Greenhouse Gas Inventory Report

2022/2023

This report has been produced in accordance with ISO 14064-1:2018 and the Greenhouse Gas Protocol.

Emissions are discussed in Scopes, for consistency with other reports.

Version	Author	Date	Description
V 1.0	Shane Gogo	30/01/2024	Reviewed by George Gray, Lumen
V 2.0	Shane Gogo	13/3/2024	2nd review by George Gray
FINAL	Shane Gogo	14/3/2024	Approved by J Scherzer
FINAL corr	Shane Gogo	27/3/2024	Corrected water emissions figure; approved by J Scherzer

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SUMMARY

Hutt City Council (HCC) has in place its Carbon Reduction and Climate Resilience Plan 2021-31, with an organisational target to reduce emissions to net zero by 2050. This report on the greenhouse gas inventory 2022/23 assesses HCC's performance against this plan. Hutt City Council's total carbon footprint for 2022/23 has been estimated at 67,702 tCO_{2-e}.

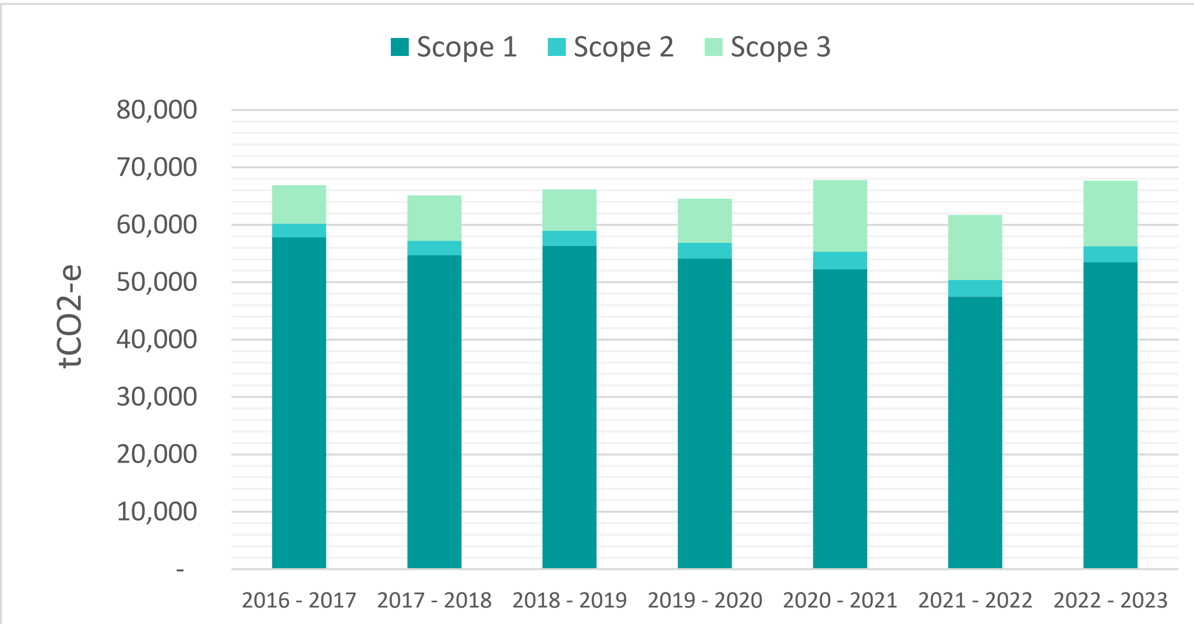
Overall emissions have increased compared to the previous year (refer Figure 1).

Increases in emissions have been recorded for Silverstream landfill (associated with an increase in the amount of waste received due to development activity in the city), the closed Silverstream Stage 1 landfill (insufficient gas extraction and destruction), and to a much lesser extent for corporate flights, and employee commuting post the Covid-19 pandemic.

