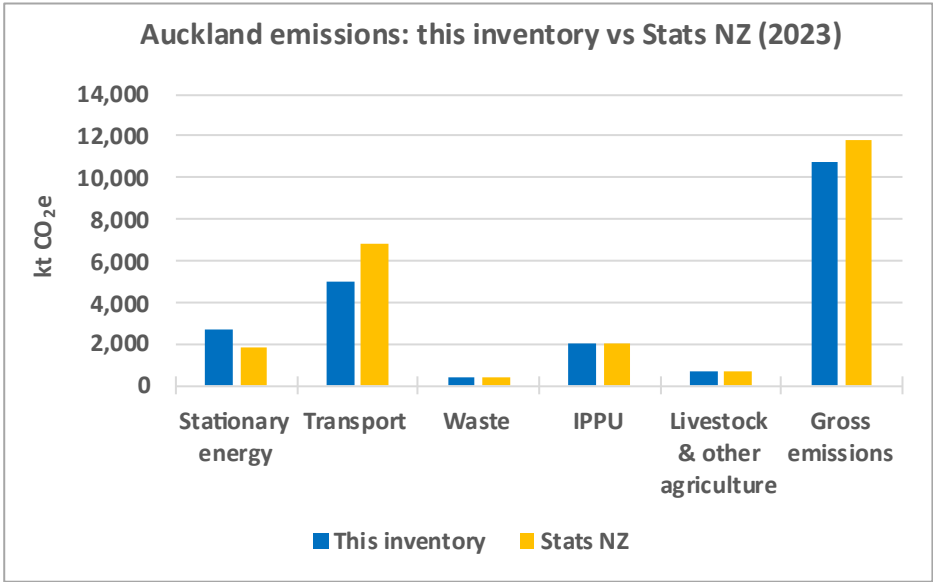


Figure 5-6 Auckland’s gross emissions in 2023 by sector vs Stats NZ data (2025a)

6 Limitations

The input data of this inventory came from various organisations. Emissions data and activity data were collected where and when available. Activity data of some emissions sources were calculated based on activity-related information. Work is in progress to fill in existing gaps where possible.

These include:

- Emissions and removals from land and HWPs;
- A need to gather more updated information as well as improve data quality of some estimated activity data, for example, coal consumption, energy use by off-road transport, allocation of energy consumption into sub-sector (residential, commercial, industrial and agriculture);
- The apportionment of on-road emissions by vehicle class (heavy vs light); and
- Electricity use for electric vehicles.

7 Conclusions

Concluding findings of the inventory are as follows:

- In 2024, Auckland's gross and net emissions were 10,515 kt CO₂e and 9,887 kt CO₂e, respectively. Carbon dioxide (CO₂) contributed 86.2 per cent of gross emissions. Transport and stationary energy dominated emissions, accounting for 45.3 per cent and 27.3 per cent of gross emissions, respectively.
- Between 2009 and 2024, gross and net emissions generally increased from 2009 to 2019, markedly dropped in 2020, then rebounded in 2021 and flattened to 2024. This change was largely driven by the COVID-19 restrictions which resulted in a marked reduction in emissions from transport. Both emissions peaked in 2019.
- Between 2016 (baseline year) and 2024, emissions decreased by 1,355 kt CO₂e (12.1 per cent) for gross and 1,533 kt CO₂e (12.7 per cent) for net emissions. The drop was due to decreased emissions from transport and other sources. To halve 2016 emissions by 2030, a reduction of 4,491 kt CO₂e (42.7 per cent) and 4,266 kt CO₂e (43.1 per cent) of 2024 gross and net emissions is required.
- Between 2023 and 2024, emissions decreased by 215 kt CO₂e (2.0 per cent) for gross and 230 kt CO₂e (2.3 per cent) for net emissions. This is driven by decreased emissions from transport and other sources, partially offset by increased emissions from energy.
- In 2024, gross emissions were 5.9 t CO₂e per capita and 64 t CO₂e per million \$NZ GDP (March 2025 prices) while net emissions were 5.5 t CO₂e per capita and 60 t CO₂e per million \$NZ GDP. Emissions per capita or per unit GDP broadly decreased from 2009. This shows that emissions have not increased as fast as population and economic growth.

