

Dunedin City GHG Emissions Inventory 2025

(1st July 2024 – 30th June 2025)

23-Jan-2026

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Executive Summary

This inventory details the Greenhouse Gas (GHG) emissions within the geographic boundaries of the Dunedin City Territorial Area. This inventory has been measured and reported using the production-based Global Protocol for Community-Scale GHG Emissions Inventory (GPC) methodology and covers the FY25 government financial year (1st July 2024 to 30th June 2025).

Dunedin City's last city-wide emissions inventory was produced for the FY22 year, with FY19 used as the city's emissions-reduction baseline year. As part of this work, the previously published annual emissions inventories for Dunedin City from FY19 to FY22 have been updated. The results presented in this report supersede past results in previous inventories. Percentage values are rounded to the nearest whole number.

Major findings of the FY25 inventory include:

- **Total gross emissions** in Dunedin City were 1,416,010 tCO₂e.
- **Transport** (e.g. emissions resulting from road, marine, and air travel) represented 44% of Dunedin City's total gross emissions, with on-road petrol and diesel consumption accounting for 23% of the city's total gross emissions. Marine transport (e.g. freight and cruise ships) represented 16% of total gross emissions.
- **Agriculture** was the second-highest emitting sector in the city and represented 39% of Dunedin City's total gross emissions. Methane from livestock enteric fermentation represented 29% of the city's total gross emissions.
- **Stationary Energy** (e.g. emissions relating to electricity, coal, and LPG use) produced 12% of total gross emissions.
- **Waste** (e.g., landfill and wastewater emissions) accounted for 3% of total gross emissions.
- **Industrial Processes and Product Use (IPPU)** (e.g. emissions from refrigerant gases and aerosols) represented 2% of Dunedin City's total gross emissions.
- **Net Forestry** emissions in FY25 totalled -296,134 tCO₂e. This indicates that carbon sequestration (carbon captured and stored in plants or soil) exceeded emissions from forest harvesting (e.g., the release of carbon following harvesting). Net forestry emissions are not included in total gross emissions but in total net emissions. Therefore, the **total net emissions** (gross emissions minus forestry) in Dunedin City were 1,119,876 tCO₂e.

Key changes from FY19 to FY25:

- **Annual total gross emissions** decreased by 13% from FY19 to FY25 (-203,526 tCO₂e).
- **Transport** emissions decreased by 8% (-53,082 tCO₂e). Within transport, marine transport, air travel and on-road transport emissions all decreased.
- **Agriculture** emissions decreased 9% (-53,212 tCO₂e), driven by a decrease in dairy cattle and sheep populations in the Dunedin City area.
- **Stationary Energy** emissions decreased by 19% (-38,841 tCO₂e), driven by a 70% reduction in coal use and a 14% decrease in electricity emissions.
- **Waste** emissions decreased by 50% (-46,569 tCO₂e), driven by a 62% decrease in emissions from landfill sites due to improvements in gas capture at some sites, and the gradual decrease in emissions from closed sites.
- **IPPU** emissions decreased by 27% (-11,822 tCO₂e), mainly due to a market shift to the use of refrigerant gases with lower GHG emissions impact.
- **Net Forestry** emissions changed from -361,337 tCO₂e to -296,134 tCO₂e driven by an increase in emissions from harvesting, and a reduction in exotic forest cover. Therefore, the **total net emissions** (gross emissions minus forestry) decreased by 11%. Net forestry emissions are heavily impacted by commercial harvesting patterns and can vary significantly year-to-year.

1.0 Introduction

Dunedin City Council (DCC) commissioned AECOM New Zealand Limited (AECOM) to develop a production-based, community-scale Greenhouse Gas (GHG) emissions footprint for Dunedin City for the 2025 financial year (FY25). The FY25 year covers the period from 1st July 2024 to 30th June 2025 (government financial year). The study boundary incorporates the Dunedin City Territorial Area which is hereafter referred to as Dunedin City for ease.

The GHG emissions inventory for FY25 estimates the relative scale of GHG emissions produced in the Dunedin City area and the relative contribution of different emission sources to Dunedin City's total emissions. The results of this inventory can be used to assess trends and changes in Dunedin City's emissions over time.

This inventory represents part of Dunedin City Council's Zero Carbon climate action plan, which involves measuring the city's emissions and tracking progress towards its 2030 net-zero target.

2.0 Approach

The methodological approach used to calculate emissions follows the Global Protocol for Community-Scale Greenhouse Gas Emissions Inventory v1.1 (GPC) published by the World Resources Institute (WRI) 2021. The GPC methodology follows a production-based approach and allocates emissions to industries rather than final users. Production-based approaches exclude global emissions relating to consumption (i.e., embodied emissions relating to products produced elsewhere but consumed within the geographic area, such as imported food products, cars, phones, clothes, etc.).

This emissions footprint assesses both direct and indirect emissions sources. Direct emissions are production-based and occur within the geographic area (Scope 1 in the GPC reporting framework). Indirect emissions are produced outside the geographic boundary (Scope 2 and 3) but are allocated to the consumption location. An example of indirect emissions is those associated with electricity consumption, which is supplied by the national grid (Scope 2). All other indirect emissions, such as cross-boundary travel (e.g., flights) and energy transportation and distribution losses, are Scope 3.

As part of this work, the previously published annual emissions inventories for Dunedin City from FY19 to FY22 have been updated, and the results presented in this report supersede past results for previous inventories.

The inventory is based on data and reporting guidance available at the time of calculation, using reasonable assumptions in line with the GPC reporting guidance, and may need to be updated in the future to account for changes in data availability or changes to reporting guidance.

Greenhouse gas emissions are generally reported in this document in Carbon Dioxide Equivalent (CO₂e) units and are referred to as 'emissions'.

All major assumptions made during data collection and analysis have been detailed within **Appendix A – Assumptions and Data Sources**.

Considering the uncertainty associated with the results is essential, particularly given the different datasets used. At the national level, in New Zealand's Greenhouse Gas Inventory the estimate of gross emissions uncertainty was $\pm 8.58\%$, with a net emissions uncertainty estimate of $\pm 24.3\%$ ¹.

¹ <https://environment.govt.nz/assets/publications/GhG-Inventory/GHG-inventory-2024/GHG-Inventory-2024-Vol-1.pdf>

3.0 Dunedin City Emissions Inventory for FY25

Total emissions are reported as gross emissions (excluding forestry harvesting and sequestration) and net emissions (including forestry harvesting and sequestration). This report focuses on gross emissions.

During FY25, Dunedin City's total gross emissions were 1,416,010 tCO₂e. Agriculture and transport emissions are the City's most significant contributors to total gross emissions.

The population of Dunedin City in FY25 was approximately 131,800 people², resulting in per capita gross emissions of 10.7 tCO₂e/person.

The total net emissions (gross emissions including forestry) in Dunedin City were 1,119,876 tCO₂e.

Table 1 Total net and gross emissions

Total Emissions	Emissions (tCO ₂ e)
Total Gross Emissions (excluding Forestry)	1,416,010
Total Net Emissions (including Forestry)	1,119,876

Figure 1 and Table 2 illustrate the six different sectors that comprise the emissions inventory. A discussion of each sector follows in Sections 3.1 through Section 3.6. Section 4.0 details the change in Dunedin City's emissions since FY19. Due to rounding, there may be some discrepancy between totals and the sum of results in the tables.