There has also been a significant increase in emissions associated with contracts, which includes Naenae Pool as a major building and construction project. However, note that the majority of emissions associated with contracted services is still estimated by applying industry-wide emission factors to the amount of money spent in various categories. Hence, there is significant uncertainty associated with those estimates.

Reductions in emissions have occurred in the use of electricity to heat and power our facilities, and in Council's transport fleet, with the vehicle fleet now over 50% electric.

Figure 1: Hutt City Council's annual emissions

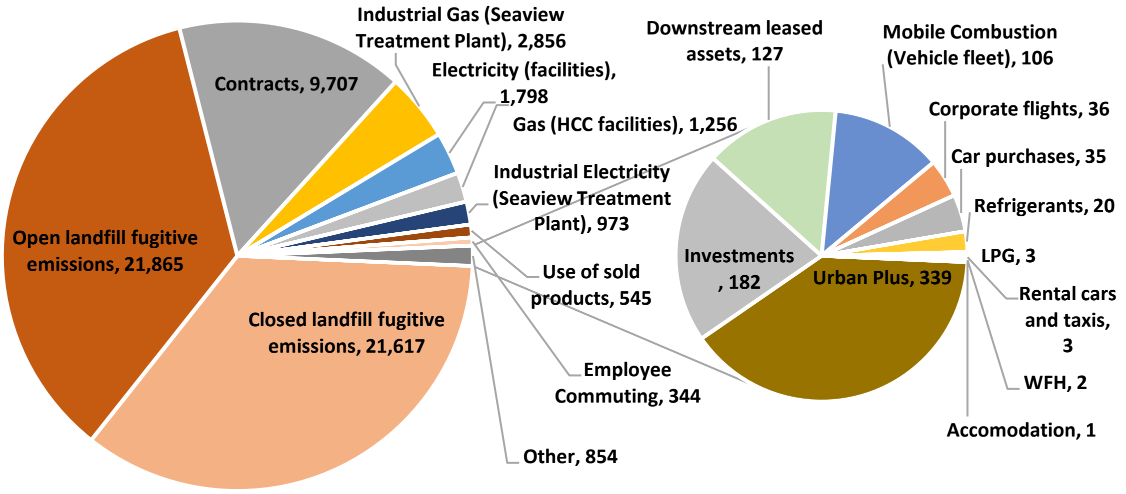


Note that emissions associated with IT networking and data services have been excluded from the reported total emissions, as there is uncertainty in the emissions reported by Microsoft. However, this emissions source is addressed in the body of the report. This approach also applies to LULUCF, as the focus of the report is on gross emissions, and because any credits arising from forests registered under the NZ Emissions Trading Scheme are scheduled to be sold, with revenue to be used to facilitate emission reductions.

Lastly, industrial and invoiced emissions for Wellington Water are based on the 2022 financial year report as the council-controlled organization was not able to provide updated data. The results are only used as a means for estimating the entity's emissions.

The following figure shows a detailed breakdown of emissions for 2022/23.

Figure 2: Hutt City Council emissions profile for 2022/23



Hutt City Council's largest emission sources are the open Silverstream landfill (Stage 2), and the closed Wainuiomata landfill and Silverstream landfill Stage 1/1A. Emissions from contracted services is the next biggest emission source, followed by a range of smaller sources.

1. INTRODUCTION

1.1 ORGANISATIONAL BOUNDARIES

The consolidation approach is applied to define carbon emissions for operational boundaries.

The following methods are widely used in organizational carbon footprint reporting: the control approach (either financial or operational control), and the equity share approach.

There are advantages and disadvantages to each approach, and a useful summary is available in the Global Greenhouse Gas Protocol Accounting and Reporting Standard for the Financial industry via the Greenhous Gas Protocol website.

For this greenhouse gas inventory, an equity share consolidation approach is used, which means that Council Controlled Organisations (CCOs) are considered an equal component of the footprint, alongside the Council's own operations. This is in order to consider Hutt City Council's overall performance and considering that Hutt City Council either has complete or significant financial interest in its CCOs, which results in significant active influence.