8 Acknowledgements

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Stats NZ: Adam Tipper for providing customised Stats NZ's data which are licensed by Stats NZ for re-use under the Creative Commons Attribution 4.0 International licence

Watercare Services Limited: Atisha Daya, Kuljit Kaur

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10 Abbreviations

This chapter is based on WRI et al., (2021)

AFOLU	Agriculture, forestry and other land use
AR4	IPCC Fourth Assessment Report
AR5	IPCC Fifth Assessment Report
C40	C40 Cities Climate Leadership Group
CDP	Formerly the Carbon Disclosure Project, a global disclosure system
CH ₄	Methane
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
EF	Emission factor
GDP	Gross domestic product
GHG	Greenhouse gas
GPC	Global Protocol for Community-scale Greenhouse Gas Emission Inventories
GWP	Global warming potential
HFCs	Hydrofluorocarbons
HWPs	Harvested wood products
ICLEI	ICLEI – Local Governments for Sustainability
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial processes and product use
LULUCF	Land use, land use change and forestry
MSW	Municipal solid waste
N ₂ O	Nitrous oxide
NF ₃	Nitrogen trifluoride
PFCs	Perfluorocarbons
SF ₆	Sulphur hexafluoride
WRI	World Resources Institute
WWTP	Wastewater treatment plant

11 Glossary

This chapter is based on WRI et al., (2021).

Activity data: A quantitative measure of a level of activity that results in GHG emissions. Activity data is multiplied by an emission factor to derive the GHG emissions associated with a process or an operation. Examples of activity data include kilowatt-hours of electricity used, quantity of fuel used, output of a process, hours equipment is operated, distance travelled, and floor area of a building.

Allocation: The process of partitioning GHG emissions among various outputs.

Base year: A historical datum (e.g., year) against which a city's emissions are tracked over time.

BASIC: An inventory reporting level that includes all scope 1 sources except from energy generation, imported waste, *IPPU*, and *AFOLU*, as well as all scope 2 sources.

BASIC+: An inventory reporting level that covers all BASIC sources, plus scope 1 *AFOLU* and *IPPU*, and scope 3 in the *Stationary Energy* and *Transportation* sectors.

Biogenic emissions (CO₂(b)): Emissions produced by living organisms or biological processes but not fossilised or from fossil sources.

City: Used throughout the GPC to refer to geographically discernible subnational entities, such as communities, townships, cities, and neighbourhoods.

City boundary: See geographic boundary.

CO₂ equivalent: The universal unit of measurement to indicate the global warming potential (GWP) of each GHG, expressed in terms of the GWP of one unit of carbon dioxide. It is used to evaluate the climate impact of releasing (or avoiding releasing) different greenhouse gases on a common basis.

Emission: The release of GHGs into the atmosphere.

Emission factor(s): A factor that converts activity data into GHG emissions data (e.g., kg CO₂e emitted per litre of fuel consumed, kg CO₂e emitted per kilometre travelled, etc.).

Geographic boundary: A geographic boundary that identifies the spatial dimensions of the inventory's assessment boundary. This geographic boundary defines the physical perimeter separating in-boundary emissions from out-of-boundary and transboundary emissions.

Global warming potential: A factor describing the radiative forcing impact (degree of harm to the atmosphere) of one unit of a given GHG relative to one unit of CO₂.

Greenhouse gas inventory: A quantified list of a city's GHG emissions and sources.

Greenhouse gases (GHG): For the purposes of the GPC, GHGs are the seven gases covered by the UNFCCC: carbon dioxide (CO₂); methane (CH₄); nitrous oxide (N₂O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); sulphur hexafluoride (SF₆); and nitrogen trifluoride (NF₃).

In-boundary: Occurring within the established geographic boundary.

Inventory boundary: The inventory boundary of a GHG inventory identifies the gases, emission sources, geographic area, and time span covered by the GHG inventory.

Out-of-boundary: Occurring outside of the established geographic boundary.

Reporting: Presenting data to internal and external users such as regulators, the general public or specific stakeholder groups.

Reporting year: The year for which emissions are reported.

Scope 1 emissions: GHG emissions from sources located within the city boundary.