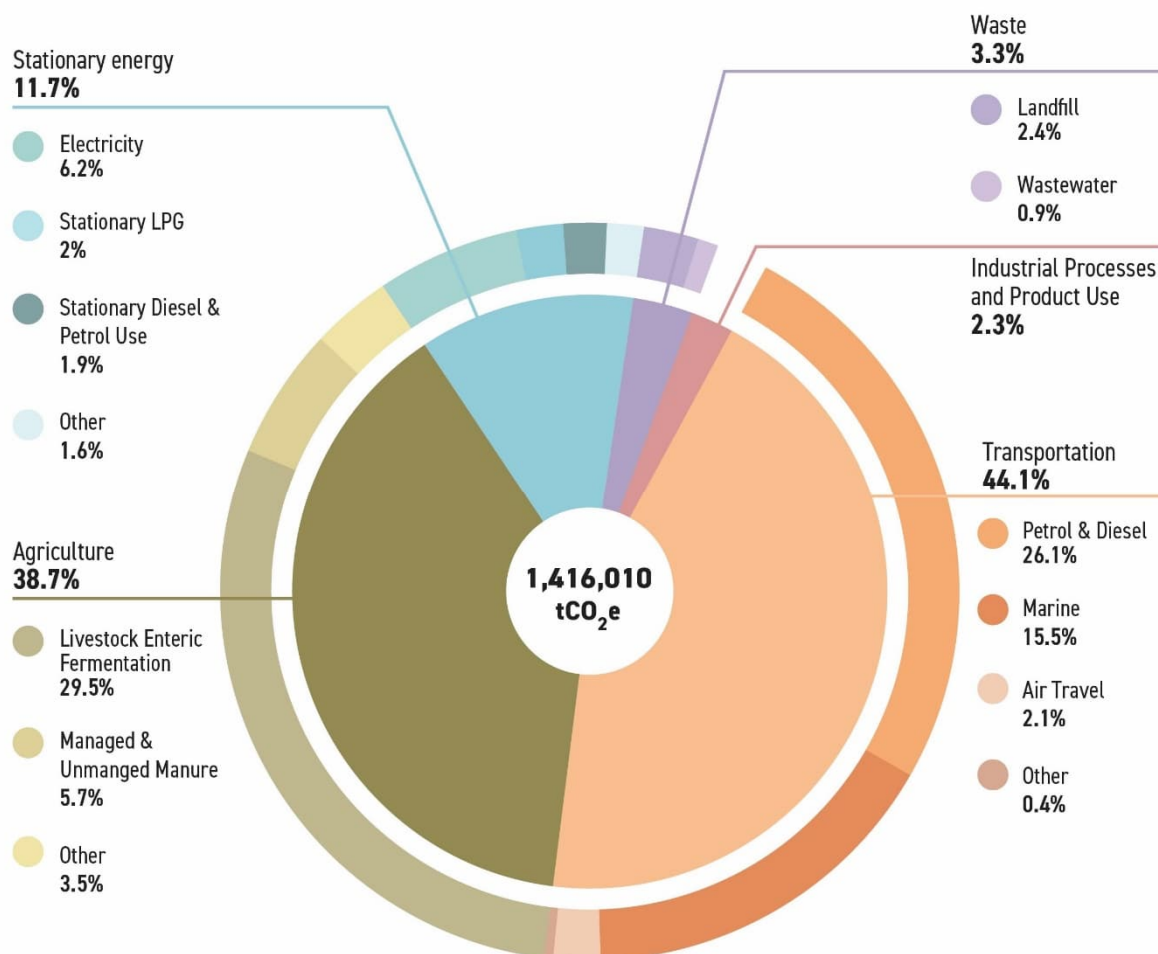


Figure 1: Dunedin City's total gross GHG emissions split by sector (tCO₂e)

² [Dunedin City, Place and ethnic group summaries | Stats NZ](#)

Table 2 Dunedin City FY25 emissions by sector

Emissions Source	Emissions (tCO ₂ e)	Percentage of Total Gross Emissions (%)
Transportation	624,128	44.1%
Agriculture	547,303	38.7%
Stationary Energy	165,894	11.7%
Waste	46,092	3.3%
Industrial Processes and Product Use (IPPU)	32,593	2.3%
Total Gross Emissions	1,416,010	100%

Table 3 shows the emission sources from largest to lowest. Appendix B presents full emissions breakdowns.

Table 3 Dunedin City FY25 emissions by source

Emissions Source	Emissions (tCO ₂ e)	Percentage of Total Gross Emissions (%)
Agriculture	547,303	38.7%
On-Road Transport	322,938	22.8%
Marine Transport	219,763	15.5%
Electricity Consumption	87,957	6.2%
Off-Road Transport	48,118	3.4%
Solid Waste	33,535	2.4%
Refrigerant and Air Conditioning Gasses	29,959	2.1%
Air Travel	29,512	2.1%
Stationary LPG	28,778	2.0%
Stationary Diesel and Petrol Use	26,617	1.9%
Coal	13,329	0.9%
Wastewater Treatment	12,556	0.9%
Biofuel	9,140	0.6%
Rail	3,797	0.3%
Other Industrial Gasses	2,634	0.2%
Biogas	73	<0.1%
Total Gross Emissions	1,416,010	100.0%

3.1 Transport

Transport was Dunedin City's highest emitting sector, producing 44% of total gross emissions.

On-road transport, consisting of all standard road vehicles (cars, trucks, buses, etc.), was responsible for 52% of transport emissions and 23% of total gross emissions. A further breakdown of on-road emissions by vehicle type and class is included in **Appendix C**.

The next largest emission source in the transport sector was marine transport emissions (from freight vessels, cruise ships, and port operations). Marine transport emissions produced 35% of transport emissions. Off-road transport was 8% of transport emissions, while air travel contributed 5% of the sector's emissions.

Cross-boundary journey emissions (e.g. for air travel, marine freight, rail, and cruise ships) are calculated based on the fuel consumed during each journey to and from Dunedin, with emissions split equally between the origin and destination location. It is acknowledged that marine transport and air travel hubs in Dunedin City support an area wider than the immediate Dunedin City area. How emissions related to these travel hubs are allocated regionally could be reconsidered in future inventories.

3.2 Agriculture

Agricultural livestock and crop farming emissions were responsible for 39% of Dunedin City's total gross emissions. Enteric fermentation represented 76% of agricultural emissions. Enteric fermentation is the methane (CH₄) released from the digestive process of ruminant animals (e.g., cattle and sheep). The second-highest source of agricultural emissions was nitrous oxide (N₂O) released by unmanaged manure from grazing animals on pasture.

Livestock was responsible for the majority of the agriculture sector's GHG emissions. In FY25, Sheep represented 85% of the total number of livestock and 48% of agricultural emissions. Cattle (dairy and non-dairy) represented 13% of the total number of livestock and 48% of agricultural emissions. This is due to their greater emissions footprint compared to sheep per animal.

It is important to note that these agricultural results do not include emissions related to the consumption of agricultural products supplied to Dunedin City as per the GPC methodology.

3.3 Stationary Energy

Electricity consumption (including transmission and distribution losses) accounted for 53% of stationary energy emissions and 6% of Dunedin City's total gross emissions. Electricity consumption emissions depend upon the amount of consumption (in kWh) and the emissions intensity of the national grid (tCO₂e/kWh), which changes annually.

LPG, diesel and petrol, coal, biofuels, and landfill biogas produced the remaining stationary energy emissions.

Biogenic CO₂ emissions from biofuels and landfill gas flaring have not been included in these totals and are reported separately in section 3.8.

3.4 Waste

Waste produced in Dunedin City (solid waste, wastewater, and compost) comprised 3% of Dunedin City's total gross emissions.

Solid waste produced 66% of waste emissions. Solid waste emissions include emissions from open (operating) landfill sites and closed landfill sites. Both open and closed landfills emit landfill (methane) gas from the breakdown of organic materials disposed of in the landfill for many years after waste enters the landfill.

The reported solid waste emissions relate to all waste-related emissions produced in FY25 from historic waste produced in Dunedin City that has entered landfill sites over the last 50+ years, per the GPC guidance for city-level reporting. This approach differs from other reporting methods used for different purposes (e.g. for the Council's organisational emissions reporting). The city-level reporting approach ensures that all emissions from Dunedin City's waste are included in the inventory, regardless of location, ownership or whether the landfill is open or closed, and accounts for the gradual release of emissions from historic waste.

Wastewater treatment (treatment plants and individual septic tanks) accounted for 27% of total waste emissions. Most households in Dunedin City (86%) are connected to wastewater treatment plants. Households not connected to wastewater treatment plants (i.e., using individual septic tanks) produced

7% of total waste emissions. Due to higher methane production, septic tanks have a higher emissions intensity per quantity of wastewater compared to the wastewater treatment plants in Dunedin City.

3.5 Industrial Processes and Product Use (IPPU)

IPPU includes emissions associated with the consumption of industrial products and synthetic gases containing GHGs for refrigerants, foam blowing, fire extinguishers, aerosols, metered dose inhalers and Sulphur Hexafluoride for electrical insulation and equipment production. No known industrial processes (as defined in the GPC requirements) are present in Dunedin City (e.g., aluminium manufacture).

IPPU contributed 2% to total gross emissions. The most significant contributor to IPPU emissions was refrigerant gases, which produced 92% of IPPU emissions.

IPPU emissions do not include energy use for industrial manufacturing, which is included in the relevant Stationary Energy sub-category (e.g., coal, electricity and/or petrol and diesel). These emissions are based on nationally reported IPPU emissions and apportioned based on population due to the difficulty of allocating emissions to geographic locations.

3.6 Forestry (Net Emissions)

Native forests (e.g., mānuka and kānuka) and exotic forests (e.g. pine) sequesters (capture) carbon from the atmosphere while the trees are growing to maturity. Harvesting of forests emits emissions via the release of carbon from organic matter and soils following harvesting. When forest sequestration exceeds emissions from harvesting in a particular year, forestry is a net-negative source of emissions, resulting in the area's total net emissions being lower than their total gross emissions. Conversely, when emissions from harvesting exceed the amount of carbon sequestered by native and exotic forests, forestry is a net-positive source of emissions, resulting in the area's total net emissions being higher than their total gross emissions.

Forests in Dunedin sequestered 740,288 tCO₂e in FY25 (mostly from exotic forests), while harvesting emissions were 444,154 tCO₂e. This meant that forestry in Dunedin was a net negative source of emissions in FY25 (rather than a positive source of emissions, where harvesting exceeds sequestration). It is noted that the planting and harvesting of exotic forests can be cyclical in nature. Some years will have higher sequestration, and others will have higher harvesting emissions determined by the age of forests, commercial operators, and the global market.

Table 4 Forestry emissions by emission source (including sequestration)

Sector / Emissions Source	tCO ₂ e
Harvest Emissions	444,154
Native Forest Sequestration	-183,659
Exotic Forest Sequestration	-556,630
Total	-296,134

3.7 Total Gross Emissions by Greenhouse Gas

Each greenhouse gas has a different impact on climate change, which is accounted for when converting quantities of each gas into units of carbon dioxide equivalent (CO₂e). This assessment uses conversion figures (i.e. global warming potentials with climate change feedback) from the IPCC 6th Assessment Report (2021).