Hutt City Council has three CCOs:

Seaview Marina and Urban Plus Limited are 100% owned by HCC; governance is conducted via the companies' respective boards of directors, with the boards accountable to Hutt City Council.

Wellington Water as a whole is 20% owned by Hutt City Council. Each shareholding council is represented on the Wellington Water Committee by one representative, Wellington Water additionally has a board of independent directors. Hutt City has varying stakes in particular assets that are managed by Wellington Water; for example, Hutt City Council has 100% legal ownership of the Seaview Wastewater Treatment Plant, with varying degrees of annual funding responsibilty (averaging at 70% split between Hutt City Council and Upper Hutt City Council).

Hutt City has complete ownership and operational control of the Silverstream landfill, which receives waste from Lower Hutt and other districts in the Greater Wellington region. This results in Hutt City Council having a disproprtionately large carbon footprint compared to other organisations within the city, as waste itself is estimated at 7% of Lower Hutt City's emissions. Hutt City Council also owns, or has management responsibility, for various closed landfills in Lower Hutt, including a closed municipal landfill in Wainuiomata.

1.2 REPORTING BOUNDARIES

Scope 1, 2, and 3 are included. Specific categories are reported as below:

Scope and categories	Subcategories	Included
Scope 1 - Direct emissions and removals		
Stationary combustion	Fossil gas used in facilities (HCC)	YES
	Direct flaring form landfills	YES
	Marina Seaview LPG use	YES
	Diesel used in generators	NO
	Biomass fuel	NO (no biomass is used)
Mobile combustion	Fuel used in owned vehicles	YES
Direct process emissions and removals from industrial processes.	Seaview Wastewater treatment Plant	YES
Direct fugitive emissions	Refrigerants (HFC)	YES
	Open landfill fugitive emissions	YES
	Closed landfills fugitive emissions	YES

Scope 2 – Indirect emissions from imported energy		
Purchased energy	Electricity	YES
	Steam	NO (no steam is used)
	Heating & cooling	NO (no additional purchased heating and cooling)

Scope 3 - Indirect emissions		
Upstream scope 3 emissions		
Purchased goods and services	Contracts	YES
	Urban Plus	YES
	Water Supply network	YES
	IT networking and data storage	NO (due to data uncertainty)
Capital goods	Buildings owned, Seaview Marina	NO (excluded as these cannot currently be accurately assessed)
	Cars	YES
Fuel- and energy-related activities (not included in scope 1 or scope 2)	Boat activities within Marina area	YES
Upstream transportation and distribution	Three-water management and network	NO (no available data)
Waste generated in operations	Seaview Wastewater Treatment Plant	Captured in Scope 1, via open landfill fugitive emissions
	Demolition wastes	Captured in Scope 1, via open landfill fugitive emissions
	Corporate wastes	Captured in Scope 1, via open landfill fugitive emissions

Business travel	Corporate flights	YES
	Rental cars and Taxis	YES
Employee commuting	Staff travel to work	YES
Working from Home	Working from Home	YES
Upstream leased assets	Building owned and leased	NO (but accounted for under facilities)
Couriers	Couriers	YES

Downstream scope 3 emissions

Downstream transportation and distribution	Product transportation	NO (no distributed sold products)
	Three-water management and network	NO
Processing of sold products		NO (no processed sold products)
Use of sold products	Urban Plus houses	YES
End-of-life treatment of sold products	Urban Plus houses	NO (no products have reached end of life)
Downstream leased assets	Facilities	YES
Franchises		NO (HCC does not have franchises)
Investments	Public investments	YES

OTHERS

Land Use change		NO

1.3 EXCLUSIONS

Scope 3 emissions are not captured in their entirety. IT networking and data services (including cloud computing) are excluded as there is uncertainty in the emissions reported by Microsoft. However, this emissions source is addressed in the body of the report.

