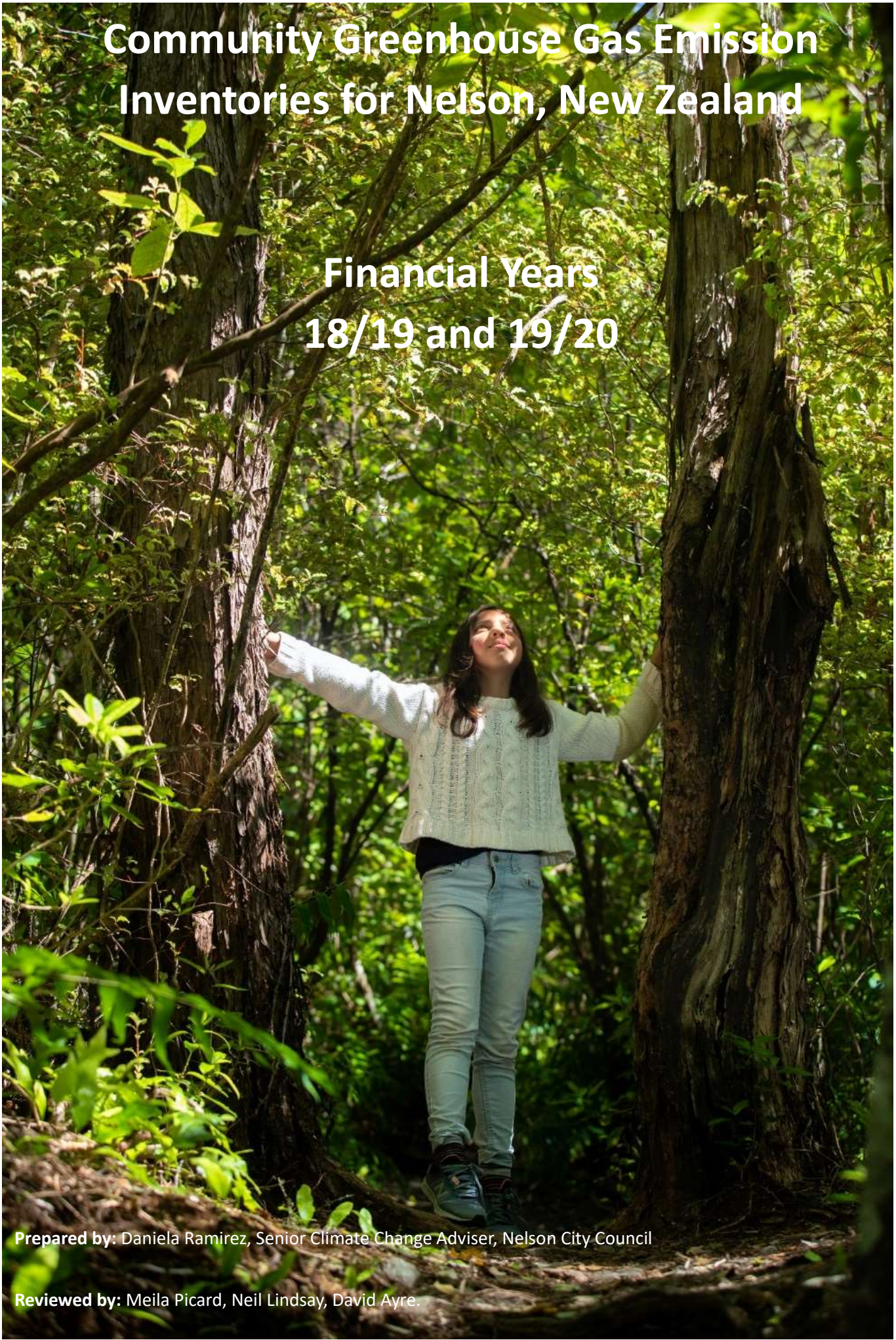
Community Greenhouse Gas Emission Inventories for Nelson, New Zealand

Financial Years 18/19 and 19/20



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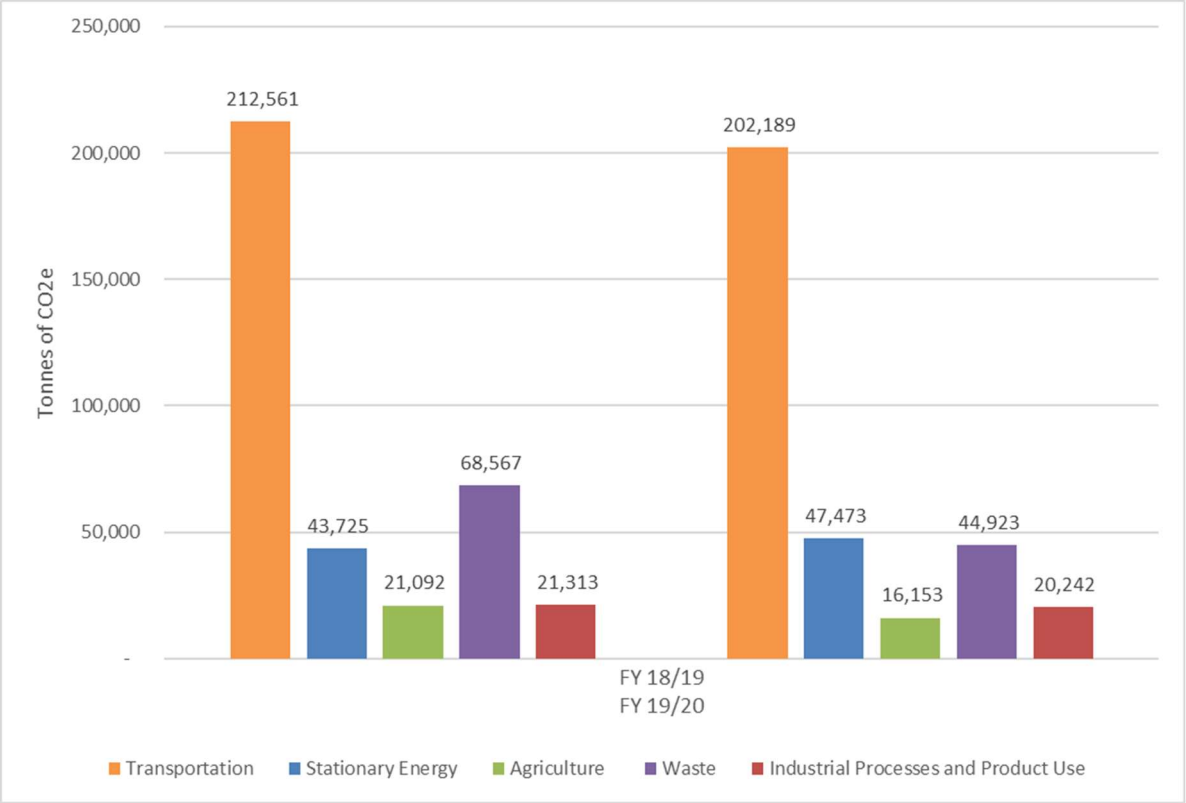

Figure 19: Comparison of Nelson region's GHG emissions by sector and Financial Year 37

Introduction

Nelson City Council has completed Community-Scale Greenhouse Gas Emission Inventories for the Nelson region (hereafter referred to as Nelson) for financial year (FY) 18/19 and 19/20 which consist of a period of 12 months from 1st July to 30th June.

The report was led by Nelson City Council and developed on a collaborative approach with Tasman District Council, Nelson Regional Development Agency (NRDA) and the Nelson Tasman Climate Forum (NTCF) members of the Science Technology and Research group. Technical support was provided by consultants from KPMG on a pro-bono basis and verification was conducted by McHugh & Shaw on a pro-bono basis too.

The report will:

- Help Council understand Nelson's local GHG emissions profile and key emission sources
- Help Council track GHG emissions from Nelson and examine progress toward emission reductions.
- Enable informed decision making and policy development
- Identify key GHG emission sectors and stakeholders that could be encouraged to reduce local community emissions
- Provide a baseline for emissions projection modelling

Methodology

The methodology used to calculate the GHG emission inventories follows the '*Global Protocol for Community-Scale Greenhouse Gas Emission Inventories* (GPC). It reports production-based emissions within the geographic area (direct) (Scope 1 in the GPC reporting framework). It also includes consumption-based emissions (indirect) such as energy consumption produced outside the geographic boundary (Scope 2). All other indirect GHG emissions such as cross-boundary travel (e.g. flights), and electricity transmission and distribution losses fit into Scope 3.

The GPC method includes GHG emissions from Stationary Energy, Transport, Waste, Industrial Processes and Product Use (IPPU), Agriculture and Forestry sectors. Key data limitations are detailed throughout the report.

All of the GHG emission calculations involved in these inventories are based on workbooks and guidance for GHG emissions measurement. Where necessary, Council's GHG emissions calculations also use methods consistent with guidance published by New Zealand's Ministry for the Environment (MfE) or Water NZ.

Regular reporting (e.g. every two years) will help Council to measure GHG emission trends and assess progress toward reducing GHG emissions. GHG emissions are generally reported here in tonnes of carbon dioxide equivalent (tCO_2e).

All assumptions made during data collection and analyses have been detailed within Section 4. Assumptions and Exclusions.

We used the BASIC+ reporting level.

We acknowledge that removals may not be unique and may have been used in organisational inventories, carbon credit projects or the national inventory.

Reporting is voluntary and not a legal requirement in New Zealand.

Assurance

Independent verification was completed by McHugh & Shaw Limited. The assurance level achieved is Limited.

The district

The boundaries for Nelson City are set by the Local Government (Nelson–Marlborough Region) Reorganisation Order 1989 and have been in place since 1989. These boundaries are regularly used to report regional statistics and other districts in New Zealand use these boundaries. The regional boundaries are therefore the most appropriate geographic boundary available.

The land area of Nelson City is approximately 422km2 (Source: Statistics NZ)

Using 2022 prices, the GDP of Nelson City was $3,005m in 2018, $3040m in 2019, and $3078m in 2020 (Source: Infometrics)

1. FY 18/19 GHG Emission Inventory Results

During the 18/19 reporting period Nelson emitted a total gross 367,257 tonnes of carbon dioxide equivalent (tCO_2e) and a net 152,320 tCO_2e.

The Nelson region's population in 18/19 was approximately 53,050 people, resulting in per capita gross GHG emissions of 6.92 tCO_2e/person in 18/19. The Transport sector's GHG emissions were the largest contributor to the inventory for Nelson, followed by Waste.