Table 5: Dunedin City's total gross emissions by greenhouse gas

Greenhouse Gas	Tonnes	Global Warming Potential (GWP)	Tonnes of CO ₂ e
Carbon Dioxide (CO ₂)	767,106	1	767,106
Biogenic Methane (CH ₄)	17,604	27.2	478,819
Non-biogenic Methane (CH ₄)	239	29.8	7,130
Nitrous Oxide (N ₂ O)	478	273	130,361
Other / Unknown Gas (in CO ₂ e)	32,593	1	32,593
Total	818,020	-	1,416,010

3.8 Biogenic Emissions

Biogenic CO₂ emissions result from the combustion of biomass materials that store and sequester CO₂, including materials used to make biofuels (e.g., trees, crops, vegetable oils, or animal fats). Biogenic CO₂ emissions from plants and animals are excluded from gross and net emissions as they are part of the natural carbon cycle.

Table 6: Biogenic Carbon Dioxide in Dunedin City in FY25 (Excluded from gross emissions)

Biogenic Carbon Dioxide (CO ₂) (Excluded from gross emissions)		
Biofuel	120,567	tCO ₂
Landfill Gas (Biogas)	12,374	tCO ₂
Wastewater Treatment	834	tCO ₂
Total Biogenic CO₂	133,776	tCO₂

Biogenic CH₄ emissions (e.g., produced by farmed cattle via enteric fermentation) are included in gross emissions due to their relatively large impact on global warming relative to biogenic CO₂. Biogenic methane represents 2% of the total gross tonnage of GHG emissions in Dunedin City but 34% of total gross GHG emissions when expressed in CO₂e. This is caused by the higher global warming impact of methane per tonne compared to carbon dioxide. Table 7 shows biogenic methane in Dunedin City in FY25 in tonnes of methane by emission source.

Table 7: Biogenic Methane in Dunedin City in FY25 (Included in gross emissions)

Biogenic Methane (CH ₄) (Included in gross emissions)		
Enteric Fermentation	15,334	tCH ₄
Landfill Gas	1,124	tCH ₄
Manure Management	530	tCH ₄
Biofuel	296	tCH ₄
Wastewater Treatment	251	tCH ₄
Composting (Green Waste)	68	tCH ₄
Total Biogenic CH₄	17,604	tCH₄

4.0 Gross Emissions Changes: FY19 to FY25

Dunedin City uses FY19 as its baseline year against which to track emissions and progress towards emission reduction targets (see Section 6.0 for information about Dunedin's targets), this section presents the changes in gross emissions between FY19 and FY25.

Between FY19 and FY25, annual total gross emissions decreased by 13%. All gross emissions sectors saw a decrease in emissions over this time period.

The previously published annual emissions inventories for Dunedin City from FY19 to FY22 have been updated as part of this inventory, with the results presented in this report superseding past results. The updated results are presented here. A description of these updates is given in Section 7.0.

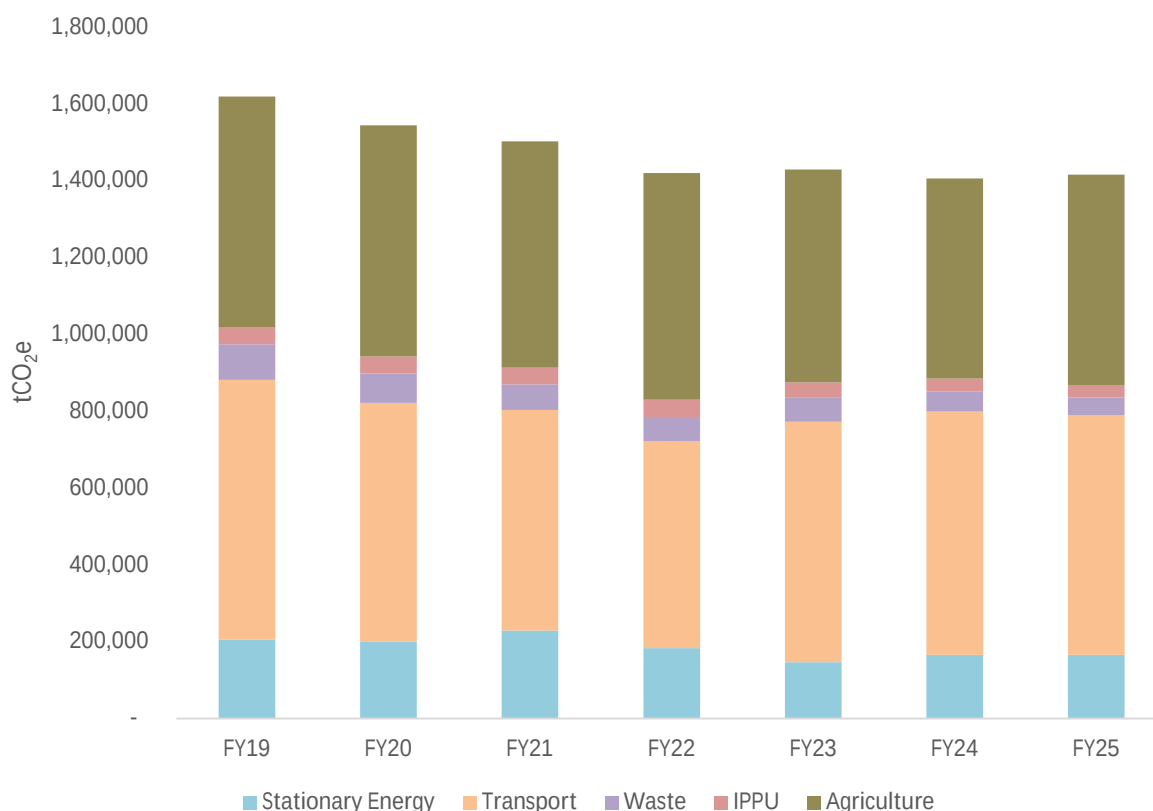


Figure 2 Change in Dunedin's total gross GHG emissions from FY19 to FY25

Due to rounding, there may be some discrepancy between totals and the sum of results in the tables.

Table 8 Dunedin City - Change in emissions by sector from FY19 to FY25

Sector / Emissions Source	Emissions (tCO ₂ e)		Percentage Change FY19 - FY25 (%)
	FY19	FY25	
Transportation	677,210	624,128	-8%
Agriculture	600,515	547,303	-9%
Stationary Energy	204,735	165,894	-19%
Waste	92,661	46,092	-50%
Industrial Processes and Product Use (IPPU)	44,415	32,593	-27%
Total Gross Emissions	1,619,536	1,416,010	-13%

Table 9 Dunedin City - Change in emissions by source from FY19 to FY25

Sector / Emissions Source	Emissions (tCO ₂ e)		Percentage Change FY19 - FY25 (%)
	FY19	FY25	
Agriculture	600,515	547,303	-9%
On-Road Transport	330,316	322,938	-2%
Marine	251,240	219,763	-13%
Electricity Consumption	100,366	87,957	-12%
Off-Road Transport	47,741	48,118	1%
Solid Waste (Landfill)	80,279	33,535	-58%
Refrigerant and Air Conditioning Gasses	41,330	29,959	-28%
Air travel	43,354	29,512	-32%
Stationary LPG	29,197	28,778	-1%
Stationary Diesel and Petrol Use	26,416	26,617	1%
Coal	44,077	13,329	-70%
Wastewater Treatment	12,383	12,556	1%
Biofuel	4,650	9,140	97%
Rail	4,559	3,797	-17%
Other Industrial Gasses	3,085	2,634	-15%
Biogas	27	73	168%
Total Gross Emissions	1,619,536	1,416,010	-13%

4.1 Transport

Transport emissions decreased 8% between FY19 and FY25 (-53,082 tCO₂e), mostly driven by a 13% reduction in marine transport emissions.

Within marine transport, there was a 30% reduction in emissions from cruise ships between FY19 and FY25 resulting from a reduction of visits. Marine freight emissions also decreased by 7% in this time, however, these emissions tend to fluctuate year-to-year based on the number of vessel visits and the length of their journeys.

Air travel emissions decreased by 32% (13,842 tCO₂e), driven by a 21% decrease in passenger numbers.

On-road transport emissions decreased by 2% (7,378 tCO₂e) driven by a 7% decrease in petrol use and a 1% increase in diesel use.

Changes in air and on-road transport emissions reflect changes nationally and may be impacted by changes to transport patterns since the COVID-19 pandemic.

4.2 Agriculture

Agriculture emissions decreased by 9% (-53,212 tCO₂e) between FY19 and FY25. This decrease was driven by a 6% decrease in livestock enteric fermentation emissions, but emissions from all agricultural sources decreased over this time.

This decrease was mainly due to a reduction in the total number of sheep and dairy cattle in Dunedin, whose populations decreased by 10% and 16% respectively.

These results are based on livestock and fertiliser data for Dunedin City from the 2017 Agricultural Census (StatsNZ), with regional data covering the subsequent years used to estimate the change in livestock and fertiliser use since 2017. Changes in agriculture in the Otago region may not reflect changes in the Dunedin City area.

4.3 Stationary Energy

Stationary energy emissions decreased by 19% (-38,841 tCO₂e). The biggest driver of this change was a 70% decrease in total coal use (-30,748 tCO₂e), particularly due to the Dunedin Energy Centre switching from coal to biofuel boilers in 2023. During this period, total biofuel emissions increased by 4,490 tCO₂e. Biofuel has a lower GHG emissions impact than coal.

Electricity emissions decreased 12% with an 11% decrease in consumption and a 2% decrease in the emissions intensity of the national grid.