This approach also applies to LULUFC, as the focus of the report is on gross emissions, and because any credits arising from forests registered under the NZ Emissions Trading Scheme are scheduled to be sold, with revenue to be used to facilitate emission reductions.

The emissions associated with capital goods are excluded as they cannot currently be assessed with accuracy. Hutt City Council is required to maintain financial records for the prior seven years, and many of HCC's assets are older than seven years.

The method of deriving emissions associated with contracts also differs, depending on the size of contract:

a) For large contracts ($250,000 or more in spend per year), Hutt City Council requests that contractors provide information on their carbon footprints associated with delivering Council's services. Emissions data is usually limited to scope 1 and 2 emissions.

b) For smaller contracts, emissions are estimated via a spend based method (i.e. an industry/activity emission factor is multiplied with the amount of dollars spent).

1.4 BASE YEAR

The base year for assessing HCC's emission reduction performance is 2016-2017, this was the year first assessed by HCC (carried out by AECOM). There are several differences in methodology and exclusions between the initial assessment and the present assessment, so these reports cannot be directly compared (e.g. the initial report excluded fugitive emissions from closed landfills). However, where possible, emissions data has been back-calculated in order to enable a comparison between different years.

2. METHODOLOGY

Generally, emissions were calculated as per *Ministry for the Environment. 2023. Measuring Emissions: A Guide for Organisations: 2023 Detailed Guide. Wellington: Ministry for the Environment,* (hereafter referred to as 'the MFE guide'). Where the methodology differs, the differences are discussed in this methodology section.

While some emission factors used could be considered out of date, such as those retrieved from Motu publications that are based on spend, an inflationary factor has been applied to update these.

2.1 SCOPE 1 – DIRECT GREENHOUSE GAS EMISSIONS

2.1.1 Stationary combustion

Direct flaring from landfills

Refer to Appendix 1.

Seaview Marina

Calculated as per the MFE guide, using invoiced consumption. Seaview Marina consumes bottled LPG and standard diesel.

2.1.2 Industrial processes

Emissions associated with the Seaview Wastewater Treatment plant are calculated as an estimate in relation to current population growth figures, using the data from the last available footprint for 2021/22. Wellington Water (WW) were unable to provide actual data for this financial year. Note that WW's greenhouse gas inventory was produced with reference to Water NZ Guidelines 2021 and as per the MFE guide.

2.1.3 Direct fugitive emissions

Open landfill fugitive emissions

Refer to Appendix 1.

Closed landfill fugitive emissions.

Refer to Appendix 1.

2.2 SCOPE 2 – INDIRECT EMISSIONS FROM IMPORTED ENERGY

Emission factors from the MFE guide are used. Since MFE has only published factors up to July 2023 this most recent factor is used for all following months. Renewable Energy Certificates are not used by Hutt City Council.

2.3 SCOPE 3 – UPSTREAM INDIRECT EMISSIONS

2.3.1 Purchased goods and services

Contracts

Emissions data was requested from HCC's larger contractors (typically those where HCC's expenditure exceeds $250,000 per year), in line with HCC's expectations. In most cases, relevant contractors and suppliers only provided Scope 1 and Scope 2 emissions data, as some contractors do not yet collect such data, and most existing contracts do not yet require the collection of this data. Note that work is under way to ensure that emissions data is available from a wider range of HCC's suppliers, and that relevant contracts include objectives and actions to reduce emissions.

Where contractors and suppliers did not provide emissions data, emissions were estimated based on contract spend and emission factors provided by Motu (*"Consumption-based greenhouse gas emissions input-output model", 2014, obtained by Motu Economic and Public Policy Research from Statistics New Zealand, MBIE and MFE in 2013. Unrestricted dataset available online from www.motu.org.nz)*. While this is not a precise method, it acts as a suitable proxy. These factors have been adjusted based on MBIE inflation figures. Only the net figures are reported.

Urban Plus

Urban Plus Limited provided information on expenses associated with construction and demolition, equipment, operational expense, and cleaning. Emissions have been estimated by using Motu factors and are included here.