Sector	GHG Emissions (tCO_2e)	% of total gross GHG emissions
Transport	212,561	57.9%
Stationary Energy	43,725	11.9%
Agriculture	21,092	5.7%
Waste	68,567	18.7%
Industrial Processes and Product Use	21,313	5.8%
Total Gross GHG Emissions (excl. Forestry)	367,257	100%
Forestry	-214,937	Not included in total gross GHG emissions
Total Net GHG Emissions (incl. Forestry)	152,320	-

Table 1: GHG emissions, by sector, for FY 18/19

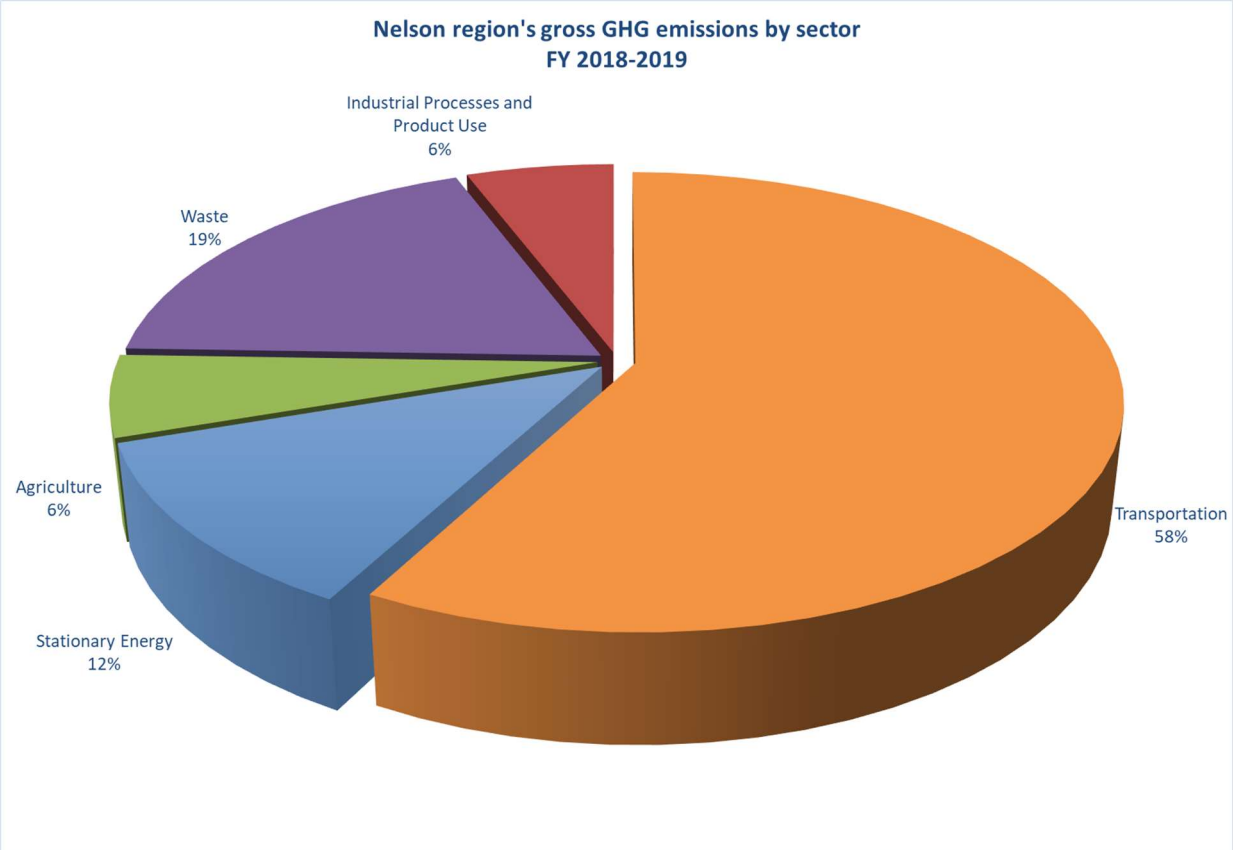

Figure 1 **Nelson region's gross GHG emissions, by sector, for FY 18/19**

GHG Emission Sector/Source		GHG Emissions (tCO_2e)	% of total gross GHG emissions
Transport	Petrol (On-Road)	64,923	17.7%
	Diesel (On-Road)	93,610	25.5%
	Electric vehicles (On-Road)	0.08	0.0%
	Biodiesel (Vehicle Use)	0	0.0%
	Petrol (Off-Road)	759	0.2%
	Diesel (Off-Road)	19,160	5.2%
	Marine Light Fuel Oil (Freight Cargo) - International	2,498	0.7%
	Marine Light Fuel Oil (Freight Cargo) - Domestic	179	0.0%
	Marine Diesel (Tourism Vessels and Local Ferries)	-	0.0%
	Jet Kerosene (Commercial Flights)	21,118	5.8%
	Aviation Gas (Local Flights)	10,271	2.8%
	LPG (Road Mobile Uses)	43.72	0.0%
Stationary Energy	Electricity Consumed	17,959	4.9%
	Electricity Transmission and Distribution Losses	1,757	0.5%
	Diesel (Stationary Use)	10,821	2.9%
	Petrol (Stationary Use)	342	0.1%
	LPG (Stationary Use)	12,841	3.5%
	Biodiesel (Stationary Use)	0	0.0%
	Coal	4	0.0%
Agriculture – See Section 5.3 for a breakdown of Sources	Livestock	18,969	5.2%
	Agricultural soil	2,121	0.6%
Waste	Open Landfill Sites	63,565	17.3%
	Wastewater Treatment	5,001	1.4%
Industrial Processes and Product Use	Industrial Processes and Product Use	21,313	5.8%
Total Gross GHG Emissions		**367,257**	**100.0%**
Forestry	Exotic Forest Sequestration	-214,937	Not included in total gross GHG emissions
Total Net GHG Emissions		152,320	

Table 2 GHG emissions by sector and source, for FY 18/19

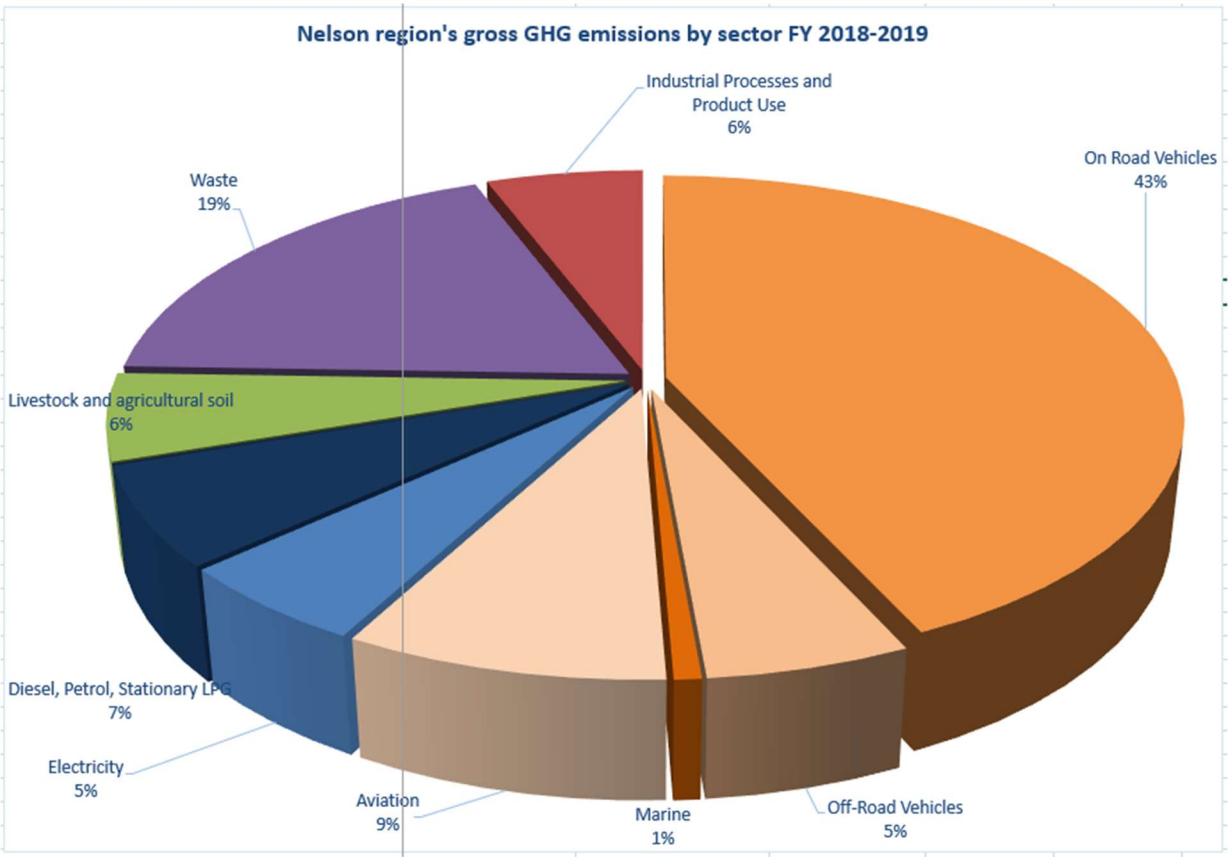

Figure 2 Nelson region's gross GHG emissions, by source, for FY 18/19

1.1.18/19 Transport GHG Emissions

The Transport sector was the largest GHG emission emitting sector, producing 212,561 tCO_2e (57.9% of Nelson's total gross GHG emissions). The largest contributor to the Transport sector's GHG emissions was from petrol and diesel, contributing to 84% of the Transport sector's GHG emissions. Petrol and diesel transport GHG emissions can be broken down into:

- On-road transport uses of petrol and diesel produced 43.2% of Nelson's total gross GHG emissions. This consists of all standard transport vehicles used on roads (e.g. cars, trucks, buses, etc.)
- off-road transport uses of petrol and diesel produced 5.4% of Nelson's total gross GHG emissions. This consists of all fuel used for the movement of machinery and vehicles off-roads (e.g. within agriculture, construction and industry).

The second largest source of the Transport sector's GHG emissions was from air travel (jet kerosene + aviation gas), which produced 31,389 tCO_2e (14.7% of the Transport sector's GHG emissions). The rest of the Transport sector's GHG emissions were from marine transport (1.3% of Transport).

Sector/Source		GHG Emissions (tCO_2e)		% of sector gross GHG emissions
Transport	Petrol (On-Road)	64,923	212,561	30.5%
	Diesel (On-Road)	93,610		44.0%
	Electric vehicles (On-Road)	0		0.0%
	Biodiesel (Vehicle Use)	0		0.0%
	Petrol (Off-Road)	759		0.4%
	Diesel (Off-Road)	19,160		9.0%
	Marine Light Fuel Oil (Freight Cargo) - International	2,498		1.2%
	Marine Light Fuel Oil (Freight Cargo) - Domestic	179		0.1%
	Marine Diesel (Tourism Vessels and Local Ferries)	-		0.0%
	Jet Kerosene (Commercial Flights)	21,118		9.9%
	Aviation Gas	10,271		4.8%
	LPG (Road Mobile Uses)	43.72		0.0%