4.4 Waste

Waste emissions decreased by 50% between FY19 and FY25 (-46,569 tCO₂e). This was driven by a reduction in open landfill emissions due to increased landfill gas capture at Green Island Landfill. Closed landfill emissions were also reduced as no new waste entered these sites.

Improvements to landfill gas capture systems have meant that more landfill gas (CH₄) has been captured and flared or used for energy generation, reducing the emissions impact of open landfill sites by 77% (-38,827 tCO₂e).

Annual emissions from closed landfill sites reduced by 36% (-10,870 tCO₂e) between FY19 and FY25. As no additional waste enters these sites, annual emissions from this source will continue to fall.

Kerbside organic collection was introduced to Dunedin City in 2024, diverting waste from landfill. In FY25 this source produced 2,953 tCO₂e.

4.5 Industrial Processes and Product Use (IPPU)

IPPU emissions decreased by 27% (11,822 tCO₂e) between FY19 and FY25. This was driven by a decrease in the consumption of particularly emissions-intensive refrigerants and air conditioning gases. Industry shifts away from the use of the more harmful IPPU gases may have contributed to this.

4.6 Forestry (Net Emissions)

Net forestry emissions changed from -361,337 tCO₂e to -296,134 tCO₂e between FY19 and FY25, driven by a 27% increase in harvest emissions.

When we take net forestry into account to give the total net emissions for Dunedin City (gross emissions minus forestry), total net emissions decreased by 11% (138,322 tCO₂e). This is a lower decrease than for total gross emissions due to the changes in net forestry.

It is important to note that net forestry emissions can be highly variable year to year, and over longer time periods, due to the cyclical and market-based nature of commercial forestry practices, where some years will have more harvesting and some years will have more forest growth.

5.0 Gross Emissions Changes: FY22 to FY25

Dunedin's last city-wide emissions inventory covered the FY22 year; this section presents the changes in emissions between FY22 and FY25. The previously published results for FY22 have been updated as part of this inventory, with the results presented in this report superseding past results. A description of these updates is given in Section 7.0.

Annual total gross emissions decreased by 0.3% from FY22 to FY25 (-4,552 tCO₂e). There were reductions of emissions across all sectors, except for transport which had a 16% increase.

Agriculture decreased the most between FY22 and FY25 with a 7% reduction (-43,277 tCO₂e). The largest driver of this was a 6% decrease in livestock enteric fermentation.

Stationary energy emissions decreased by 9% (-17,090 tCO₂e). Coal was the largest driver of this change, with a 63% reduction of use over time (-22,511 tCO₂e), particularly driven by the Dunedin Energy Centre switch from coal to biofuel boilers. Electricity consumption emissions increased 2% with a 1% increase in consumption and a 2% increase in the emissions intensity of the national grid

Waste emissions reduced by 26% (-16,529 tCO₂e), primarily due to improved gas capture methods at open landfill sites and a gradual reduction in emissions from closed landfill sites.

Industrial Processes and Product Use (IPPU) emissions decreased by 27% (-12,210 tCO₂e), driven by a national decrease in the consumption of particularly emissions-intensive refrigerant and air conditioning gas use. This may be due to industry shifts away from the use of the more harmful IPPU gasses.

Transport emissions increased 16% (84,553 tCO₂e). Of particular note is the effect of the COVID-19 pandemic on reduced transport in FY22, particularly for cruise ships, on-road transport, and air travel. Cruise ships did not visit Dunedin City in FY21 or FY22, so their return contributed to an additional 41,049 tCO₂e in FY25³ compared to FY22. Marine freight also increased by 11% (17,832 tCO₂e), on-road transport increased by 6% (18,639 tCO₂e), and air travel increased by 23% (5,561 tCO₂e).

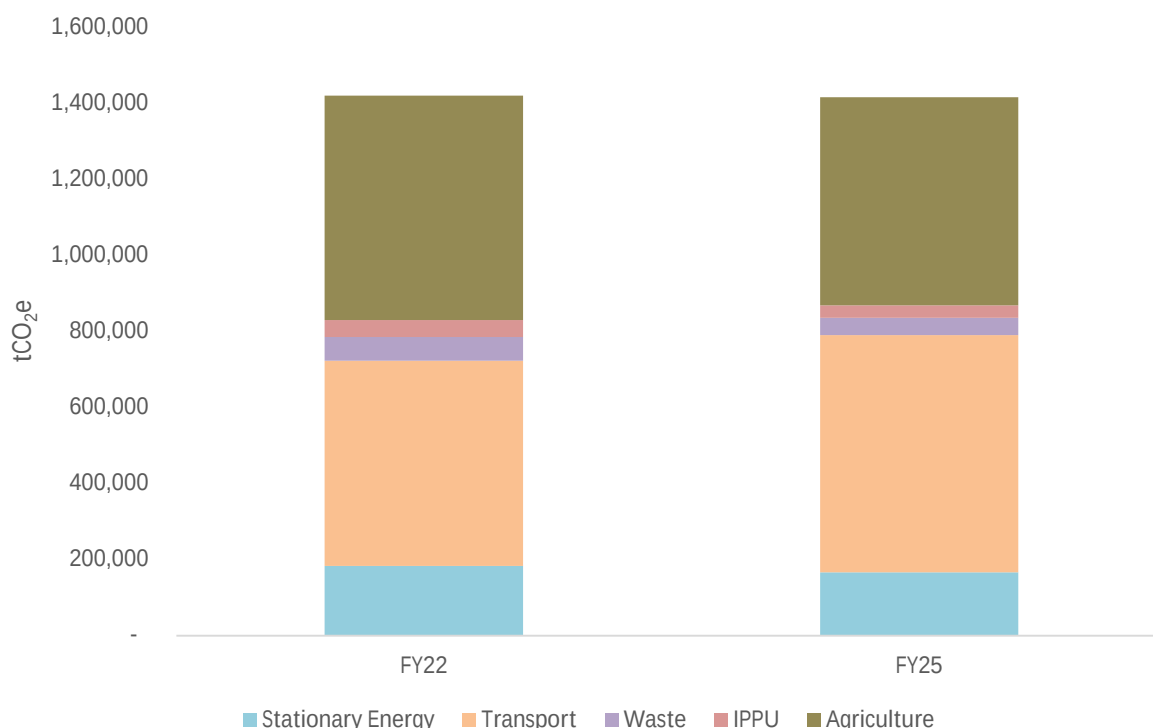


Figure 3 Change in Dunedin City total gross emissions from FY22 to FY25

³ Note that emissions in FY25 are lower than in the two years prior to the COVID-19 pandemic impacts (FY19 and FY20).

6.0 Net Zero 2030 Goal Tracking

Like the New Zealand's national emissions reduction target, Dunedin City's emissions reductions target is in two parts (the 'split gas approach').

Split gas emissions reduction targets:

- Dunedin aims to achieve net zero emissions of carbon dioxide and other greenhouse gases by 2030 (except biogenic methane) based on the FY19 baseline inventory presented here (*i.e. Total Net Emissions excluding Biogenic Methane*).
- Dunedin also aims to achieve a 24-47% reduction in biogenic methane emissions below FY19 levels by 2050, including a 10% reduction below FY19 levels by 2030 (*i.e. Total Biogenic Methane Emissions*).

Table 10 presents the results of this inventory using the split gas approach as per the emissions reduction targets.

Total net emissions (excluding methane) are heavily impacted by commercial forest harvesting patterns and can vary significantly year-to-year. During this period, there has been a decrease in commercial forest cover, and an increase in forest harvesting emissions resulting in an increase in total net emissions (excluding methane) despite a reduction in total gross emissions (excluding methane).

Table 10 Change in Dunedin's total emissions from 2018/19 to 2024/25 (split gas approach, expressed in CO₂-equivalent units)

	FY19 (tCO ₂ e)	FY25 (tCO ₂ e)	% Change (FY19 to FY25)
Total Gross Emissions (excluding biogenic methane)	1,066,182	937,191	-12%
Forestry Net Emissions	-361,337	-296,134	-18% ⁴
Total Net Emissions (excluding biogenic methane)	704,845	742,859	5%
Total Biogenic Methane Emissions (tCO₂e)	553,353	478,819	-13%

⁴ Note that this percentage change is a reduction in net sequestration so this change will increase total net emissions for Dunedin City

7.0 Update to the FY19 to FY22 Inventory Results

The previously published annual emissions inventories for Dunedin City from FY19 to FY22 have been updated as part of this inventory, with the results presented in this report superseding past results.

Global warming potential and emission factor updates:

- Updates to the global warming potential values, from the Intergovernmental Panel for Climate Change(IPCC) AR5 values (2014) to the IPCC AR6 (2021) values, in-alignment with best practice GHG emissions reporting. This particularly affects agriculture, waste and IPPU emissions.
- Updates to the emission factors used, from Ministry for the Environment (MfE) 2022 factors to MfE 2025 factors.

Method and data updates:

- The petrol and diesel calculations for FY22 have been updated to account for an anomaly in the background data.
- The open landfill calculations have been updated to utilise measured methane capture data.
- The air travel (jet kerosene) emissions calculations have been updated to align with Dunedin Airport GHG emissions reporting.
- The wastewater emissions calculations have been updated to align with Dunedin City Council's GHG emissions reporting, and to enable direct comparison over time.
- The coal emissions calculations have been updated to account for a small error in the previous calculations.
- The FY22 forestry emissions calculations have been updated with new national exotic forestry data that had not published at the time of the last inventory.