Scope 2 emissions: GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the city boundary.

Scope 3 emissions: All other GHG emissions that occur outside the city boundary as a result of activities taking place within the city boundary.

Transboundary emissions: Emissions from sources that cross the geographic boundary.

12 Appendix: Emissions tables, update of historic emissions, data sources

Table A-1 GHG emissions by sector and sub-sector for 2024 (in the GPC format)*

GPC ref No.	GHG Emissions Source (By Sector and Sub-sector)	Total GHGs (metric tonnes CO ₂ e)		
		Scope 1	Scope 2	Scope 3
I	STATIONARY ENERGY			
I.1	Residential buildings	212,493	413,118	31,280
I.2	Commercial and institutional buildings and facilities	375,000	289,335	21,908
I.3	Manufacturing industries and construction	1,139,854	182,630	13,828
I.4.1/2/3	Energy industries	NO	NO	NO
I.4.4	Energy generation supplied to the grid	20		
I.5	Agriculture, forestry and fishing activities	81,000	84,108	6,369
I.6	Non-specified sources	NO	NO	NO
I.7	Fugitive emissions from mining, processing, storage, and transportation of coal	NO		
I.8	Fugitive emissions from oil and natural gas systems	22,935		
SUB-TOTAL	(city induced framework only)	1,831,282	969,191	73,385
II	TRANSPORTATION			
II.1	On-road transportation	3,717,175	12,914	978
II.2	Railways	3,216	3,084	233
II.3	Waterborne navigation	23,860	IE	285,028
II.4	Aviation	NO	IE	717,240
II.5	Off-road transportation		NO	NO
SUB-TOTAL	(city induced framework only)	3,744,250	15,998	1,003,480
III	WASTE			
III.1.1/2	Solid waste generated in the city	172,311		73,988
III.2.1/2	Biological waste generated in the city	NO		NO
III.3.1/2	Incinerated and burned waste generated in the city	NO		NO
III.4.1/2	Wastewater generated in the city	84,600		NO
III.1.3	Solid waste generated outside the city	NO		
III.2.3	Biological waste generated outside the city	NO		
III.3.3	Incinerated and burned waste generated outside city	NO		
III.4.3	Wastewater generated outside the city	NO		
SUB-TOTAL	(city induced framework only)	256,911		73,988
IV	INDUSTRIAL PROCESSES and PRODUCT USES			
IV.1	Emissions from industrial processes occurring in the city boundary	1,579,189		
IV.2	Emissions from product use occurring within the city boundary	391,000		
SUB-TOTAL	(city induced framework only)	1,970,189		
V	AGRICULTURE, FORESTRY and OTHER LAND USE			
V.1	Emissions from livestock	499,769		
V.2	Emissions from land	-450,730		
V.3	Emissions from aggregate sources and non-CO ₂ emission sources on land	-101,182		
SUB-TOTAL	(city induced framework only)	-52,143		
VI	OTHER SCOPE 3			
VI.1	Other Scope 3			NE
TOTAL	(city induced framework only)	7,750,490	985,188	1,150,852