Table 3 Transport's GHG emissions by source, for FY 18/19

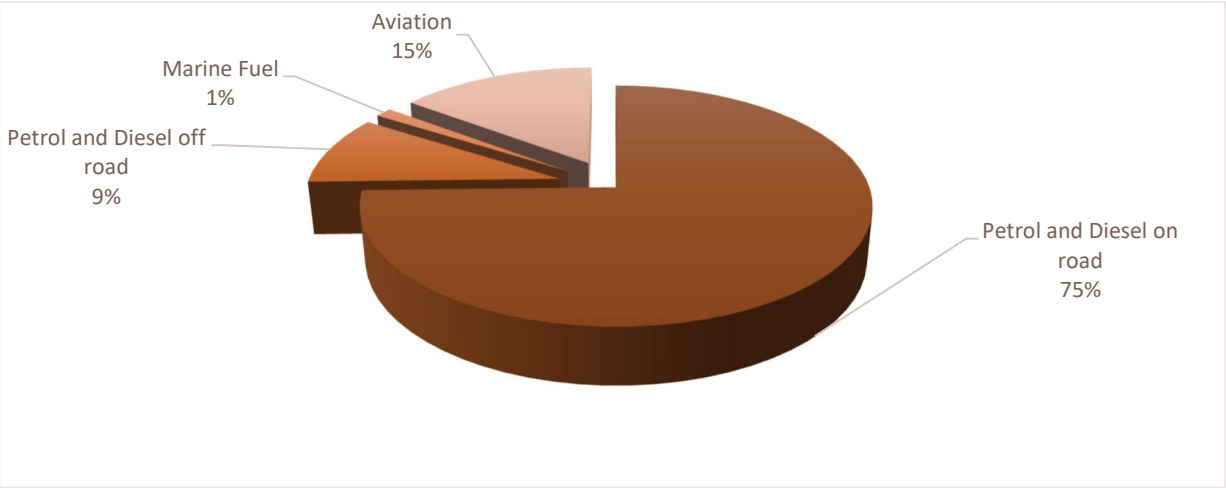

Figure 3 Transport GHG emissions, by % contribution for FY 18/19

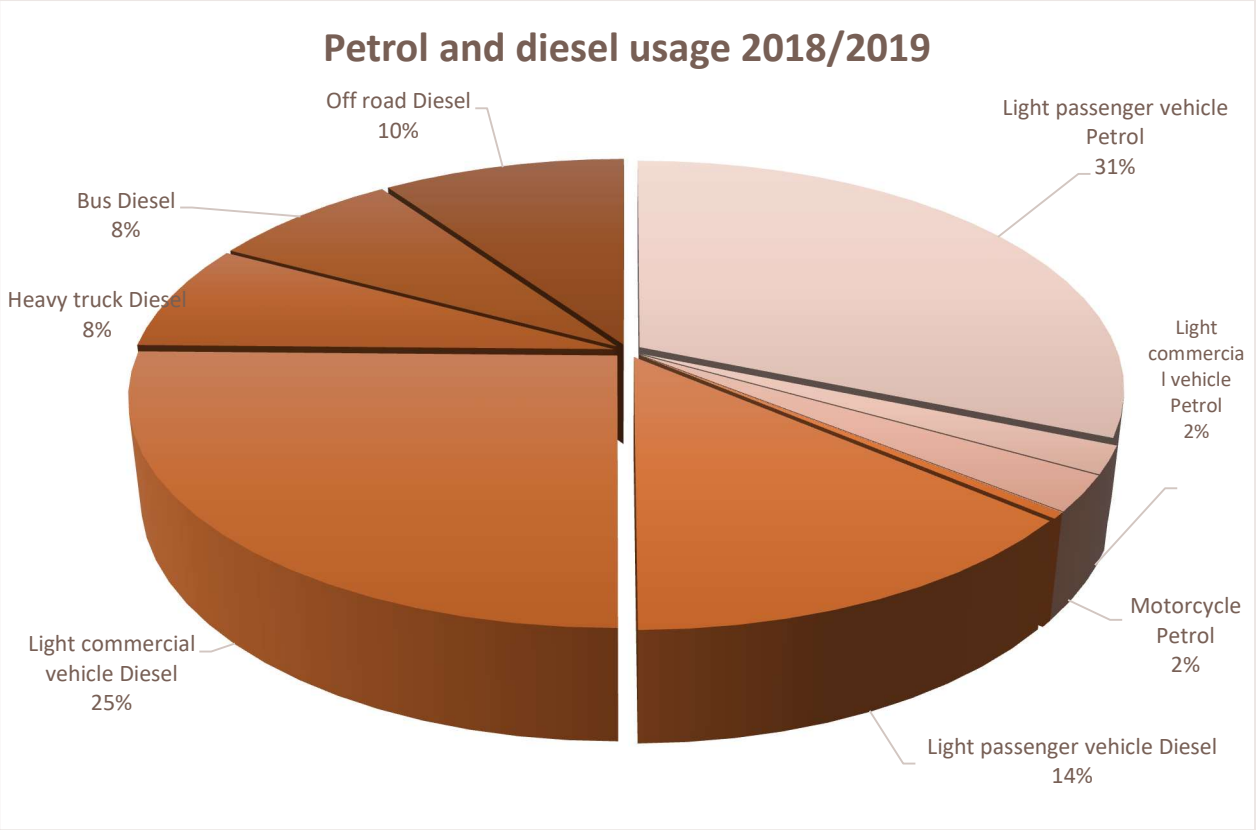

Figure 4 Breakdown of diesel and petrol used for on/off road vehicle FY 18/19

1.2.FY 18/19 Stationary Energy GHG Emissions

The Stationary Energy sector was Nelson's third highest emitting sector producing 43,725 tCO_2e (11.9% of Nelson's total gross GHG emissions). The largest contributor to the Stationary Energy sector's GHG emissions was from electricity consumed (including associated electricity transmission and distribution losses) (45% of the Stationary Energy sector's GHG emissions). The second largest source was LPG use in stationary energy activities.

Sector/Source		GHG Emissions (tCO_2e)		% of sector gross GHG emissions
Stationary Energy	Electricity (kWh)	17,959	43,725	41%
	Transmission & distribution losses	1,757		4%
	Diesel	10,821		25%
	Petrol	342		1%
	LPG	12,841		29%
	Biodiesel	0.000118		0%
	Coal	4.14		0%

Table 4 Stationary Energy GHG emissions, by sub-sector, for FY 18/19

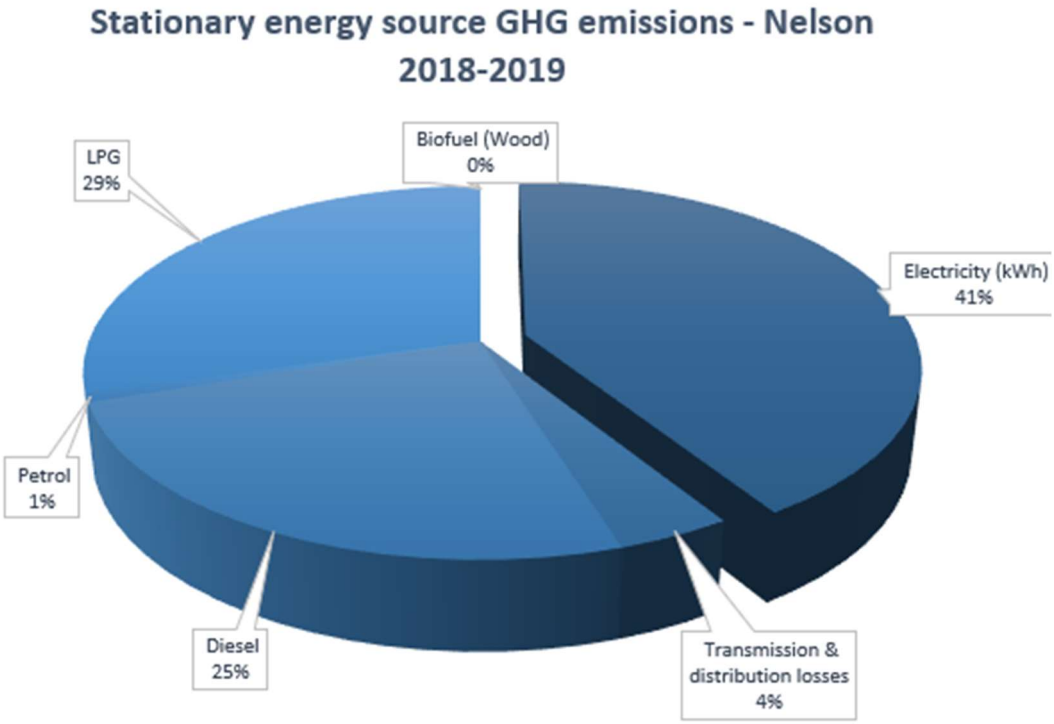

Figure 5 Stationary Energy GHG emissions, by % contribution for FY 18/19

The Stationary Energy sector's GHG emissions are also broken down by sub-sector.

Sub-sector	Description	tCO_2e
Residential Building	All emissions from energy use in households	13,956
Commercial/Institutional Building & Facilities	All emissions from energy use in commercial buildings and facilities	22,064
	All emissions from energy use in public buildings such as schools, hospitals, government offices, highway street lighting, and other public facilities	
Manufacturing Industries & Construction	All emissions from energy use in industrial facilities and construction activities, except those included in energy industries sub-sector. This also includes combustion for the generation of electricity and heat for own use in these industries.	7,704
Energy Industries	All emissions from energy production and energy use in energy industries	-
Energy Generation supplied to the grid	All emissions from the generation of energy for grid-distributed electricity, steam, heat and cooling	-
Agriculture, forestry & fishing activities	All emissions from energy use in agriculture, forestry, and fishing activities	-
Non-Specified sources	All remaining emissions from facilities producing or consuming energy not specified elsewhere	-
Fugitive emissions	From mining, processing, storage and transport of coal/oil and natural gas systems	-
Total		**43,725**

Table 5 Stationary Energy GHG emissions, by source, for FY 18/19

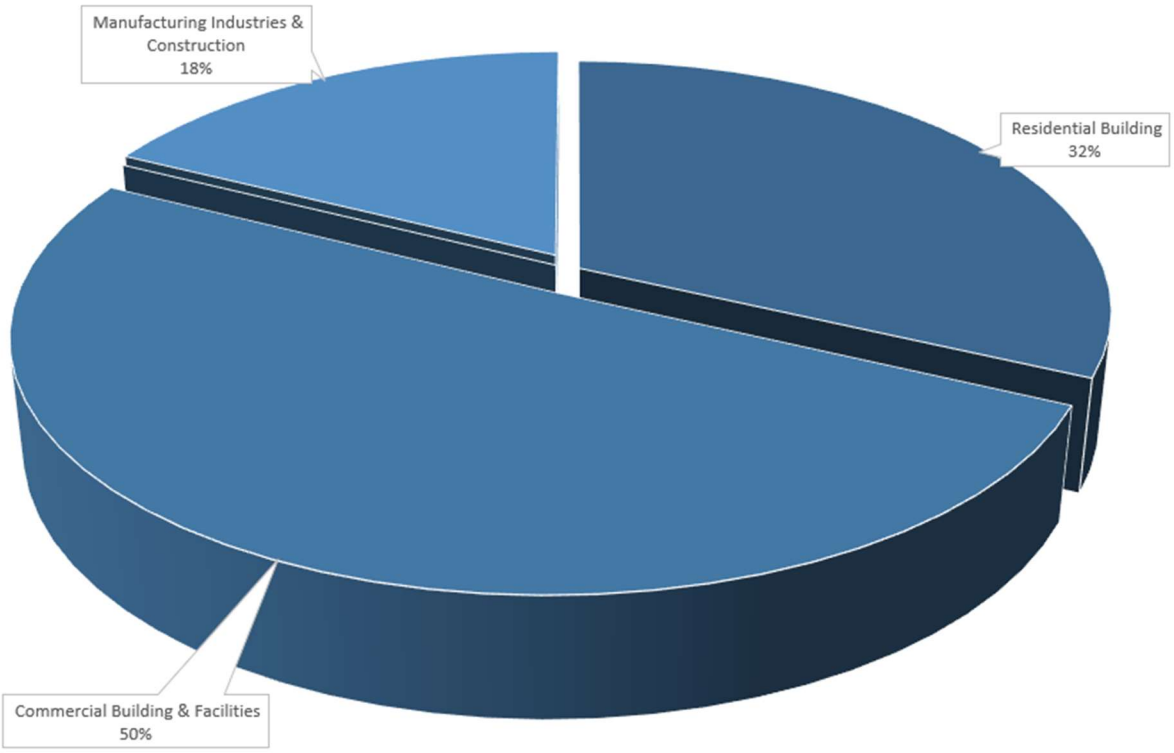

Figure 6 Stationary Energy sub-sector GHG emissions FY 18/19

1.3.FY 18/19 Agriculture GHG Emissions

The agriculture sector was Nelson's fifth highest emitting sector producing 21,092 tCO_2e (5.7% of Nelson's total gross GHG emissions). Livestock produced the majority of the agriculture sector's GHG emissions, 18,969 tCO_2e (89.9% of the agriculture sector's GHG emissions).

Sheep are farmed in the largest numbers across Nelson, accounting for 87.1% of farmed livestock. Enteric fermentation from livestock produced 18,128 tCO_2e (86% of the agriculture sector's GHG emissions). The second largest source of the agriculture sector's GHG emissions was from urine and dung deposited by manure from grazing animals on pasture.

The measurement of GHG emissions in the agriculture sector for this report considered the following sources and GHG gases:

Livestock

- enteric fermentation (CH_4): driven primarily by the number of animals, type of digestive system, and type and amount of feed consumed
- manure management (CH_4): from manure deposited directly onto pasture. This source of emission was calculated using emission factors from the National inventory and data from number of livestock (dairy cattle, non-dairy cattle (beef cattle); and sheep)

Agricultural soils

- Urine and Dung Deposited by Grazing Animals (used a percentage of livestock from National inventory data) N_2O released from manure deposited directly onto pasture by grazing livestock

- Liming and dolomite (CO_2): Lime applications (calcic lime and dolomite). Liming is used to reduce soil acidity and improve plant growth on agricultural land and managed forest.