Table 11 presents the updated Dunedin City FY19 to FY22 emissions inventory results, this includes the FY23 to FY25 results for reference. Full results for FY19 to FY22 have been provided to Dunedin City Council.

Table 11 Dunedin City - Change in emissions by sector from FY19 to FY25

Sector / Emissions Source	Emissions (tCO ₂ e)						
	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Transport	677,210	621,022	574,735	539,575	625,974	633,880	624,128
Agriculture	600,515	601,876	589,742	590,580	553,708	521,475	547,303
Stationary Energy	204,735	200,931	228,721	182,984	146,107	165,463	165,894
Waste	92,661	76,529	66,240	62,621	63,067	51,931	46,092
IPPU	44,415	44,415	43,669	44,803	40,283	33,547	32,593
Total Gross Emissions	1,619,536	1,544,774	1,503,106	1,420,563	1,429,138	1,406,295	1,416,010
Net Forestry	-361,337	-524,194	-428,596	-472,435	-260,545	-279,009	-296,134
Total Net Emissions	1,258,198	1,020,580	1,074,510	948,127	1,168,594	1,127,286	1,119,876

8.0 Closing Statement

Dunedin City's GHG emissions inventory provides information for decision-making and action by the council, Dunedin City stakeholders, and the wider community. We encourage the Council to use the results of this study to inform updates to emissions reduction plans and targets. Best practice emissions measurement and management is always improving. It is recommended that this emissions footprint be updated regularly to inform ongoing positive decision-making to address climate change issues.

9.0 Limitations

Where this Report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in the Report. AECOM assumes no liability for any inaccuracies in or omissions to that information. This Report was prepared between **August 2025 and January 2026** and is based on the information reviewed at the time of preparation. AECOM disclaims responsibility for any changes that may have occurred after this time. This Report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This Report does not purport to give legal advice.

Legal advice can only be given by qualified legal practitioners. Except as required by law, no other party should rely on this document without the prior written consent of AECOM. Where such agreement is provided, AECOM will provide a letter of reliance to the agreed third party in the form required by AECOM. To the extent permitted by law, AECOM expressly disclaims and excludes liability for any loss, damage, cost, or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in this Report. AECOM does not admit that any action, liability, or claim may exist or be available to any third party. It is the responsibility of third parties to independently make inquiries or seek advice in relation to their particular requirements and proposed use of the information.

10.0 Appendix A: Assumptions and Data Sources

The following table details assumptions and exclusions for the FY25 inventory.

Table 12 Dunedin City Emissions Inventory 2025 Assumptions and Exclusions

Sector / Category	Assumptions and Exclusions
General	
Geographical Boundary	LGNZ local council mapping boundaries have been applied.
Population	Population figures are provided by StatsNZ. The calendar year population for the year in which the financial year begins was used for the financial year population.
Global Warming Potential Used	Emissions are expressed as carbon dioxide equivalent (CO ₂ e) using the 100-year Global Warming Potential (GWP) values from the IPCC 6 th Assessment Report (AR6).
Full Inventory	Emissions for all sources broken down by individual main greenhouse gases are provided in the supplementary spreadsheet information supplied with this report.
GPC Production Approach	GPC reporting is predominately production-based (as opposed to consumption-based) but includes indirect emissions from energy consumption. Production-based emissions reporting is generally preferred by policymakers due to robust, established methodologies such as the GPC, which enable comparisons between different studies. Production-based approaches exclude globally produced emissions relating to consumption (e.g., embodied emissions relating to products made elsewhere but consumed within the geographic area, such as imported food products, cars, phones, clothes, etc.). Cross-boundary movements such as air travel and marine freight journeys departing or arriving in Dunedin have been included, with emissions related to the journeys split equally between the origin and destination, per GPC requirements, despite the emissions being produced outside the Dunedin City geographical boundary.
Emission Factors	All emission factors have detailed source information in the calculation tables within which they are used. Where possible, the most up-to-date, NZ-specific emission factors have been applied. This inventory uses applicable emission factors predominantly from the New Zealand Ministry of the Environment Measuring emissions: A guide for organisations: 2025 detailed guide. The emission factors for electricity are obtained from MBIE data for the financial year.
Transport Emissions	
Petrol and Diesel:	Total petrol and diesel consumption in Dunedin City was calculated from aggregated petrol and diesel sales data for Dunedin City, Clutha District, and Waitaki District, which was then apportioned out to these territorial authorities based on the total distance travelled by vehicles in each territorial authority in the financial year (known as Vehicle Kilometres Travelled or VKT). Allocating fuel consumption across a region based on VKT does not account for the likely makeup of a particular geographic area's vehicle fleet (e.g., a more rural area may use more diesel, or a more urban area may have more hybrid or electric vehicles travelling).

	Fuel sold in an area does not always mean that the fuel is used in that area. However, this approach is considered a robust and comparable fuel consumption estimate in a geographic area. Total petrol and diesel fuel use was then divided by likely end use. The division into Transport and Stationary Energy end use (and within Transport, on-road and off-road) was calculated using fuel end-use data provided by the Energy Efficiency and Conservation Authority (EECA) in April 2020. - On-road Transport is defined as all standard transport vehicles used on roads e.g. cars, bikes, buses. - Off-road Transport is defined as machinery for Agriculture, construction and other industries used off-roads. - Stationary Energy petrol and diesel use is defined as fuel not used for transport either on or off roads. Petrol and diesel used for Stationary Energy have been reported in the Stationary Energy sector. This method produces results for off-road and stationary uses of petrol and diesel that are heavily impacted by changes in on-road transport uses of petrol and diesel as this represents the largest proportion of petrol and diesel sales. Better data and understanding of off-road and stationary uses of petrol and diesel are required to improve the applicability of these results.
Rail Diesel	Consumption was calculated by Kiwi Rail using the induced activity method for system boundaries. The following assumptions were made: - Net Weight is product weight only and excludes container tare (the weight of an empty container) - The Net Tonne-Kilometres (NTK) measurement has been used. NTK is the sum of the tonnes carried, multiplied by the distance travelled. - National fuel consumption rates have been used to derive litres of fuel for distance. - The type of locomotive engine used, and jurisdiction topography have not been incorporated in the calculations. Using the induced activity method, the trans-boundary routes were determined, and the number of stops taken along the way derived. The total litres of diesel consumed per route was then split between the departure territorial authority, arrival territorial authority and any territorial authority the freight stopped at along the way. If the freight travelled through but did not stop within a territorial authority, no emissions were allocated. This data is subject to commercial confidentiality.
Jet Kerosene	Full flight emissions relating to jet kerosene emissions have been provided by Dunedin Airport following an approved method. The approach used is based on fuel used by outgoing flights from Dunedin. This approach accounts for journey emissions being split between the origin and destination location with other airports using the same method to calculate the outgoing flights from their airport (therefore covering in-bound flights to Dunedin).
Aviation Gas	Aviation gas is mainly used by small aircraft for relatively short flights. Emissions have been calculated based on the total aviation gas fuel uplifted at Dunedin Airport. The fuel figure was provided by Dunedin Airport and is acknowledged to be a reasonable estimate. No estimate of aviation gas usage has been made for aerodromes and other flights outside Dunedin Airport. This is expected to be a small emission source.

Marine Diesel – Freight	Calculated using the induced activity method as per rail diesel. An estimate of fuel use was calculated for vessels arriving and departing from Dunedin. - The schedule of vessels arriving and departing from Dunedin, which contains details on the size of the vessel, was used to calculate fuel consumption. - Shipping distances and vessel fuel burn rates were used for these calculations. - As per the induced activity method, only 50% of emissions calculated per one-way arrival and departure were allocated to Dunedin. The remaining 50% of each leg was allocated to the originating or destination location. All calculated emissions from freight are allocated to Dunedin City despite the understanding that imports and exports through Port Otago service an area larger than Dunedin City. This approach aligns with the GPC reporting guidance but could be reconsidered in the future, alternative options could include: - Allocating emissions based on the origin of exports, and the destination of imports (data dependent) - Allocating emissions based on relative population size across the Otago Region - A hybrid approach such as by identifying key exports (such as from logging and meat/dairy) and allocating the associated export-related emissions based on the origin location of those exports, and allocating the remaining emissions on a population basis.
Marine Diesel (Local)	Port operational vessels: - Fuel use has been provided directly by Port Otago. - All emissions from this source have been allocated to Dunedin City Private use, other commercial operators, and commercial fishing: - Most small private boats use fuel purchased at vehicle gas stations so this consumption will be included in off-road transport petrol and diesel emissions. - No data was available to determine emissions from other commercial operators, and commercial fishing which don't refuel at standard diesel suppliers in Dunedin (this is likely to be a small emissions source).
Cruise Ships	Cruise ship emissions have been estimated using the induced activity method similar to rail diesel and marine freight. An estimate of fuel use was calculated for each vessel arriving and departing from Dunedin based on the estimated fuel consumption of each vessel, the distance travelled to and from Dunedin, and while stationary in port. As per the induced activity method, for emissions produced during the journey to/from Dunedin the emissions are allocated equally between Dunedin and the next/last port.
LPG	Total South Island consumption data was used and then split per capita to determine the territorial authority's consumption. National LPG end use data has been used to break down consumption into Stationary Energy and Transport usage; these are then reported separately in their respective categories. It is acknowledged that per-capita use of LPG may vary across the South Island, however more local data was not available at the time of calculation.