* See Table 3-2 for the meaning of cell colours

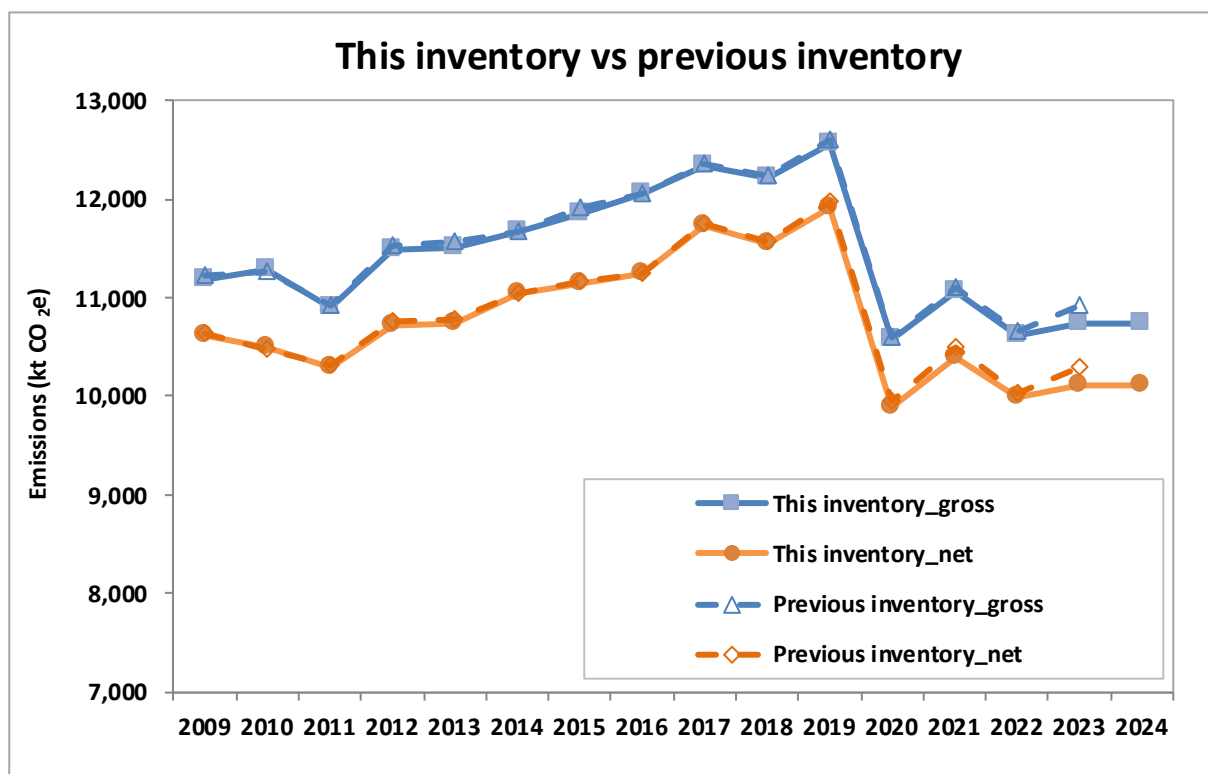


Figure A-1 Comparison of GHG emissions: this inventory vs previous 2023 inventory

Table A-2 2016 gross emissions profile in this inventory vs previous 2016 inventory

Sources	2016 inventory*		This inventory		Change	
	ktCO ₂ e	% of gross emissions	ktCO ₂ e	% of gross emissions	ktCO ₂ e	% of gross emissions
Energy – Residential	595	5.2%	572	4.7%	-23	-0.2%
Energy – Commercial	604	5.3%	650	5.4%	45	0.4%
Energy – Industrial	1,513	13.2%	1,524	12.7%	12	0.1%
Energy – Agricultural	322	2.8%	167	1.4%	-155	-1.4%
Fugitive from natural gas	**		110	0.9%		
Transport – Road	4,256	37.1%	4,340	36.0%	84	0.7%
Transport – Rail	12	0.1%	9	0.1%	-3	0.0%
Transport – Sea	412	3.6%	389	3.2%	-23	-0.2%
Transport – Air	257	2.2%	800	6.6%	543	4.7%
Transport – Off-road	**		**			
Waste	396	3.5%	508	4.2%	111	1.0%
Industrial processes & product use	2,317	20.2%	2,250	18.7%	-67	-0.6%
Agriculture	778	6.8%	730	6.1%	-48	-0.4%
Gross emissions	11,463	100.0%	12,048	100%	585	5.1%

* Auckland's greenhouse gas inventory to 2016 (Xie, 2019), updated emissions CO₂e in AR5.

** Emissions were reported in "Energy" sources.

Table A-3 2023 gross emissions profile in this inventory vs previous 2023 inventory