All of these emissions represent nearly 88.4% of the sources of GHG in the agriculture sector in the National GHG Inventory report. The remainder 11.6% from the sector that were not included in this Report are:

- Manure management (N_2O emissions) – New Zealand has a much lower proportion of agricultural emissions from manure management, compared with other Annex I Parties as most manure is deposited directly onto pastures.
- Inorganic and organic fertilizers (N_2O emissions)
- Crop residues
- Cultivation of organic soils
- Indirect (N_2O emissions) from managed soils
- Field burning of agricultural resides
- Urea application

	GHG Source	% of sector gross GHG emissions	GHG emissions tCO_2e	% of sector gross GHG emissions
Livestock	Enteric Fermentation	86%	18,128	89.8%
	Manure Management	4%	841	
Agricultural soil	Urine and dung deposited by grazing animals	9.6%	2,025	10.2%
	Liming & Dolomite	0.5%	96.3	
Total emissions CO_2e		**100.0**	**21,092**	

Table 6 Agriculture GHG emissions by source, for FY 18/19

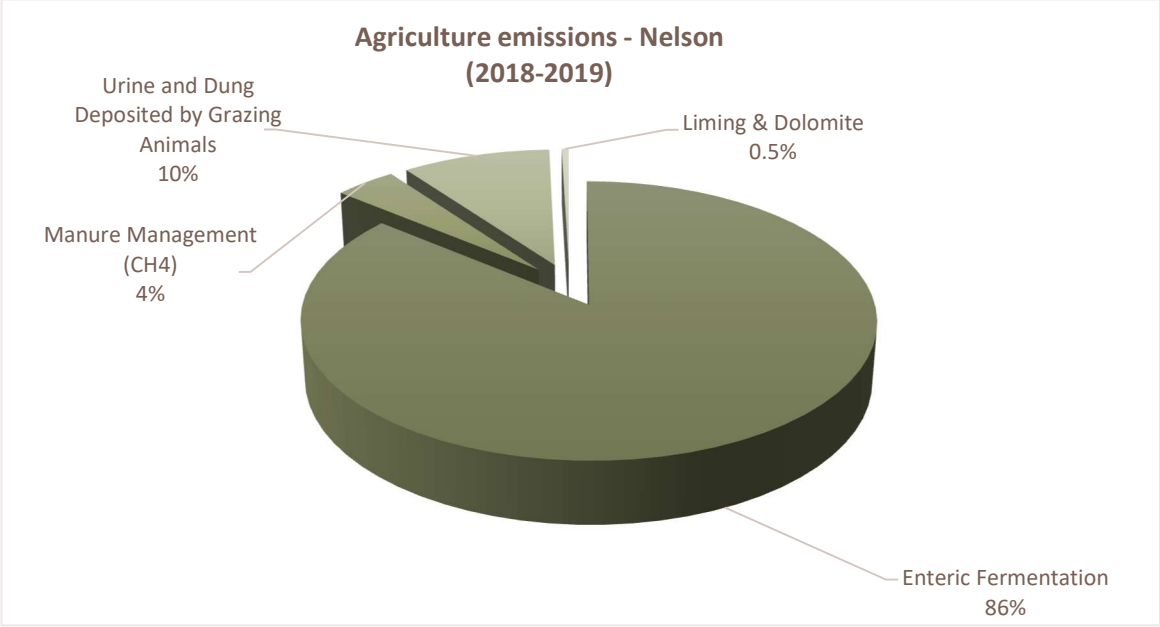

Figure 7 Agriculture' s GHG emissions, by % contribution for FY 18/19

1.4.FY 18/19 Waste GHG Emissions

The Waste sector (solid waste and wastewater treatment) was Nelson's second highest emitting sector producing 68,567 tCO_2e in 18/19 (18.7% of Nelson's total gross GHG emissions). Solid waste sent to landfill produced 63,565 tCO_2e (93% of the Waste sector's GHG emissions).

Solid waste GHG emissions include emissions from open landfills only. 90% of the Atawhai closed landfill is over 50 years old, which under the management of closed landfills manual is considered 'non producing'.

Sector/Source		GHG Emissions (tCO_2e)		% of sector gross GHG emissions
Waste	Open Landfill Sites	63,565	68,567	93%
	Wastewater Treatment	5,001		7%

Table 7 Waste's GHG emissions, by source, for FY 18/19

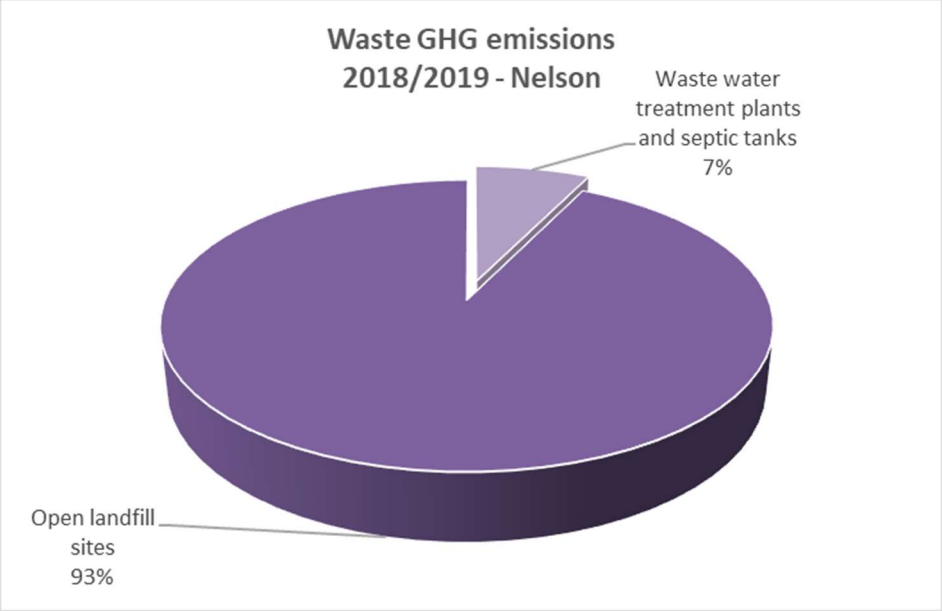

Figure 8 Waste's GHG emissions, by % contribution for FY 18/19

1.5.FY 18/19 Industrial Processes and Product Use (IPPU) GHG Emissions

The IPPU sector was Nelson's fourth highest emitting sector producing 21,313 tCO_2e in 18/19 (5.8% of Nelson's total gross GHG emissions). The use of refrigerants represents 87.7% of the IPPU sector's GHG emissions.

The GHG emissions for Industrial Product Use include GHG emissions from Hydrofluorocarbon (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). It is understood that there are no large industrial operations within the Nelson region's boundary that result in significant Industrial Processes GHG emissions for industrial processes of:

- **Mineral industry**: cement production, lime production, or glass production.
- **Chemical industry**: Ammonia, Nitric acid, Adipic acid, Caprolactam, glyoxal, and glyoxylic acid, Carbide, Titanium dioxide, Soda ash
- **Metal industry**: production of iron steel and metallurgical coke, ferroalloy, aluminium, magnesium, lead, zinc, and rare earth metals.

The data was estimated using the following emissions from the national figure from "product use emissions" per capita using Nelson's population.

- Non-energy Products from Fuels and Solvent Use (Lubricant, paraffin wax, other use)
- Product Uses as Substitutes for ODS
    - Refrigeration and air conditioning (Commercial, domestic, industrial, transport refrigeration, Mobile Air-Conditioning)
    - Foam Blowing Agents
    - Fire Protection
    - Aerosols

- Other Product Manufacture and Use
    - Electrical Equipment
    - SF6 and PFCs from Other Product Use (medical and others)
    - N_2O from Product Uses (medical application)

Sector/Source		GHG Emissions (tCO_2e)		% of sector gross GHG emissions
Non-energy Products from Fuels and Solvent Use	Lubricant, paraffin wax, other use	513	513.23	2.4%
Product Uses as Substitutes for ODS	Refrigeration and air conditioning (Commercial, domestic, industrial, transport refrigeration, Mobile Air-Conditioning)	18,690		87.7%
	Foam Blowing Agents	61.15		0.3%
	Fire Protection	23.61		0.1%
	Aerosols	989	19,764	4.6%
Other Product Manufacture and Use	Electrical Equipment	128		0.6%
	SF6 and PFCs from Other Product Use (medical and others)	29.45		0.1%
	N_2O from Product Uses (medical application)	877	1,035	4.1%
Total		**21,313**		

Table 8 IPPU GHG emissions, by source, for FY 18/19

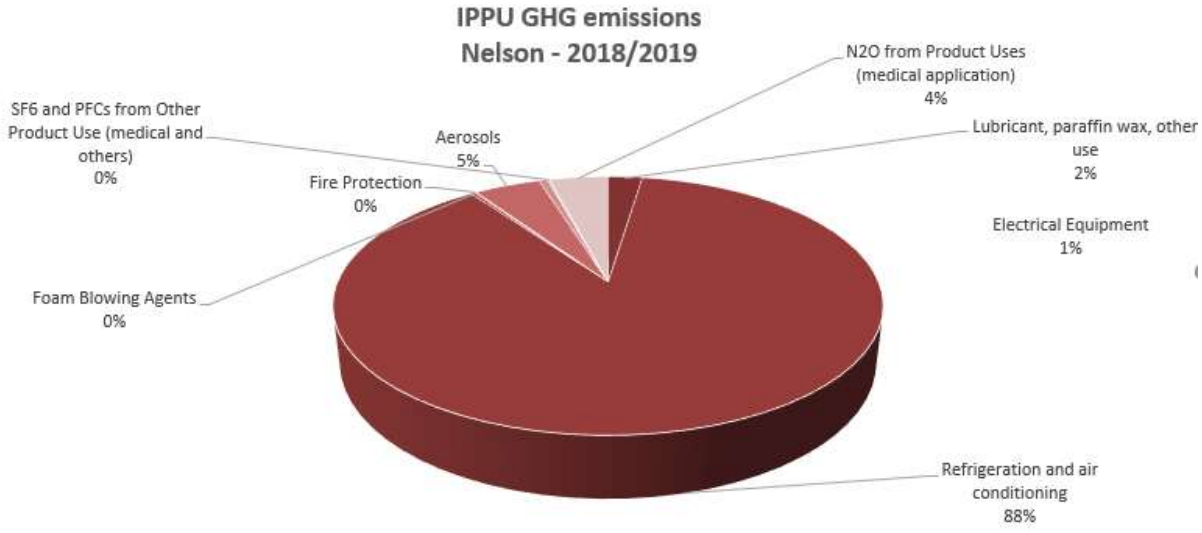

Figure 9: IPPU GHG emissions, by % contribution for FY 18/19

1.6.FY 18/19 Forest Carbon Sequestration

This inventory accounts for exotic forest carbon stock.

GHG emissions from harvesting and deforestation were not applicable as it was used the "average accounting" approach for LULUCF land-use emission factors.

This inventory doesn't consider native forest as the data for regenerating (growing) forest areas was not available.

For exotic forest, the only data available was for FY19/20, so, the same data was used for base year FY 18/19.

In 18/19 the Forestry sector produced net negative GHG emissions of -214,937 tCO_2e due to the sequestration of carbon by exotic forest.

1.7.FY 18/19 Biogenic GHG emissions

Biogenic carbon dioxide (CO_2) and methane (CH_4) GHG emissions from biomass combustion are accounted but reported separately as an information item, because the carbon embedded in biomass is part of the natural carbon cycle. Emissions are listed in Table 9.

The following biogenic CO_2 GHG emissions from plants and animals are excluded from total gross GHG emissions as they originate from organic material disposed of in the landfill or they are part of the natural carbon cycle:

- Combustion of recovered biogas (methane) from the York Valley landfill used at Nelson Hospital
- Biogas flaring at the York Valley landfill
- wood biofuels originate from forestry

The following biogenic CH_4 GHG emissions are included in total gross GHG emissions:

- enteric fermentation and manure produced by farmed cattle.
- Landfill biogas (methane) produced from solid waste

The national Emission Reduction Plan includes targets to reduce Biogenic CH_4 GHG emissions by between 24 percent and 47 percent below 2017 levels by 2050, and a 10 percent reduction below 2017 levels by 2030.

Sector/Source		**Biogenic GHG Emissions (tCO_2 equivalent)**
Biogenic CO_2 GHG Emissions	Biofuel (Wood)	510
	Landfill Biogas - Methane (Recovered)	31
	Biodiesel (Stationary Use)	0.118
	Biodiesel (Transport)	2.45

	Enteric Fermentation	18,128
	Manure Management	842
	Landfill Biogas - Methane (Non-Recovered)	13,959

Table 9: Biogenic carbon dioxide emissions, for FY 18/19

1.8.18/19 GHG Emissions Inventory- Summary

During FY 18/19 reporting period Nelson's total gross GHG community emissions were 367,257 tonnes of carbon dioxide equivalent (tCO_2e), which equates to 6.9 tCO_2e/person. This was below per capita estimates for all cities except for Wellington (see Figure below).