	For reference, in FY25 LPG use represented 2% of Dunedin City's emissions.
Stationary Energy Emissions	
Consumer Energy End Use	Stationary Energy demand (e.g., electricity use, natural gas, etc.) is broken down by the sector in which it is consumed. We report Stationary Energy demand in the following categories: industrial (which includes Agriculture, forestry, and fishing), commercial, and residential. These sectors follow the definitions of Australia New Zealand Standard Industrial Classification 2006. In addition to Agriculture, forestry and fishing, the industrial sector includes mining, food processing, textiles, chemicals, metals, mechanical/electrical equipment and building and construction activities. Emissions from petrol and diesel used for Stationary Energy are not broken down into these sectors. Energy demand for transport is reported in the transport sector.
Electricity Consumption	Electricity demand has been calculated using grid demand trends from the EMI website (www.emi.ea.govt.nz) to obtain raw grid exit point data for Dunedin. The reconciled demand has been used per EMI's confirmation. The breakdown into sectors is based on NZ average consumption per sector (residential, commercial, and industrial).
Public Transport Electricity	Electricity used in the public transport system is included in the Transport sector. An estimate of electricity consumption has been derived from data covering the distance travelled in the reporting year.
Private Transport Electricity	Electricity used for private transport (e.g., electric cars, bikes, and micro-mobility) is included in the Transport sector. An estimate of electricity consumption has been derived from data covering the distance travelled in FY19 and adjusted for subsequent years based on the change in the number of electric vehicles in the fleet in Dunedin.
Coal Consumption	For FY19 to FY22, coal consumption data was provided by the University of Otago from their Dunedin Energy Study data. This data includes coal used by multiple organisations, and in residential settings in Dunedin, not just the University of Otago. For FY23 to FY25, coal consumption data estimates were provided by Dunedin City Council to align with the Dunedin Energy Study.
Biofuel and Wood Consumption	For FY19 to FY22, biofuel and wood burning consumption data was directly provided by the University of Otago from their Dunedin Energy Study data. This data includes biofuel and wood burned by multiple organisations, and in residential settings in Dunedin, not just the University of Otago. For FY23 to FY25, biofuel consumption data estimates were provided by Dunedin City Council to align with the Dunedin Energy Study. The carbon dioxide (CO₂) emissions produced from the burning of biofuels have been excluded from the emissions totals as they are considered to be biogenic (but are reported separately). Only the methane and nitrous oxide emissions have been included in the reported CO₂e figures for biofuels.
LPG Consumption	Total South Island consumption data was used and then split per capita to determine the territorial authority's consumption. National LPG end use data has been used to break down consumption into Stationary Energy and Transport usage; these are then reported separately in their respective categories.

Petrol and Diesel (Stationary Energy end use)	Total petrol and diesel consumption in Dunedin City was calculated from aggregated petrol and diesel sales data for Dunedin City, Clutha District, and Waitaki District, which was then apportioned out to these territorial authorities based on the total distance travelled by vehicles in each territorial authority in the financial year (known as Vehicle Kilometres Travelled or VKT). Allocating fuel consumption across a region based on VKT does not account for the likely makeup of a particular geographic area's vehicle fleet (e.g., a more rural area may use more diesel, or a more urban area may have more hybrid or electric vehicles travelling). Fuel sold in an area does not always mean that the fuel is used in that area. However, this approach is considered a robust and comparable fuel consumption estimate in a geographic area. Total petrol and diesel fuel use was then divided by likely end use. The division into Transport and Stationary Energy end use (and within Transport, on-road and off-road) was calculated using fuel end-use data provided by the Energy Efficiency and Conservation Authority (EECA) in April 2020. - On-road Transport is defined as all standard transport vehicles used on roads e.g. cars, bikes, buses. - Off-road Transport is defined as machinery for Agriculture, construction and other industries used off-roads. - Stationary Energy petrol and diesel use is defined as fuel not used for transport either on or off roads. Petrol and diesel used for Stationary Energy have been reported in the Stationary Energy sector. This method produces results for off-road and stationary uses of petrol and diesel that are heavily impacted by changes in on-road transport uses of petrol and diesel as this represents the largest proportion of petrol and diesel sales. Better data and understanding of off-road and stationary uses of petrol and diesel are required to improve the applicability of these results.
Biogenic Emissions	Some Carbon Dioxide (CO₂) emissions are biogenic. These are CO₂ emissions where the carbon has recently been derived from CO₂ present in the atmosphere (for example, some agricultural and Waste emissions). These emissions are not included in calculating total CO₂e.
Agricultural Emissions	
Agriculture	Agriculture emissions relate to emissions produced by livestock, crops and fertiliser in the geographic area. They do not relate to imported foods or goods (reported in a consumption-based footprint) or agricultural activities such as farm transport or food processing within the geographic area (these are reported in this inventory under Transport or Stationary Energy, respectively). Territorial authority-level livestock numbers and fertiliser data were taken from the 2017 Agricultural Census (StatsNZ), with the change in regional data (StatsNZ) used to estimate the change in livestock and fertiliser use in the individual territorial authorities since 2017. Changes in agriculture in the Otago region may not reflect changes in the Dunedin City area.
Solid Waste Emissions	
Landfill Emissions	Landfill Waste volume and landfill gas capture system information have been provided by Dunedin City Council. A proportion of waste in Dunedin is collected by companies where Dunedin City Council cannot access the data for the years FY23-FY25. This is assumed to be a small proportion, so this waste is not included in the solid waste calculations.

	This proportion of waste is expected to represent an immaterial amount of GHG emissions relative to the Dunedin City GHG emissions inventory. Solid Waste emissions from landfills are measured using the IPCC First Order Decay method, which covers landfill activity between 1950 and the present day, as per the GPC reporting requirements. This method accounts for the gradual release of emissions from waste over a long period of time and calculates the emissions produced per year from waste in landfills (including emissions from closed landfill sites). This approach differs from that used by individual councils for their organisational footprints, which include council-owned landfill sites. The predominant organisational footprint method calculates the likely future emissions from waste entering landfill that year and attributes those emissions to that year (and doesn't include emissions from waste already in the landfill or emissions from closed landfill sites). Waste volume: - Where information is unavailable, waste volumes have been estimated based on historical national data on a per capita basis (MfE, 2023). Landfill gas capture system efficiency and Landfill gas flaring/burning for energy generation: - Data or assumptions provided directly from council or landfill management contacts Emissions are allocated to territorial authorities based on where the waste was produced, even if the waste is disposed of in a landfill outside the territorial authority.
Wastewater Emissions	
Wastewater Treatment Plants	Wastewater treatment plant emissions have been provided by Dunedin City Council. These were calculated following the WaterNZ (2021) guidance. A new method was adopted for FY25 which resulted in higher emissions due to the method alone (and not real-world changes). Due to this and to enable comparison, the FY19 to FY24 results have been back-calculated from the FY25 results based on the population difference. Calculation of emissions includes emissions released directly from wastewater treatment, flaring of captured gas (if present) and discharge onto land/water. Note that the results for each treatment plant may differ from emissions calculated for other purposes (e.g. council organisational GHG reporting) due to the different requirements of GHG reporting for various purposes.
Individual Septic Tanks	Individual Septic Tanks: - Populations not connected to known wastewater treatment plants are assumed to be using septic tanks. - The population not connected to centralised wastewater treatment has been estimated based on the number of rateable properties not connected to sewerage.
Industrial Processes and Product Use Emissions	
Industrial processes	It is assumed that there are no significant non-energy-related emissions of greenhouse gases from industrial processes in the region (e.g., aluminium manufacturing).
Industrial Product Use	National data covering industrial product use (e.g., fire extinguishers, and refrigerants) have been estimated based on data provided within the New

	Zealand Greenhouse Gas Emissions 1990-2023 (MfE 2025). Emissions are estimated on a per capita basis, applying a national average per person. Due to delays in publishing data, all IPPU data are representative of the national use from 2 years prior.
Forest Emissions and Sequestration	
Exotic Forestry Harvested and Exotic Forest coverage	Harvested forestry, and forest cover information for Dunedin has been derived from Landcare Research data and data provided by two commercial operators representing approximately 70% of commercial forestry in Dunedin. This emissions footprint accounts for forest carbon stock changes from afforestation, reforestation, deforestation, and forest management (i.e., it applies land-use accounting conventions under the United Nations Framework Convention on Climate Change rather than the Kyoto Protocol). It treats emissions from harvesting and deforestation as instantaneous rather than accounting for the longer-term emission flows associated with harvested wood products. The emissions footprint considers regenerating (growing) forest areas only. Capture of carbon from the atmosphere is negligible for mature forests that have reached a steady state.
Native Forest	Native forest land area for each territorial authority has been provided by Landcare Research. FY19 data is the latest data available. It is assumed that there has been no significant change in the area covered by native forest in the Dunedin City area.