Sources	2023 inventory*		This inventory		Change	
	ktCO ₂ e	% of gross emissions	ktCO ₂ e	% of gross emissions	ktCO ₂ e	% of gross emissions
Energy – residential buildings	546	5.0%	557	5.2%	11	0.1%
Energy – commercial & institutional buildings	484	4.4%	658	6.1%	174	1.6%
Energy – manufacturing & construction	1,355	12.4%	1,298	12.1%	-57	-0.5%
Energy – agriculture	149	1.4%	143	1.3%	-6	-0.1%
Energy – gas T&D losses	26	0.2%	26	0.2%	-1	0.0%
On-road transport	4,013	36.8%	4,013	37.4%	0	0.0%
Trains	6	0.1%	6	0.1%	0	0.0%
Ferries & ships	363	3.3%	363	3.4%	0	0.0%
Aviation	678	6.2%	642	6.0%	-36	-0.3%
Off-road transport	49	0.4%	**			
landfill gas	310	2.8%	268	2.5%	-42	-0.4%
Waste water treatment	94	0.9%	94	0.9%	0	0.0%
Steel production	1,496	13.7%	1,496	13.9%	0	0.0%
Glass making & others	103	0.9%	55	0.5%	-48	-0.4%
Industrial product use	581	5.3%	445	4.1%	-136	-1.2%
Agriculture	665	6.1%	666	6.2%	1	0.0%
Gross emissions	10,919	100.0%	10,730	100%	-189	-1.7%

* Auckland's greenhouse gas inventory to 2023 (Xie, 2025).

** Emissions from "Off-road transport" were reported in "Energy" sources.

Table A-4 Analysis of changes in 2016 emissions from previous 2016 inventory

Source	Emissions in 2016 (ktCO ₂ e)		Change		% Change to 2016 inventory		Reasons of change
	2016 inventory*	This inventory	ktCO ₂ e	%	Gross emissions	Net emissions	
STATIONARY ENERGY							
Electricity	925	927	2	0.3%	0.0%	0.0%	Update of emissions
Natural gas	978	946	-31	-3.2%	-0.3%	-0.3%	Update of natural gas use
LPG	131	281	149	113.5%	1.3%	1.5%	Update of LPG use
Wood	140	9	-130	-93.5%	-1.1%	-1.3%	Update of wood use
Coal	34	838	804	2353.3%	7.0%	7.8%	Update of coal use
Liquid fuel	828	22	-806	-97.3%	-7.0%	-7.9%	date of liquid fuel use
TRANSPORT							
Petrol (vehicles)	2,583	2,682	99	3.8%	0.9%	1.0%	Update of emissions factors
Diesel (vehicles)	1,668	1,657	-11	-0.7%	-0.1%	-0.1%	Update of emissions factors
LPG (vehicles)	5	2	-4	-70.7%	0.0%	0.0%	Update of LPG use
Electricity (trains and vehicles)	3	3	0	3.5%	0.0%	0.0%	Update of emissions factors
Train (diesel)	8	6	-3	-33.9%	0.0%	0.0%	Update of diesel use
Ferry	33	27	-6	-18.0%	-0.1%	-0.1%	Update of diesel use
Aviation	257	800	543	211.5%	4.7%	5.3%	Update of emissions
Shipping	379	362	-17	-4.5%	-0.1%	-0.2%	Update of emissions factors
Diesel for off-road transport	**	**					
WASTE							
Solid waste disposal	390	449	60	15.4%	0.5%	0.6%	Update of emissions
Waste water treatment	7	58	51	748.5%	0.4%	0.5%	Update of emissions
INDUSTRIAL PROCESSES and PRODUCT USES (IPPU)							
Industrial processes	1,770	1,774	4	0.2%	0.0%	0.0%	Update of emissions
Product use	547	476	-71	-13.0%	-0.6%	-0.7%	Update of emissions

Source	Emissions in 2016 (ktCO ₂ e)		Change		% Change to 2016 inventory		Reasons of change
	2016 inventory*	This inventory	ktCO ₂ e	%	Gross emissions	Net emissions	
AGRICULTURE, FORESTRY and OTHER LAND USE (AFOLU)							
Livestock	637	604	-33	-5.1%	-0.3%	-0.3%	Update of emissions
Land	-1,313	-787	527	-40.1%	4.6%	5.1%	Update of emissions
Aggregate sources and non-CO2 emission sources on land	257	106	-151	-58.6%	-1.3%	-1.5%	Update of emissions
Gross emissions	11,464	12,048	585	5.1%			
Net emissions	10,266	11,242	976	9.5%			

* Auckland's greenhouse gas inventory to 2016 (Xie, 2019), updated emissions CO₂e in AR5.