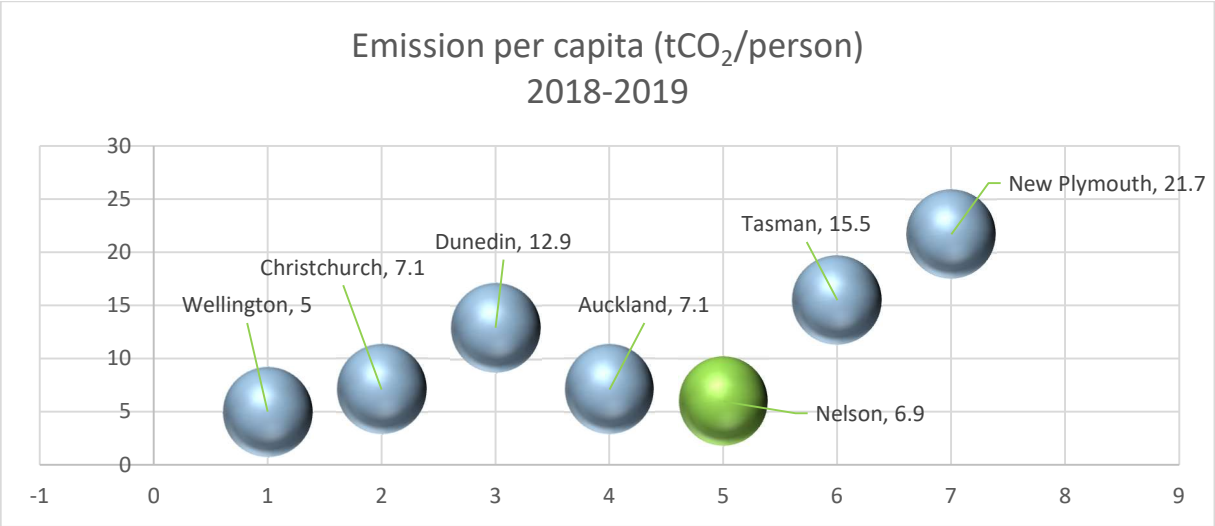

Figure 10: Per capita total gross GHG emissions comparison

The comparison of total gross GHG emissions with other councils that have reported under the GPC provides a high-level comparison as they might have differences in methodology and emission factors.

Table 1 summarises the 18/19 GHG emission results for different sectors while Table 2 displays emissions from all calculated emissions sources. High level findings are provided below.

- **Transport** (e.g. road and air travel) was the largest GHG community emission emitting sector, producing 57.9% of Nelson's total gross GHG emissions, with petrol and diesel use contributing to 84% of the Transport sector's GHG emissions. Petrol and diesel transport GHG emissions can be broken down into:
    - On-road transport uses of petrol and diesel produced 43.2% of Nelson's total gross GHG emissions. This consists of all standard transport vehicles used on roads (e.g. cars, trucks, buses, etc.)
    - off-road transport uses of petrol and diesel produced 5.4% of Nelson's total gross GHG emissions. This consists of all fuel used for the movement of machinery and vehicles off-roads (e.g. within agriculture, construction and industry).

- **Stationary Energy** (i.e. non-transport energy use) was the third largest GHG community emission emitting sector, producing 11.9% of Nelson's total gross GHG community emissions, with electricity consumed (including associated electricity transmission and distribution losses) contributing to 45% of the Stationary Energy sector's GHG emissions.

- **Agriculture** (e.g. from livestock and agricultural soil) was the fifth highest GHG community emission emitting sector, producing 5.7% of Nelson's total gross GHG emissions, with enteric fermentation contributing to 98% of the Agriculture sector's GHG emissions.

- **Waste** (solid waste and wastewater treatment) was Nelson's second highest emitting sector producing 68,567 tCO_2e in 18/19 (18.7% of Nelson's total gross GHG emissions). Solid waste sent to landfill produced 63,565 tCO_2e (93% of the Waste sector's GHG emissions).

- **Industrial Processes and Product Use (IPPU)** sector (e.g. the use of industrial chemicals) produced the fourth highest (5.8%) of Nelson's total gross GHG community emissions.

2. FY 19/20 GHG Emission Inventory Results

During FY 19/20 reporting period the Nelson region emitted a total gross 330,980 tonnes of carbon dioxide equivalent (tCO_2e) and a net 116,043 tCO_2e.

The Nelson region's population in 19/20 was approximately 54,150 people, resulting in per capita gross GHG emissions of 6.1 tCO_2e/person. The Transport sector's GHG emissions were the largest contributor to the inventory, followed by the Stationary Energy sector (refer to **Table 14**).

Sector	GHG Emissions (tCO_2e)	% of total gross GHG emissions
Transport	202,189	61.1%
Stationary Energy	47,473	14.3%
Agriculture	16,153	4.8%
Waste	44,923	13.6%
Industrial Processes and Product Use	20,242	6.1%
Total Gross GHG Emissions (excl. Forestry)	**330,980**	**100%**
Forestry	-214,937	Not included in total gross GHG emissions
Total Net GHG Emissions (incl. Forestry)	116,043	

Table 10: GHG emissions by sector, for FY 19/20

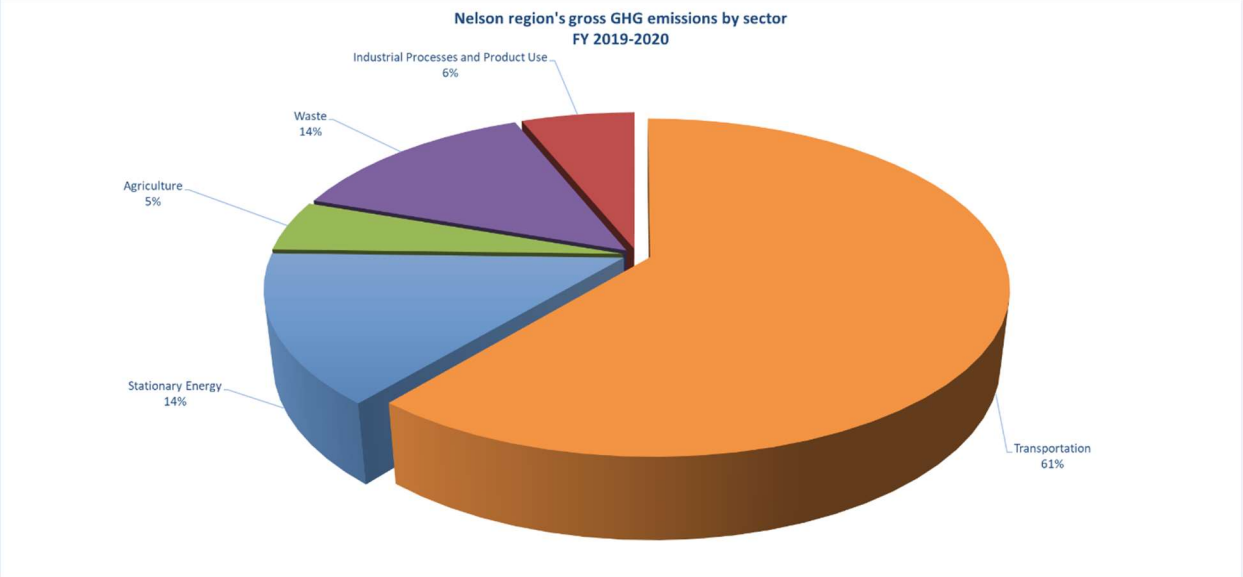

Figure 11: Gross GHG emissions, by sector for FY 19/20

GHG Emission Sector/Source		GHG Emissions (tCO_2e)	% of total gross GHG emissions
Transport	Petrol (On-Road)	60,108	18.2%
	Diesel (On-Road)	94,999	28.7%
	Electric vehicles (On-Road)	0.14	0.0%
	Biodiesel (Vehicle Use)	0	0.0%
	Petrol (Off-Road)	702	0.2%
	Diesel (Off-Road)	19,444	5.9%
	Marine Light Fuel Oil (Freight Cargo) - International	1,668	0.5%
	Marine Light Fuel Oil (Freight Cargo) - Domestic	174	0.1%
	Marine Diesel (Tourism Vessels and Local Ferries)	0	0.0%
	Jet Kerosene (Commercial Flights)	14,779	4.5%
	Aviation Gas (Local Flights)	10,271	3.1%
	LPG (Road Mobile Uses)	43	0.0%
Stationary Energy	Electricity Consumed	21,258	6.4%
	Electricity Transmission and Distribution Losses	2,294	0.7%
	Diesel (Stationary Use)	10,982	3.3%
	Petrol (Stationary Use)	317	0.1%
	LPG (Stationary Use)	12,618	3.8%
	Biodiesel (Stationary Use)	0	0.0%
	Coal	4	0.0%
Agriculture – See Section 3.3 for a breakdown of Sources	Livestock	14,029	4.2%
	Agricultural soil	2,125	0.6%
Waste	Open Landfill Sites	39,756	12.0%
	Wastewater Treatment	5,167	1.6%
Industrial Processes and Product Use	Industrial Processes and Product Use	20,242	6.1%
Total Gross GHG Emissions		**330,980**	**100.0%**
Forestry	Exotic Forest Sequestration	-214,937	Not included in total gross GHG emissions
Total Net GHG Emissions		116,043	

Table 11: GHG emissions, by sector and source, for FY 19/20

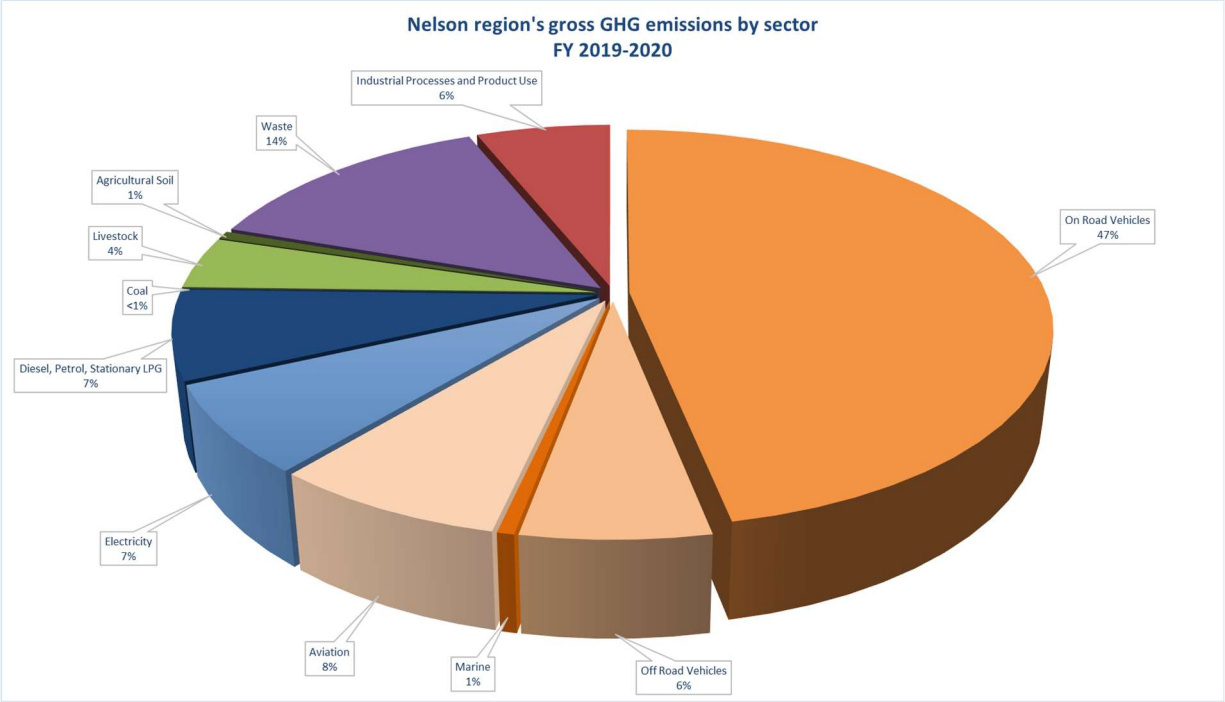

Figure 12: Gross GHG emissions, by source, for FY 19/20

2.1.FY 19/20 Transport GHG emissions

The Transport sector was the highest GHG emission emitting sector, producing 202,189 tCO_2e (61.1% of Nelson's total gross GHG emissions). The largest contributor to the Transport sector's GHG emissions was from petrol and diesel, contributing to 86% of the Transport sector's GHG emissions. Petrol and diesel transport GHG emissions can be broken down into:

- On-road transport uses of petrol and diesel produced 46.9% of Nelson's total gross GHG emissions. This consists of all standard transport vehicles used on roads (e.g., cars, trucks, buses, etc.)
- off-road transport uses of petrol and diesel produced 6.1% of Nelson's total gross GHG emissions. This consists of all fuel used for the movement of machinery and vehicles off-roads (e.g. within agriculture, construction and industry).