Wellington Water

Wellington Water (WW) completed an operational footprint for the financial year 2021/22 and did not include emissions associated with purchased goods and services. They have not updated footprint data since, thus, the emission figures for 22/23 have been adjusted based on population growth, in order to derive an estimate for 2022/23.

In 2021 Wellington Water provided an inventory of maintenance related expenses, emissions associated with these are included and assumed to be the same as the previous year.

IT networking and data storage

HCC uses Microsoft (MS) Azure for cloud-based information sharing and storage. While Microsoft Azure reports all scopes of emissions associated with this usage, there is some uncertainty with the data collected. The offshore MS storage facility in Australia manages storage for all businesses and organisations in the Oceania region, and there is uncertainty around whether the emissions data is representative of HCC's emissions or emissions for the Oceania region. As a result, emissions associated with IT networking and data storage have been excluded from total reported emissions, until the accuracy of Microsoft Azure's scope of emissions data can be confirmed.

2.3.2 Capital Goods

Cars (vehicle purchases)

Upstream emissions associated with the purchase of vehicles have been estimated based on Motu factors and amortised across the duration of vehicle ownership.

2.3.3 Business travel

Corporate flights

HCC uses Orbit Travel as a travel agent. As part of this service, they produce a report based on distance travelled, in kilometres, associated with air travel. This information is submitted to CarbonEES, who organise and present the data on their software platform eBench. Emissions are calculated using the appropriate emission factors from the MFE guide 2023.

2.3.4 Employee commuting

A staff survey was completed in December 2023, and the associated emissions of each respondent was calculated as per the MFE guide. These emissions were averaged and extrapolated to account for every council staff member.

2.3.5 Employees working from home

A staff survey was completed in December 2023, and the associated emissions of each respondent was calculated as per the MFE guide. These emissions were averaged and extrapolated to account for every council staff member.

2.3.6 Couriers

Emissions associated with couriers were estimated based on contract spend and emission factors provided by Motu (in "*Consumption-based greenhouse gas emissions input-output model". 2014. Obtained by Motu Economic and Public Policy Research from Statistics New Zealand, MBIE and MFE in 2013. Unrestricted dataset available online from www.motu.org.nz).* The specific factor used was "Postal and courier pickup and delivery services". While this is not a precise method, it acts as a suitable proxy. These factors have been adjusted based on MBIE inflation data.

2.4 SCOPE 3 – DOWNSTREAM INDIRECT EMISSIONS

2.4.1 Downstream transportation and distribution

The only significant downstream transportation and distribution that Hutt City Council carries out is associated with the Three Waters. These emissions are therefore captured elsewhere (Scope 2, Scope 3 – purchased goods and service, and Scope 3 – capital goods).

Houses sold by Urban Plus are built on site and not transported.

2.4.2 Use of sold products

Emissions associated with houses sold by Urban Plus have been estimated based on the cumulative number of houses sold by UPL and StatsNZ data on regional household emissions.

2.4.3 Downstream leased assets

The majority of HCC's leased assets are captured within Scope 1 and 2. Although HCC is invoiced for the energy consumption at these sites, it passes this on to the lessee to settle. Council leases property under operating leases. A majority of these leases have a non-cancellable term of 36 months, with the exception of housing leases that have a non-cancellable term of 22 working days.

For the remaining sites, especially tenanted houses, the emissions are estimated based on the average Wellington household emissions from StatsNZ, as well as StatsNZ data on the average number of occupants in a household.

2.4.4 Public investments

The emissions associated with HCC's public investments are calculated by using the Motu derived emission factor for the *Banking and financing; financial asset investing* industry.