11.0 Appendix B: Dunedin City Emissions Inventory FY25 - Full Inventory Tables

Transport Emissions

Table 13 Dunedin City FY25 Transport emissions by emission source

Emissions Source	FY25 Emissions (tCO ₂ e)	Percentage of Total Gross Emissions in FY25 (%)
Diesel	239,081	16.9%
Marine Freight	176,586	12.5%
Petrol	130,518	9.2%
Cruise Ships	41,049	2.9%
Jet Kerosene	29,377	2.1%
Rail Diesel	3,797	0.3%
Marine Diesel (Local)	2,128	0.2%
LPG	1,172	0.1%
Electric Vehicles (Private)	232	<0.1%
Aviation Gas (Air Travel)	135	<0.1%
Buses (Electric)	53	<0.1%
Total	624,128	44.1%

Agriculture Emissions

Table 14 Dunedin City FY25 Agriculture emissions by emission source

Emissions Source	FY25 Emissions (tCO ₂ e)	Percentage of Total Gross Emissions in FY25 (%)
Livestock Enteric Fermentation	417,084	29.5%
Unmanaged Manure on Pasture	66,425	4.7%
Agricultural Leaching and Deposition (Manure, Urine, and Fertiliser)	42,513	3.0%
Managed Manure	14,428	1.0%
Fertilisers on Land	6,853	0.5%
Total	547,303	38.7%

Stationary Energy Emissions

Table 15 Dunedin City FY25 Stationary Energy emissions by emission source

Emissions Source	FY25 Emissions (tCO ₂ e)	Percentage of Total Gross Emissions in FY25 (%)
Electricity Consumption	79,599	5.6%
LPG	28,778	2.0%
Stationary Petrol & Diesel Use	26,617	1.9%
Coal	13,329	0.9%
Biofuel / Wood	9,140	0.6%
Electricity T&D Loss	8,358	0.6%
Biogas	73	0.0%
Total	165,894	11.7%

Waste Emissions

Table 16 Dunedin City FY25 Waste emissions by emission source

Emissions Source	FY25 Emissions (tCO ₂ e)	Percentage of Total Gross Emissions in FY25 (%)
Closed Landfill Sites	19,006	1.4%
Open Landfill Sites	11,576	0.8%
Wastewater Treatment Plants	9,442	0.7%
Individual Septic Tanks	3,115	0.2%
Composting (Commercial)	2,953	0.2%
Total	46,092	3.3%

IPPU Emissions

Table 17 Dunedin City FY25 IPPU emissions by emission source

Emissions Source	FY25 Emissions (tCO ₂ e)	Percentage of Total Gross Emissions in FY25 (%)
Refrigerants and Air Conditioning	29,959	2.1%
Aerosols	1,981	0.1%
SF6 - Electrical Equipment	360	0.0%
Foam Blowing	161	0.0%
SF6 - Other	73	0.0%
Fire Extinguishers	60	0.0%
Total	32,593	2.3%

Forestry Emissions

Table 18 Dunedin City FY25 Forestry emissions

Sector / Emissions Source	FY25 Emissions (tCO ₂ e)
Harvest Emissions	444,154
Native Forest Sequestration	-183,659
Exotic Forest Sequestration	-556,630
Total (Net)	-296,134

12.0 Appendix C: Dunedin City On-Road Transport Emissions Assessment

12.1 Executive Summary

This section details the additional analysis undertaken to break down Dunedin City's on-road transport Greenhouse Gas (GHG) emissions. On-road transport represented 23% of Dunedin City's total gross emissions in the FY25 governmental financial year (1st July 2024 to 30th June 2025). The study boundary incorporates the jurisdiction of the Dunedin City Council.

The result supersedes the previously published Dunedin City On-Road Transport Emissions for FY22.

Greenhouse gas emissions are generally reported in this document in Carbon Dioxide Equivalent (CO₂e) units and are referred to as 'emissions'.

Key findings of this analysis include:

FY25 On-Road Transport Emissions by Vehicle Type:

- Cars represented 48% of on-road transport emissions and 11% of Dunedin City's total gross emissions. Cars represented 74% of on-road Vehicle Kilometres Travelled (VKT) in Dunedin City.
 - Electric cars represented <0.1% of Dunedin City's on-road transport emissions and 1% of Vehicle Kilometres Travelled (VKT).
- Commercial vehicles represented 51% of on-road transport emissions and 12% of Dunedin City's total gross emissions.
 - Light commercial vehicles (e.g. 'utes' and vans) represented 33% of Dunedin City's on-road transport emissions, while heavy commercial vehicles represented 18% of on-road transport emissions.
- Buses represent 2% of all on-road transport emissions (this includes public transport, electric buses, school buses, and coaches).
 - Electric buses represented 1% of bus emissions in Dunedin City despite covering about a 12% of kilometres travelled by public busses, with diesel buses accounting for 99% of bus emissions.

Changes in On-road Transport Emissions from FY19 to FY25:

- On-road transport emissions decreased by 2%.
- Car emissions have decreased by 7% overall.
 - Car petrol and diesel decreased by 14% and 7% respectively during this period, while hybrid and electric car emissions increased 877% and 255% respectively from low starting points.
- Commercial vehicle emissions increased 4%, driven by a 9% increase in light commercial vehicle emissions.
 - Heavy commercial vehicle emissions decreased by 5% during the same period.
- Bus emissions decreased by 31%. This is likely due to a transition to electric buses, which were introduced in FY23.

12.2 Methodology

The basis for this assessment is the results presented in the Dunedin City GHG Emissions Inventory 2025. The emissions for on-road transport have been broken down by vehicle class and type using Vehicles Kilometres Travelled (VKT) emissions data from the New Zealand Transport Agency (NZTA) for FY19⁵ and vehicle fleet statistics data from the Ministry of Transport⁶. Changes in the vehicle fleet in Dunedin have been used to estimate changes in emissions since FY19. The reported emissions align with the results of the Dunedin City GHG Emissions Inventory for FY25.

For this assessment, the word 'emissions' represents GHG emissions only (in tCO₂e).

Definition of on-road vehicle categories⁷:

- Light duty vehicles:
 - o Cars: passenger cars and sports utility vehicles (SUVs). This includes passenger cars and SUVs for commercial purposes (e.g., taxis).
 - o Light commercial vehicles: Utes and vans with gross vehicle mass up to 3.5 tonnes. Privately owned non-commercial utes are also included in this category.
- Heavy duty vehicles:
 - o Heavy commercial vehicles: commercial vehicles with gross vehicle mass higher than 3.5 tonnes
 - o Buses with gross vehicle mass higher than 3.5 tonnes

The bus category includes public transport, school buses, and private commercial buses (including tourist coaches).

Key Limitations

- The results presented take data provided by Waka Kotahi, which have been adjusted to align with Dunedin City's GHG Emissions Inventory for FY25.
- The electricity contribution to plug-in hybrid vehicle emissions has not been calculated for this assessment. However, it is assumed to have a minimal impact on results.
- Data used for this assessment is based on modelling results provided by Waka Kotahi, there are inherent assumptions within all modelling.

⁵ Provided directly to AECOM

⁶ <https://www.transport.govt.nz/statistics-and-insights/fleet-statistics/>

⁷ <https://www.nzta.govt.nz/assets/Highways-Information-Portal/Technical-disciplines/Air-quality/Planning-and-assessment/Vehicle-emissions-prediction-model/VEPM-6.3-technical-report-2023.pdf>

12.3 On-Road Transport Emissions in FY25

On-road transport is the largest contributor to transport emissions in Dunedin City, representing 52% of Transport emissions and 23% of Dunedin City's total gross emissions. Table 19 and Figure 4 detail on-road transport emissions per vehicle category and fuel type.

Of note:

- Cars represent 48% of on-road emissions.
- Commercial vehicles represent 51% of on-road emissions⁸.
- Buses represent 2% of on-road emissions
- Electric vehicles (EV), including electric busses, represent 0.1% of on-road emissions represent approximately 1% of kilometres travelled by vehicles.
- Diesel fuel represents 60% of on-road emissions

This highlights the impact of both private and commercial vehicles on Dunedin City's on-road transport emissions.

Table 19 On-road transport emissions by vehicle type and fuel type in FY25 (tCO₂e)

Vehicle Type	Petrol	Diesel	Electric	Total tCO ₂ e	% of Total
Cars	121,816	32,524	232	154,572	48%
Commercial Vehicles	7,504	155,581	1	163,085	51%
Buses		5,228	53	5,281	2%
Total	129,320	193,333	285	322,938	
% of Total	40%	60%	0.1%		

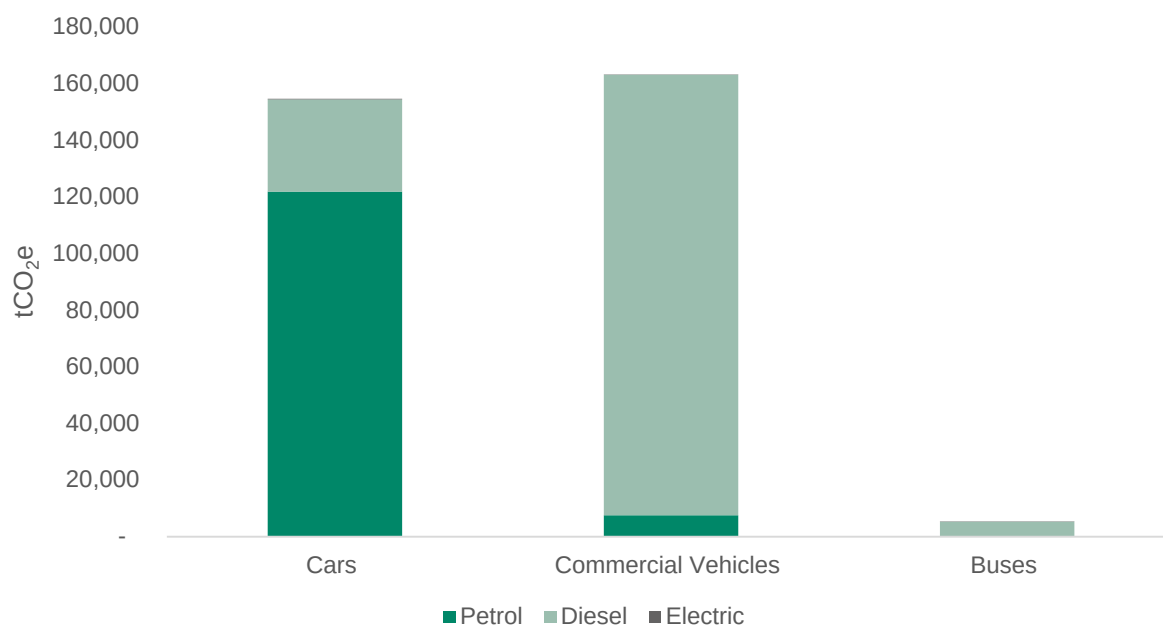


Figure 4 On-road transport emissions by vehicle type and fuel type in FY25

⁸ This category includes privately owned non-commercial 'utes'.