The second largest source of the Transport sector's GHG emissions was from air travel (jet kerosene + aviation gas) which produced 25,049 tCO_2e (12% of the Transport sector's GHG emissions). The rest of the Transport sector's GHG emissions were from marine transport (1% of Transport).

Sector/Source		GHG Emissions (tCO_2e)		% of sector gross GHG emissions
Transport	Petrol (On-Road)	60,108	202,189	29.73%
	Diesel (On-Road)	94,999		46.99%
	Electric vehicles (On-Road)	0.14		0.0%
	Biodiesel (Vehicle Use)	0.01		0.0%
	Petrol (Off-Road)	702		0.33%
	Diesel (Off-Road)	19,444		9.62%
	Marine Light Fuel Oil (Freight Cargo) - International	1668		0.83%
	Marine Light Fuel Oil (Freight Cargo) - Domestic	174		0.086%
	Marine Diesel (Tourism Vessels and Local Ferries)	0		0.0%
	Jet Kerosene (Commercial Flights)	14,779		7.31%
	Aviation Gas	10,271		5.08%
	LPG (Road Mobile Uses)	43		0%

Table 12 Transport GHG emissions by source, for FY 19/20

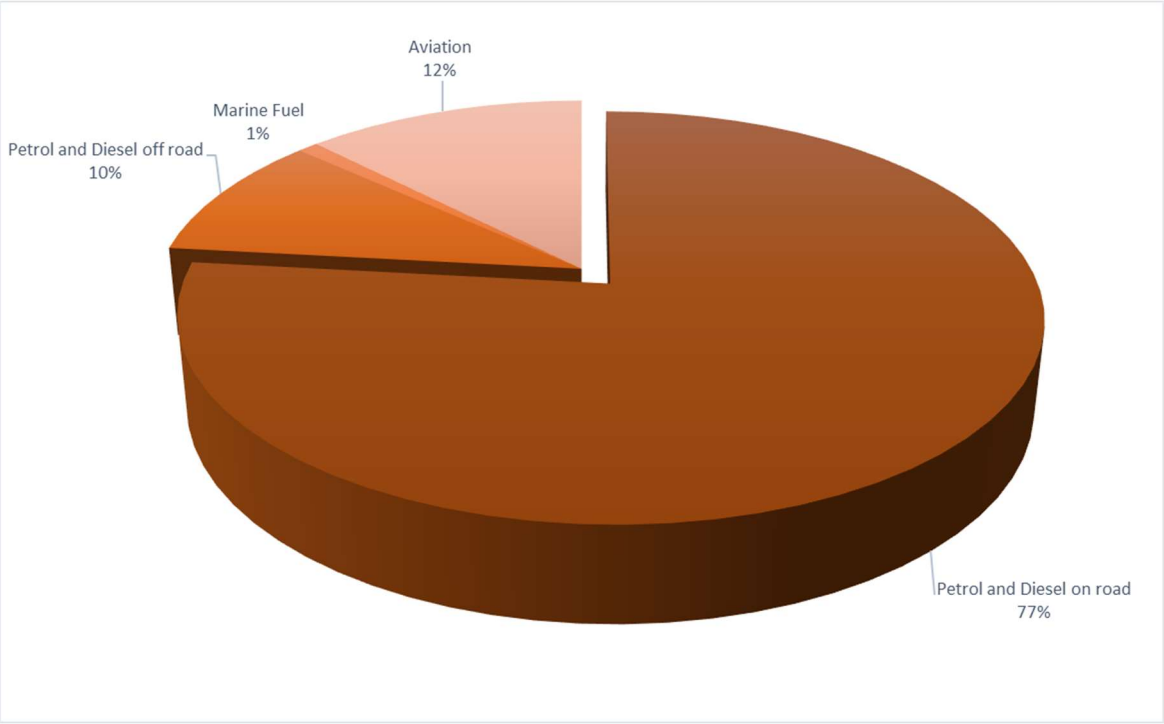

Figure 13 Transport GHG emissions by % contribution for FY 19/20

2.2.FY 19/20 Stationary Energy GHG emissions

The Stationary Energy sector was Nelson's second highest emitting sector producing 47,473 tCO_2e (14.3% of Nelson's total gross GHG emissions). The largest contributor to the Stationary Energy sector's GHG emissions was from electricity consumed (including associated electricity transmission and distribution losses) (45% of the Stationary Energy sector's GHG emissions). The second largest source was LPG use in stationary energy activities

Sector/Source		GHG Emissions (tCO_2e)		% of sector gross GHG emissions
Stationary Energy	Electricity (kWh)	21,258	47,473	45%
	Transmission & distribution losses	2,294		5%
	Diesel	10,982		23%
	Petrol	317		1%
	LPG	12,618		27%
	Biodiesel	0.001		0%
	Coal	4.15		0.0014%

Table 13 Stationary Energy GHG emissions by sub-sector, for FY 19/20

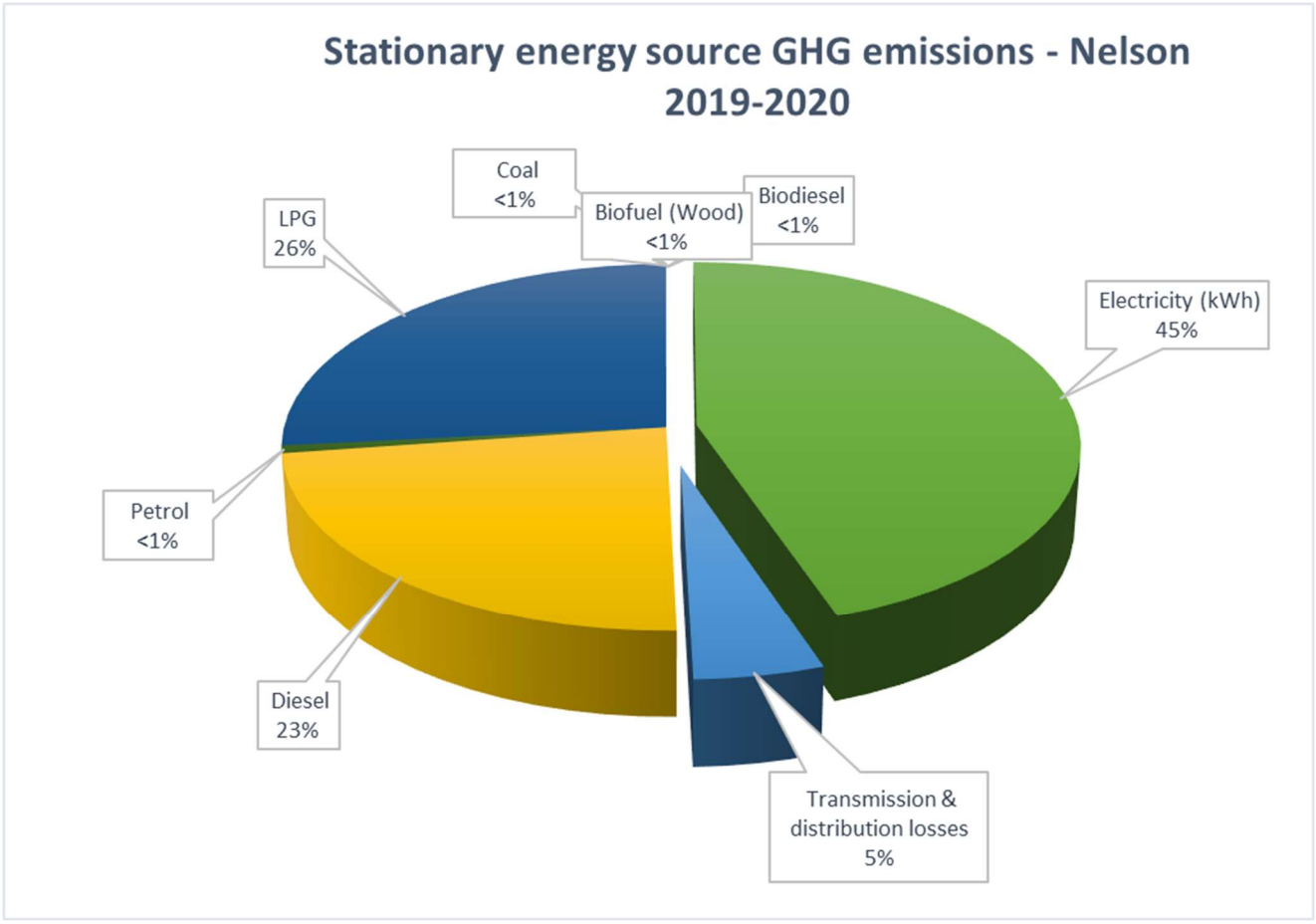

Figure 14 Stationary Energy GHG emissions, by % contribution for FY 19/20

The Stationary Energy sector's GHG emissions are also broken down by sub-sector:

Sector/Sub-Sector	Description	tCO_2e
Residential Building	All emissions from energy use in households	15,858
Commercial/Institutional Building & Facilities	All emissions from energy use in commercial buildings and facilities	22,475
	All emissions from energy use in public buildings such as schools, hospitals, government offices, highway street lighting, and other public facilities	
Manufacturing Industries & Construction	All emissions from energy use in industrial facilities and construction activities, except those included in energy industries sub-sector. This also includes combustion for the generation of electricity and heat for own use in these industries.	9,139
Energy Industries	All emissions from energy production and energy use in energy industries	-
Energy Generation supplied to the grid	All emissions from the generation of energy for grid-distributed electricity, steam, heat and cooling	-
Agriculture, forestry & fishing activities	All emissions from energy use in agriculture, forestry, and fishing activities	-
Non-Specified sources	All remaining emissions from facilities producing or consuming energy not specified elsewhere	-
Fugitive emissions	From mining, processing, storage and transport of coal/oil and natural gas systems	-
Total		**47,473**

Table 14 Stationary Energy GHG emissions, by source, for FY 19/20

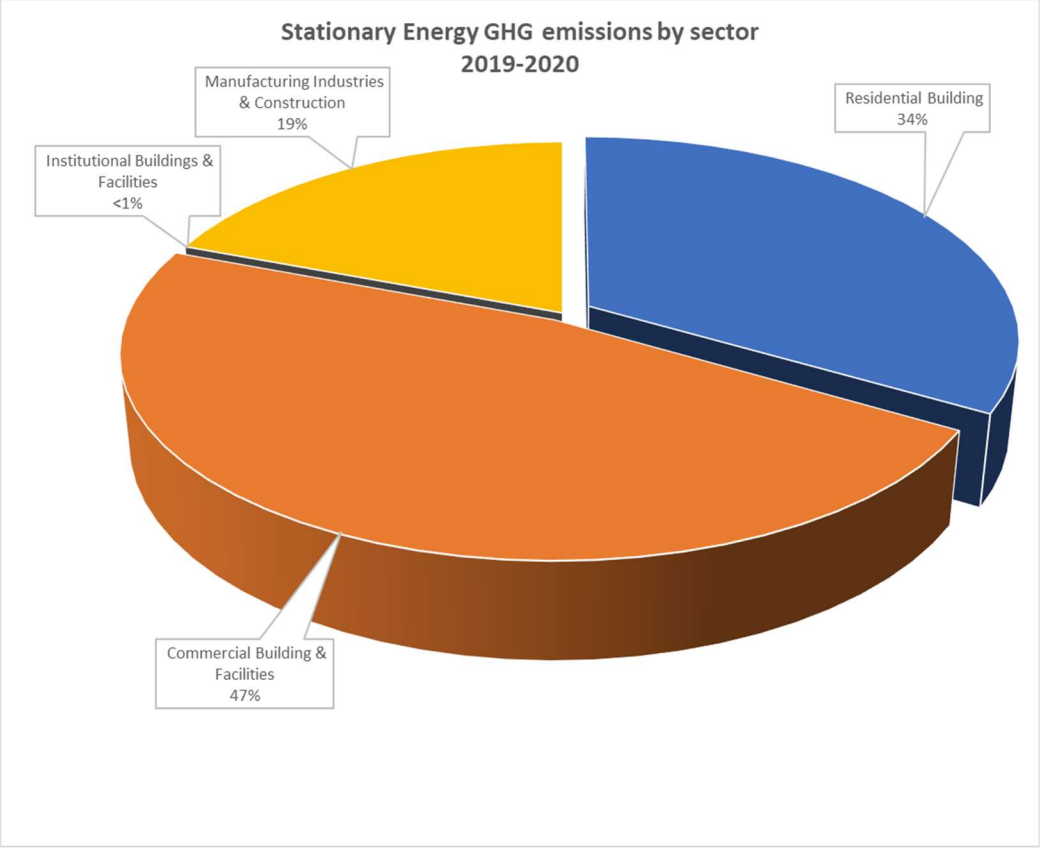

Figure 15: Stationary Energy sub-sector GHG emissions FY 19/20

2.3.19/20 Agriculture GHG emissions

The agriculture sector was Nelson's fifth highest emitting sector producing 16,153 tCO_2e (4.88% of Nelson's total gross GHG emissions). Livestock produced the majority of the agriculture sector's GHG emissions, 14,028 tCO_2e (86.8% of the agriculture sector's GHG emissions).