2.5 LAND USE, LAND USE CHANGE, FORESTRY

Regarding the land use, land use change, forestry category (LULUCF), Council owns forest land in Lower Hutt, some of which results in net carbon sequestration (eg post-1989 native forests). Some of the forests have been registered under the NZ Emissions Trading Scheme and earn carbon credits, most of which are intended to be used to facilitate emissions reductions (through the sale of carbon credits, and the use of proceeds for implementing carbon emission reductions or facilitating additional carbon sequestration through planting). Therefore, for the purposes of this carbon footprint report, LULUCF has been excluded, to avoid double counting.

3. RESULTS

3.1 2022/2023 EMISSIONS

Scope and categories	Subcategories	Included
Scope 1 - Direct GHG emissions and removals		
Stationary combustion	Fossil gas (HCC facilities)	1256
	Direct flaring from landfills	Included with fugitive emissions to avoid double counting
	Marina Seaview LPG use	3
	Fossil gas (industrial – Seaview Wastewater Treatment Plant)	2,856
	Diesel used in generators	-
	Biomass fuel	-
Mobile combustion	Fuel used in owned vehicles	106
Industrial Processes - Direct process emissions and removals from industrial processes.	Seaview Wastewater Treatment Plant	5,748
Direct fugitive emissions	Refrigerants (HFC)	20
	Open landfill fugitive emissions	21,865
	Closed landfills fugitive emissions	21,617
Scope 2 - Indirect emissions from imported energy		
Purchased energy	Electricity (HCC facilities)	1,798
	Electricity (industrial – Seaview Wastewater Treatment Plan)	973
	Steam	No steam is used
	Heating & cooling	No additional purchased heating and cooling
Scope 3 - Indirect emissions		
Upstream scope 3 emissions		
Purchased goods and services	Contracts	9,707
	Urban Plus	339
	Water Supply network	109
	IT networking and data storage	27 (but excluded from total report emissions due to some data uncertainty)
Capital goods	Buildings owned	Excluded as these cannot be accurately assessed
	Seaview Marina	
	Cars (vehicle purchases)	35
Fuel- and energy-related activities (not included in scope 1 or scope 2)	Boat activities within Marina area	Included in use of sold products
Upstream transportation and distribution	Three-water management and network	Captured in other categories
Waste generated in operations	Seaview Wastewater Treatment Plant	Captured in Scope 1, via open landfill fugitive emissions

	Demolition wastes	Captured in Scope 1, via open landfill fugitive emissions
	Corporate wastes	Noted, however captured in Scope 1, via open landfill fugitive emissions
Business travel	Corporate flights	36
	Rental cars and Taxis	3
Employee commuting	Staff travel to work	344
Working from Home		2
Upstream leased assets	Building owned and leased	-
Couriers	Couriers	29

Downstream scope 3 emissions

Downstream transportation and distribution	Product transportation	No distributed sold products
	Three-water management and network	Captured elsewhere
Processing of sold products	Not relevant	-
Use of sold products	Urban Plus houses	545
End-of-life treatment of sold products	Urban Plus houses	-
Downstream leased assets	Facilities	127
Franchises	Not relevant	-
Investments	Public investments	182