Emissions from these vehicle types can be broken down further by vehicle class. Table 20 details on-road transport emissions per vehicle class.

Of note:

- Commercial vehicles lighter than 3.5 tonnes represent 33% of on-road emissions in Dunedin City. Many of these will be commercial 'utes' and small vans, but also includes non-commercial 'utes'.
- Commercial vehicles heavier than 25 tonnes represent 14% of on-road emissions in Dunedin City. This generally represents vehicles used for freight movement.

Table 20 On-road transport emissions by vehicle class in FY25 (tCO₂e)

Vehicle Class	GHG Emissions (tCO ₂ e)	% of Total
Cars	154,572	48%
Light Commercial Vehicles <3.5 Tonne	106,406	33%
Heavy Vehicles 3.5-25 Tonne	11,943	4%
Heavy Vehicles 25-50+ Tonne	44,736	14%
Bus Urban 15-18 Tonne	4,801	1%
Bus Coach >18 Tonne	480	0.1%
Total	322,938	100%

Alongside total emissions, emissions have also been compared to the distance travelled by different vehicle types. Table 21 shows the emissions per vehicle class as above but also includes the VKT by each vehicle class in Dunedin City and the average emissions per VKT for each vehicle class.

Of note:

- Cars represent 74% of all VKT in Dunedin City but represent 48% of all on-road emissions in Dunedin City.
- Large (25-50+ tonne) commercial vehicles represent 4% of all VKT in Dunedin City but represent 14% of all on-road emissions in Dunedin City.

These figures do not consider the weight of freight or the number of people being moved per vehicle, where larger vehicles may be more efficient per tonne of freight moved than smaller vehicles or where buses may be more efficient per person than cars.

Table 21 On-road transport vehicle class VKT, emissions, and calculated average emissions per VKT

Vehicle Type	Vehicle Kilometres Travelled (VKT)	GHG Emissions (tCO ₂ e)	Average tCO ₂ e per VKT
Cars	689,923,509	154,572	0.0002
Light Commercial Vehicles <3.5 Tonne	182,544,797	106,406	0.0006
Heavy Vehicles 3.5-25 Tonne	18,179,535	11,943	0.0007
Heavy Vehicles 25-50+ Tonne	33,838,428	44,736	0.0013
Bus Urban 15-18 Tonne	3,897,221	4,801	0.0012
Bus Coach >18 Tonne	508,128	480	0.0009
Total	928,891,618	322,938	0.0003

12.4 On-Road Transport Emissions Change from FY19 to FY25

This section displays the change in on-road transport emissions from FY19 to FY25. During this period on-road transport emissions decreased by 2%.

Table 22 Change in on-road transport emissions by vehicle type (tCO₂e)

Vehicle Type	FY19	FY20	FY21	FY22	FY23	FY24	FY25	% Change (FY19 to FY25)
Cars	165,828	151,390	157,450	143,809	151,112	142,996	154,572	-7%
Commercial Vehicles	156,784	149,609	156,908	153,609	154,448	147,369	163,085	4%
Buses	7,704	7,164	7,259	6,881	5,861	5,701	5,281	-32%
Total	330,316	308,163	321,617	304,299	311,421	296,066	322,938	-2%

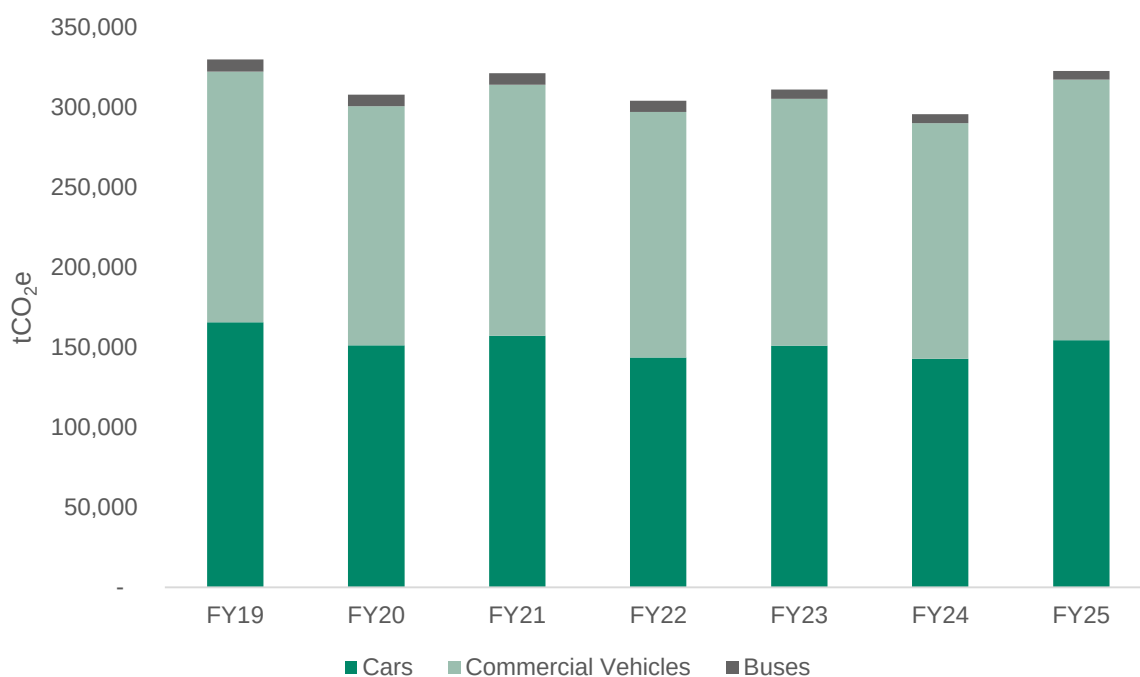


Figure 5 On-road transport emissions by vehicle type FY19-FY25

Notable changes when examining on-road emissions changes from FY19-FY25 (Table 23):

Commercial Vehicles:

- Light commercial vehicle emissions increased by 9%, reflecting a national trend of an increasing number of light commercial vehicles in New Zealand⁹
- Heavy commercial vehicle emissions decreased 5% between FY19 and FY25.

Cars:

- Car emissions decreased by 7% from a high point in FY19, potentially reflecting mode shift to active and public transport, improvements in efficiency, and a fleet shift to lower emission vehicles (electric and hybrid vehicles).
- Car diesel vehicle emissions have decreased by 7%, with car petrol emissions decreased by 14%.

⁹ https://ehinz.ac.nz/assets/Surveillance-reports/Released_2025/NumberOfVehicles-2505.pdf

- There has been a large growth in the number of both hybrid and electric vehicles in Dunedin City, and emissions have grown in line with this increase. These vehicles still represent a very small proportion of on-road emissions and are vastly lower-emitting than the equivalent internal combustion engine vehicles.

Busses:

- There was a 32% decrease in bus emissions, likely due to a transition of some busses from diesel to electric.

Table 23 Change in on-road transport emissions by vehicle class (tCO₂e)

Vehicle Type	FY19	FY20	FY21	FY21	FY23	FY24	FY25	% Change (FY19 to FY25)
Car Petrol	129,631	116,612	120,521	106,988	113,233	104,800	111,532	-14%
Car Diesel	35,079	33,150	34,075	32,844	31,536	29,573	32,524	-7%
Car Hybrid	1,053	1,541	2,750	3,845	6,170	8,408	10,284	877%
Car Electric	65	86	104	132	174	215	232	255%
Light Commercial Vehicles	97,293	94,514	100,147	98,330	99,249	96,459	106,406	9%
Heavy Commercial Vehicles	59,491	55,095	56,760	55,279	55,198	50,910	56,680	-5%
Buses	7,704	7,164	7,259	6,881	5,861	5,701	5,281	-32%
Total	330,316	308,163	321,617	304,299	311,421	296,066	322,938	-2%

12.5 Reducing On-Road Transport Emissions

Efforts to reduce emissions from on-road transport should consider options to address both private car emissions and commercial vehicle emissions as they represent a similar proportion of Dunedin City's on-road transport emissions. Over the study period car emissions have decreased while commercial vehicle emissions have increased, driven by an increase in light commercial vehicle emissions (i.e. from vans, and commercial and non-commercial utes).

Options to reduce private car emissions include encouraging and providing opportunities for mode shifts to active travel and public transport, and efforts to improve the fuel efficiency of the vehicle fleet in Dunedin. Options to reduce commercial vehicle emissions include incentivising lower-emission commercial vehicles and shifting freight to alternative modes such as rail and marine transport.