Sheep are farmed in the largest numbers across Nelson, accounting for 69.5% of farmed livestock. Enteric fermentation from livestock produced 13,241 tCO2e (82% of the agriculture sector's GHG emissions). The second largest source of the agriculture sector's GHG emissions was from manure from grazing animals on pasture.

The measurement of GHG emissions in the agriculture sector for this report considered the following sources and GHG gases:

Livestock

- enteric fermentation (CH_4): driven primarily by the number of animals, type of digestive system, and type and amount of feed consumed
- manure management (CH_4): from manure deposited directly onto pasture. This source of emission was calculated using emission factors from the National inventory and data from number of livestock (dairy cattle, non-dairy cattle (beef cattle); and sheep)

Agricultural soils

- Urine and Dung Deposited by Grazing Animals (used a percentage of livestock from National inventory data) N_2O released from manure deposited directly onto pasture by grazing livestock
- Liming and dolomite (CO_2): Lime applications (calcic lime and dolomite). Liming is used to reduce soil acidity and improve plant growth on agricultural land and managed forest.

All these emissions represent nearly 88.4% of the sources of GHG in the agriculture sector in the National GHG Inventory report. The remainder 11.6% from the sector that were not included in this Report are:

- Manure management (N_2O emissions) – New Zealand has a much lower proportion of agricultural emissions from manure management, compared with other Annex I Parties as most manure is deposited directly onto pastures.
- Inorganic and organic fertilizers (N_2O emissions)
- Crop residues
- Cultivation of organic soils
- Indirect (N_2O emissions) from managed soils
- Field burning of agricultural resides
- Urea application

•

	GHG Source	% of sector gross GHG emissions	GHG emissions tCO_2e	% of sector gross GHG emissions
Livestock	Enteric Fermentation	82%	13,241	89.1%
	Manure Management	4.9%	787	
Agricultural soil	Urine and dung deposited by grazing animals	12.6%	2,028	10.9%
	Liming & Dolomite	0.6%	96.30	
Total emissions CO_2e			**16,153**	

Table 15: Agriculture's GHG emissions by source, for FY 19/20

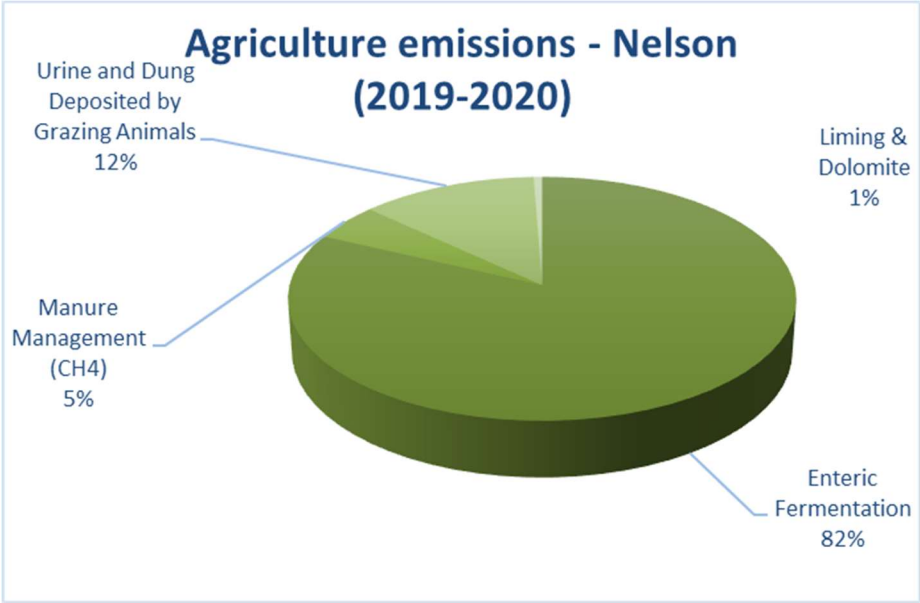

Figure 16 Agriculture's GHG emissions by % contribution for FY 19/20

2.4.19/20 Waste GHG emissions

The Waste sector (solid waste and wastewater treatment) was Nelson's third highest emitting sector producing 44,923 tCO2e in 19/20 (13.57% of Nelson's total gross GHG emissions). Solid waste sent to landfill produced 39,756 tCO_2e (88% of the Waste sector's GHG emissions).

Solid waste GHG emissions include emissions from open landfills only. 90% of the Atawhai closed landfill is over 50 years old, which under the management of closed landfills manual is considered 'non producing'.

Sector/Source		GHG Emissions (tCO_2e)		% of sector gross GHG emissions
Waste	Open Landfill Sites	39,756	44,922	88%
	Wastewater Treatment	5,166		12%

Table 16 Waste GHG emissions by source, for FY 19/20

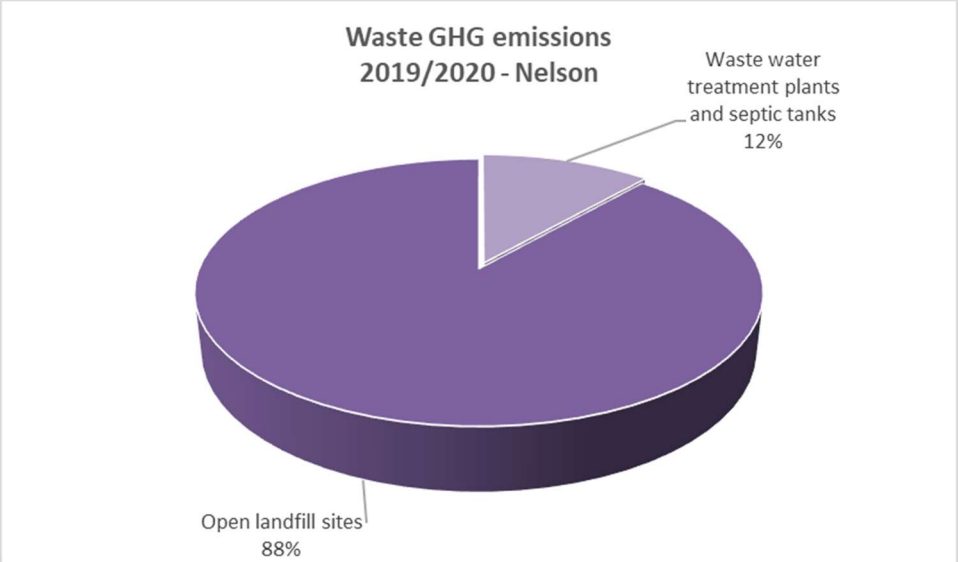

Figure 17 Waste source GHG emissions by % contribution for FY 19/20

2.5.FY 19/20 Industrial Processes and Product Use (IPPU) GHG emissions

The IPPU sector was Nelson's fourth highest emitting sector producing 20,242 tCO_2e in 19/20 (6.1% of Nelson's total gross GHG emissions). The use of refrigerants represents 87% of the IPPU sector's GHG emissions.

The GHG emissions for Industrial Product Use include GHG emissions from (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). It is understood that there are no large industrial operations within the Nelson region's boundary that result in significant Industrial Processes GHG emissions for industrial processes of:

- **Mineral industry**: cement production, lime production, or glass production.
- **Chemical industry**: Ammonia, Nitric acid, Adipic acid, Caprolactam, glyoxal, and glyoxylic acid, Carbide, Titanium dioxide, Soda ash
- **Metal industry**: production of iron steel and metallurgical coke, ferroalloy, aluminium, magnesium, lead, zinc, and rare earth metals.

The GHG emissions for Industrial Product Use include GHG emissions from:

- Hydrofluorocarbon (HFCs) and Perfluorocarbons (PFCs)
    - Refrigeration and air conditioning
    - Fire suppression and explosion protection
    - Aerosols
    - Solvent cleaning
    - Waterproof films for electronic circuits
    - Foam blowing

- Sulphur hexafluoride (SF_6).
    - electrical equipment and propellants in aerosol products
    - used by end-consumers (e.g., running shoes and anaesthesia).

The data was estimated using the national figure and Nelson's population.

Sector/Source		GHG Emissions (tCO_2e)		% of sector gross GHG emissions
Non-energy Products from Fuels and Solvent Use	Lubricant, paraffin wax, other use	516	516	2.6%
Product Uses as Substitutes for ODS	Refrigeration and air conditioning (Commercial, domestic, industrial, transport refrigeration, Mobile Air-Conditioning)	17,614		87.0%
	Foam Blowing Agents	72.12		0.4%
	Fire Protection	23.93		0.1%
	Aerosols	937.44	18,647	4.6%
Other Product Manufacture and Use	Electrical Equipment	139.52		0.7%
	SF6 and PFCs from Other Product Use (medical and others)	29.51		0.1%
	N_2O from Product Uses (medical application)	908.64	1,077	4.5%
Total		**20,242**		

Table 17 IPPU GHG emissions by source, for FY 19/20

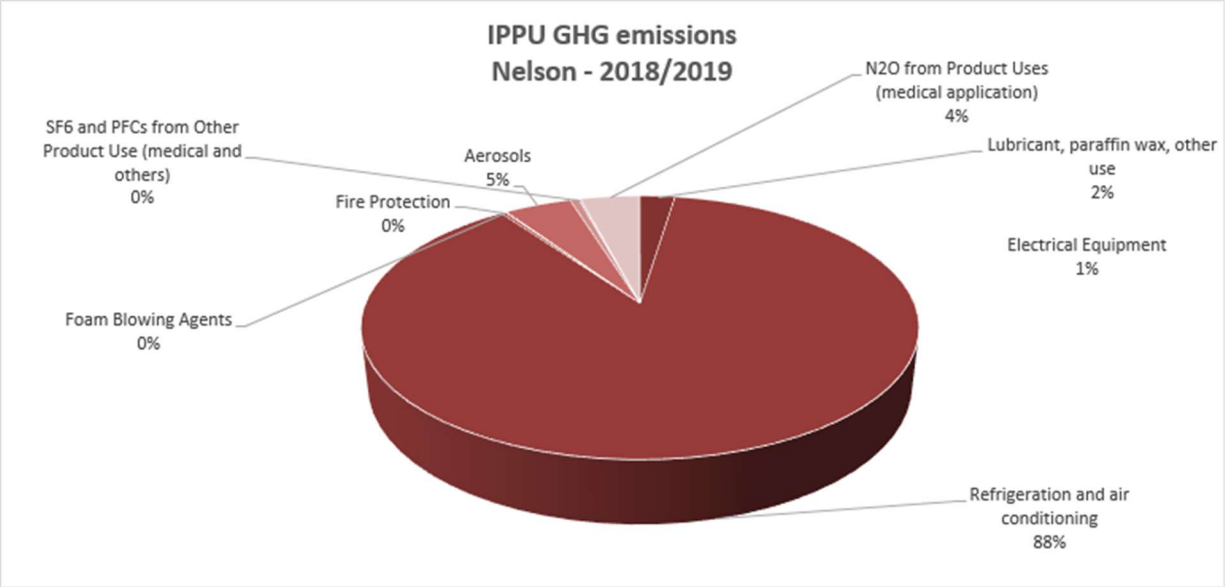

Figure 18 IPPU GHG emissions, by % contribution for FY 19/20

2.6.FY 19/20 Forest Carbon Sequestration and GHG emissions

This inventory accounts for exotic forest carbon stock.