** Emissions from "Off-road transport" were reported in "Energy" sources.

Table A-5 Analysis of changes in 2023 emissions from previous 2023 inventory*

Source	Emissions in 2023 (ktCO ₂ e)		Change		% Change to 2021 inventory		Reasons of change
	2023 inventory*	This inventory	ktCO ₂ e	%	Gross emissions	Net emissions	
STATIONARY ENERGY							
Electricity	790	788	-1	-0.2%	0.0%	0.0%	Update of electricity use
Natural gas	850	830	-20	-2.4%	-0.2%	-0.2%	Update of natural gas use
LPG	320	341	21	6.5%	0.2%	0.2%	Update of LPG use
Wood	23	3	-20	-86.2%	-0.2%	-0.2%	Update of wood use
Coal	555	698	142	25.6%	1.3%	1.4%	Update of coal use
Liquid fuel	22	22	0	-0.2%	0.0%	0.0%	No changes
TRANSPORT							
Petrol (vehicles)	2,208	2,208	0	0.0%	0.0%	0.0%	No changes
Diesel (vehicles)	1,797	1,797	0	0.0%	0.0%	0.0%	No changes
LPG (vehicles)	0	0	0	-0.1%	0.0%	0.0%	No changes
Electricity (trains and vehicles)	11	11	0	-0.2%	0.0%	0.0%	No changes
Train (diesel)	4	4	0	0.0%	0.0%	0.0%	No changes
Ferry	21	21	0	0.0%	0.0%	0.0%	No changes
Aviation	678	642	-36	-5.3%	-0.3%	-0.3%	Update of emissions attributable to Auckland
Shipping	342	342	0	0.0%	0.0%	0.0%	No changes
Diesel for off-road transport	49	**					
WASTE							
Solid waste disposal	310	268	-42	-13.6%	-0.4%	-0.4%	Update of emissions
Waste water treatment	94	94	0	0.0%	0.0%	0.0%	No changes
INDUSTRIAL PROCESSES and PRODUCT USES (IPPU)							
Industrial processes	1,599	1,551	-48	-3.0%	-0.4%	-0.5%	Update of Stats NZ customised emissions data
Product use	581	445	-136	-23.4%	-1.2%	-1.3%	Update of Stats NZ customised emissions data

AGRICULTURE, FORESTRY and OTHER LAND USE (AFOLU)							
Livestock	579	579	0	0.0%	0.0%	0.0%	No changes
Land	-400	-393	7	-1.8%	0.1%	0.1%	Update of emissions
Aggregate sources and non-CO2 emission sources on land	-135	-134	1	-0.8%	0.0%	0.0%	Update of emissions
Gross emissions	10,919	10,730	-189	-1.7%			
Net emissions	10,298	10,116	-182	-1.8%			

* Auckland's greenhouse gas inventory to 2023 (Xie, 2025).

** Emissions from "Off-road transport" were reported in "Energy" sources.

Table A-6 Information sources and data quality

	Activity data or emissions data	Data quality*
STATIONARY ENERGY		
Electricity	Total consumption was sourced from various organisations (Vector Ltd, 2025; Counties Energy Ltd, 2026; NZEA, 2025). Electricity consumption by the residential sub-sector was sourced from (NZEA, 2025). Allocation into other sub-sectors was based on the Energy End-Use Database (EECA, 2025a).	H for total consumption as data was robust. M for sub-sector consumption due to uncertainty in breakdown of total consumption into sub-sectors.
Natural gas	Total supply was provided by First Gas Limited (2026). Its allocation to sub-sectors was based on Vector Ltd (2025) and Stats NZ's data for Auckland (Stats NZ, 2025a).	H for total consumption as data was robust. M for sub-sector consumption due to uncertainty in breakdown of total consumption into sub-sectors.
LPG	Emissions (total and sub-sectors) from LPG, diesel and solid fuels (coal and wood) were based on Stats NZ's data for Auckland (Stats NZ, 2025a) and industrial emissions data (Atkins, 2018; EECA, 2024; EECA, 2025b).	M for total and sub-sector consumption due to uncertainty in calculations.
Wood	The same as LPG. The ratio of emissions from coal and wood for residential sources was based on Auckland air emissions inventory (Metcalf, et. al., 2018).	M due to uncertainty in calculation.
Coal	The same as LPG.	The same as LPG.
Liquid fuel	Liquid fuel use data was from industrial emissions data (Atkins, 2018).	M due to uncertainty in calculation.
Off-road transport	Due to lack of data, the emissions are not reported in this section but are included in Energy.	Not assessed.
TRANSPORT		
Petrol (vehicles)	Petrol sales were provided by Auckland Transport and based on the local authority fuel tax reports.	H as data was robust.
Diesel (vehicles)	Diesel sales were provided by Auckland Transport and based on the local authority fuel tax reports.	H as data was robust.
LPG (vehicles)	LPG use was estimated by portioning New Zealand's consumptions (MoT, 2024a) by the ratio of vehicle fleet in Auckland to New Zealand (MoT, 2024b).	M as data was estimated.
Electricity (trains and vehicles)	Electricity use for trains was provided by Auckland Transport. The data for vehicles was estimated by portioning New Zealand's consumptions (MoT, 2026a) by the ratio of vehicle fleet in Auckland to New Zealand (MoT, 2026b).	M as data for vehicles was estimated.
Train (diesel)	Diesel consumption for passenger trains was provided by Auckland Transport. Diesel use by freight trains was calculated based on rail tonnage data from the Freight Information Gathering System (FIGS) (MoT, 2026c).	M as data for freight trains was calculated based on activity-related information.
Ferry	Diesel use was provided by Auckland Transport.	H as data was robust.
Aviation	The Joint User Hydrant Installation (JUHI) Depot provided aviation fuel consumption at Auckland Airport. The proportion attributable to Auckland was calculated based on passenger information (Stats NZ, 2025b; Auckland Airport, 2026).	M due to uncertainty in estimating the portion attributable to Auckland.
Shipping	Total amount of fuel oil used to re-fuel ships at seaports was provided by Auckland Transport. The proportion attributable to Auckland was calculated based on export data at NZ shipping ports in tonnage from the Freight Information Gathering System (FIGS) (MoT, 2026c).	M due to uncertainty in estimating the portion attributable to Auckland.

	Activity data or emissions data	Data quality*
WASTE		
Solid waste disposal	Emissions from landfills were provided by the waste team at Auckland Council, which was based on the amount of solid waste and its composition. The team also provided emissions from food scraps processed at Reporoa Organics Processing Facility. Emissions from farm fills and rural waste were provided by Stats NZ (2025a).	M due to uncertainty in estimating total amount of solid waste and its composition.
Waste water treatment	Emissions data was provided by Watercare Services Ltd (2025).	M due to uncertainty in calculations.
INDUSTRIAL PROCESSES and PRODUCT USES (IPPU)		
Industrial processes	Emissions data was sourced from Stats NZ (2025a) and New Zealand's Greenhouse Gas Inventory (MfE, 2026a)	H as data was robust.
Product use	Total CO ₂ e emissions from industrial product use were provided by Stats NZ (2025a). The proportion of CO ₂ , N ₂ O, HFCs, PFCs and SF ₆ was reported the same as in New Zealand's Greenhouse Gas Inventory (MfE, 2026a)	M due to uncertainty in the proportion of CO ₂ , N ₂ O, HFCs, PFCs and SF ₆ .
AGRICULTURE, FORESTRY and OTHER LAND USE (AFOLU)		
Livestock	The number of livestock (dairy cattle, non-dairy cattle, sheep, deer, pig, goat and horse) was sourced from Stats NZ (2025b).	M due to uncertainty in calculations.
Land	Emissions and removals were calculated by portioning national data.	M due to uncertainty in calculations.
Aggregate sources and non-CO ₂ emission sources on land	Emissions from liming and urea application were estimated based on national emissions (MfE, 2026a) allocated to Auckland based on the proportion of all fertilisers used to the national total (Stats NZ, 2025b). Direct and indirect N ₂ O from managed soils were calculated using the number of livestock. HWP's emissions were calculated by portioning national data.	M due to uncertainty in calculations.

* The quality of activity data was assessed with a High (H)-Medium (M)-Low (L) rating where possible, see section 2.2 for details.

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