GHG emissions from harvesting and deforestation were not applicable as it was used the "average accounting" approach for LULUCF land-use emission factors.

This inventory doesn't consider native forest as the data for regenerating (growing) forest areas was not available.

For exotic forest, the only data available was for FY19/20, so, the same data was used for base year FY 18/19.

In 19/20 the Forestry sector produced net negative GHG emissions of -214,937 tCO_2e due to the sequestration of carbon mostly by exotic forest.

2.7.FY 19/20 Biogenic GHG emissions

Biogenic carbon dioxide (CO_2) and methane (CH_4) GHG emissions from biomass combustion are accounted but reported separately as an information item, because the carbon embedded in biomass is part of the natural carbon cycle. Emissions are listed in Table 15

The following biogenic CO_2 GHG emissions from plants and animals are excluded from total gross GHG emissions as they originate from organic material disposed of in the landfill or they are part of the natural carbon cycle:

- Combustion of recovered biogas (methane) from the York Valley landfill used at Nelson Hospital
- Biogas flaring at the York Valley landfill
- wood biofuels originate from forestry

The following biogenic CH_4 GHG emissions are included in total gross GHG emissions:

- enteric fermentation and manure produced by farmed cattle.
- Landfill biogas (methane) produced from solid waste

The national Emission Reduction Plan includes targets to reduce Biogenic CH_4 GHG emissions by between 24 percent and 47 percent below 2017 levels by 2050, and a 10 percent reduction below 2017 levels by 2030.

Sector/Source		Biogenic GHG Emissions (tCO_2 equivalent)
Biogenic CO_2 GHG Emissions	Biofuel (Wood)	510.2
	Landfill Biogas - Methane (Recovered)	29.20
	Biodiesel (Stationary Use)	1.118
	Biodiesel (Transport)	2.45
	Enteric Fermentation	13,241
	Manure Management	787
	Landfill Biogas - Methane (Non-Recovered)	10,998

Table 18 Biogenic carbon dioxide emissions for FY 19/20

2.8.FY 19/20 GHG Emission Inventory- Summary

During FY 19/20 reporting period Nelson's total gross GHG emissions were 330,980 tonnes of carbon dioxide equivalent (tCO_2e) which equates to 6.1 tCO_2e/person. This was below per capita estimates for Christchurch, Auckland, Tasman, New Plymouth and Dunedin and above the per capita estimate for Wellington.

Table 12 summarises the 19/20 GHG emission results for different sectors while Table 13 displays emissions from all calculated emissions sources. High level findings are provided below.

- **Transport** was the largest GHG emission emitting sector, producing 61.1% of Nelson's total gross GHG emissions, with petrol and diesel use contributing to 86% of the Transport sector's GHG emissions.

  Petrol and diesel transport GHG emissions can be broken down into:
  - On-road transport uses of petrol and diesel produced 46.9% of Nelson's total gross GHG emissions. This consists of all standard transport vehicles used on roads (e.g. cars, trucks, buses, etc.)
  - off-road transport uses of petrol and diesel produced 6.1% of Nelson's total gross GHG emissions. This consists of all fuel used for the movement of machinery and vehicles off-roads (e.g. within agriculture, construction and industry).

- **Stationary Energy** (i.e. non-transport energy use) was the second largest GHG emission emitting sector, producing 14.3% of Nelson's total gross GHG emissions, with electricity consumed (including associated electricity transmission and distribution losses) contributing to 50% of the Stationary Energy sector's GHG emissions.

- **Waste** (gas emitted from landfill sites and wastewater treatment) produced 13.57% of the Nelson's total gross GHG emissions.

- **Agriculture** (e.g. from livestock and crops) was the fifth highest GHG emission emitting sector, producing 4.88% of Nelson's total gross GHG emissions, with enteric fermentation from livestock contributing the highest portion of the Agriculture sector's GHG emissions.

- **Industrial Processes and Product Use** (IPPU) sector (e.g. the use of industrial chemicals) produced 6.1% of Nelson's total gross GHG emissions

3. Comparison of GHG Emission Inventories Between FY 18/19 and FY 19/20

Between 18/19 and 19/20, total gross GHG emissions in Nelson decreased from 367,257 tCO_2e to 330,980 tCO_2e, (36,277 tCO_2e). The sector with the largest real decrease in GHG emissions was waste, decreasing by 23,644 tCO_2e between 18/19 and 19/20.

The sector with the largest increase in GHG emissions was Energy with the electricity consumed increasing from 17,959 to 21,258 (3,299.03 tCO_2e increase).

Table 31 shows the change in gross GHG emissions for each sector between years.

Sector	FY 18/19 GHG Emissions (tCO_2e)	FY 19/20 GHG Emissions (tCO_2e)	Change Between 18/19 and 19/20 (tCO_2e)	% Change Between 18/19 and 19/20
Transport	212,561	202,189	-10,372	-4.88%
Stationary Energy	43,725	47,473	+3,748	+8.57%
Agriculture	21,092	16,153	-4,938	-1.6%
Waste	68,567	44,923	-23,644	-34.5%
Industrial Processes and Product Use	21,313	20,242	-1,070	-0.3%
Total Gross GHG Emissions (excl. Forestry)	**367,257**	**330,980**	**-36,277**	**-9.9%**

Table 19 GHG emissions comparison by sector by FY

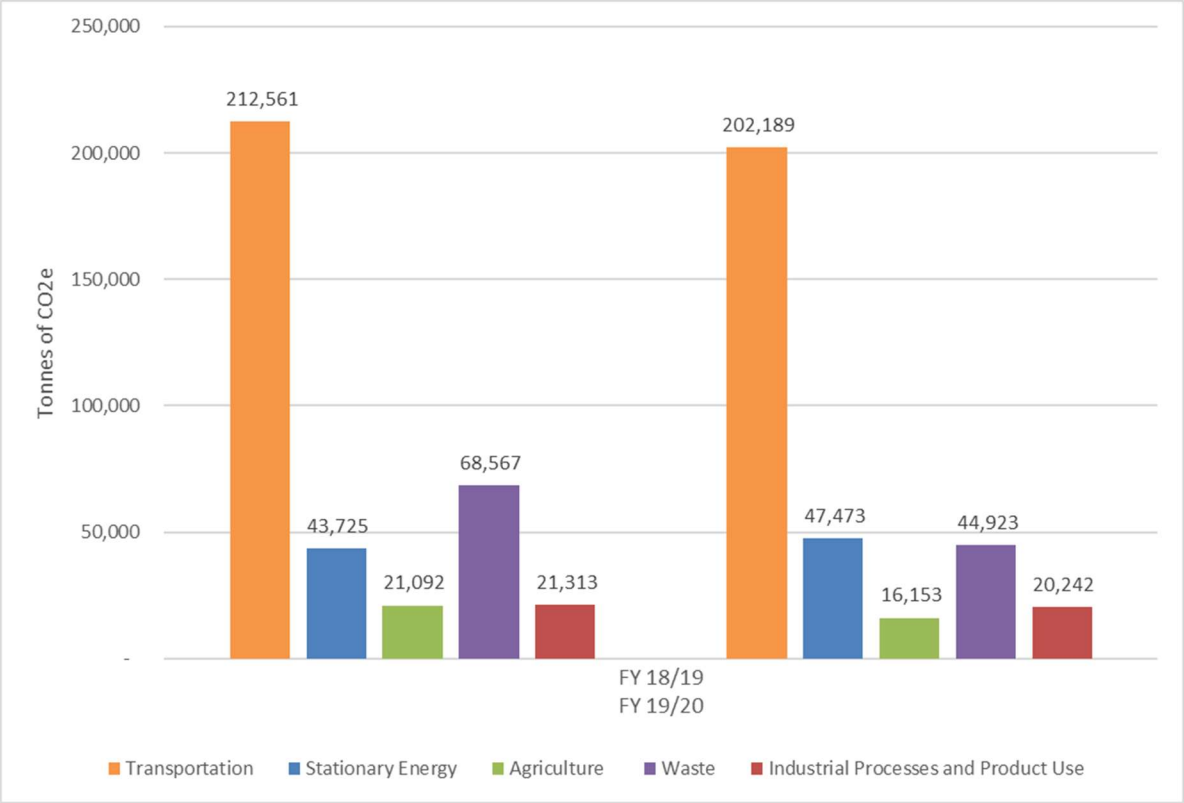

Figure 19: Comparison of Nelson region's GHG emissions by sector and Financial Year

GHG Emission Sector/Source		FY 18/19 GHG emissions (tCO_2e)	FY 19/20 GHG emissions (tCO_2e)	Change between 18/19 and 19/20 (tCO_2e)	% change between 18/19 and 19/20
Transport	Petrol (On-Road)	64,923	60,108	-4,814.89	-1.3%
	Diesel (On-Road)	93,610	94,999	1,389.00	0.4%
	Electric vehicles (On-Road)	0.08	0	0.06	0.0%
	Biodiesel (Vehicle Use)	0	0	0.01	0.0%
	Petrol (Off-Road)	759	702	-56.26	0.0%
	Diesel (Off-Road)	19,160	19,444	284.30	0.1%
	Marine Light Fuel Oil (Freight Cargo) - International	2,498	1668	830	0.2%
	Marine Light Fuel Oil (Freight Cargo) - Domestic	179	174	-4.96	0.0%
	Marine Diesel (Tourism Vessels and Local Ferries)	-	-	-0.08	0.0%
	Jet Kerosene (Commercial Flights)	21,118	14,778	-6,339.97	-1.6%
	Aviation Gas (Local Flights)	10,271	10,271	0.00	0.0%
	LPG (Road Mobile Uses)	43.72	23	-20.40	0.0%
Stationary Energy	Electricity Consumed	17,959	21,258	3,299.03	1.0%
	Electricity Transmission and Distribution Losses	1,757	2,294	537.10	0.2%
	Diesel (Stationary Use)	10,821	10,982	160.56	0.1%
	Petrol (Stationary Use)	342	317	-25.36	0.0%
	LPG (Stationary Use)	12,841	12,618	-223.34	0.1%
	Biodiesel (Stationary Use)	0	0	0.00	0.0%
	Coal	4	4	0.01	0.0%
Agriculture	Livestock	18,969	14,028	-4,941.00	-1.6%
	Agricultural soil	2,121	2,124	3.00	0.0%
Waste	Open Landfill Sites	63,565	39,756	-23,809	-6.5%
	Wastewater Treatment	5,001	5,167	-8.72	0.1%
Industrial Processes and Product Use	Industrial Processes and Product Use	21,313	20,242	-1,070.46	-0.3%
Total Gross GHG Emissions		**367,257**	**330,980**	**-36,277**	**-9.88%**

Table 20 GHG breakdown emissions comparison by sector by FY

4. Assumptions and Exclusions

This Report was prepared between January 2021 and 2022 and is based on the information retrieved during that time.

General assumptions

- Local Government NZ (LGNZ) local council mapping boundaries have been applied.
- GHG emissions are expressed on a carbon dioxide-equivalent basis (CO_2e)
- Total GHG emissions are reported as gross GHG emissions (excluding Forestry) and net GHG emissions (including Forestry).
- The colour scheme used for each sector follows the recommended GPC reporting framework
- Where location specific data was not accessible, information was calculated via a per capita break-down of national or regional level data.
- When data is shown as “zero” is because the total amount of footprint is a decimal or centesimal figure and was too low to be rounded to a entire number.
- When data is shown with a dash “- “is because the information was not available

Exclusions

- Exclude embodied GHG emissions