OTHERS

Land Use change	Land use change	excluded

3.2 SCOPE 1 – DIRECT GREENHOUSE GAS EMISSIONS

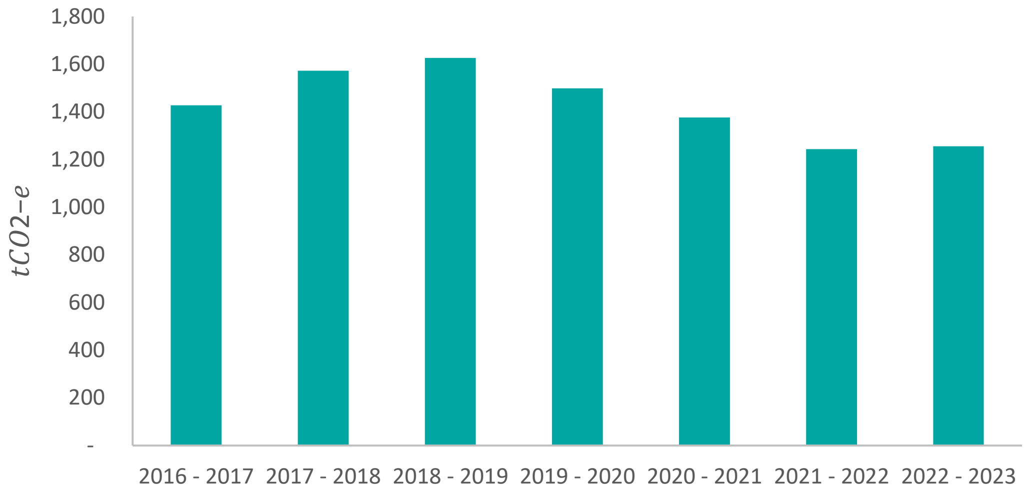
3.2.1 Stationary combustion

Fossil gas used in facilities

Emissions from fossil gas consumption have been steadily reducing since the 2019 calendar year, initially due to the closure of Naenae pool, and then due to the decarbonisation programme to phase out gas and improve energy efficiency (e.g. replacement of a gas boiler with a heat pump at the Eastbourne Summer Pool).

Hutt City Council is committed to removing fossil gas from all facilities by 2030, which consequentially means that HCC is not expected to directly consume any fossil fuels from the next decade outside of emergency situations (during a civil defence emergency Hutt City Council may operate diesel generators to support the emergency response).

Figure 3: Fossil gas consumption, for HCC facilities



Direct flaring from landfills

Direct flared emissions are those associated with the engines of the power plant (and a supplementary flare) at Silverstream landfill, which destroys methane, producing carbon dioxide and electricity. These are noted separately as some landfill emissions are fugitive, whilst these are direct emissions.

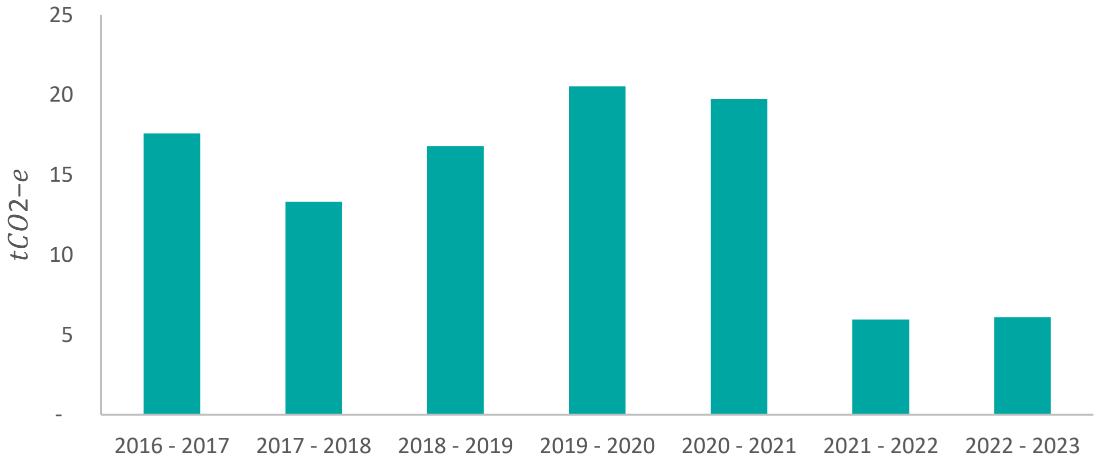
In all totals and time series these emissions are included with 'open landfill emissions', due to this breakdown only being available for one year (please refer to Appendix 1 for more detail on landfill emissions.

	Silverstream fugitive emissions separated by pathway (tCO2e)			
	Stage 1 & 1a		Stage 2	
Financial year	**Through cap**	**From engines**	**Through cap**	**From engines**
2021/22	1,472	1,856	7,833	9,923
2022/23	**5,384**	**1,461**	**10,744**	**11,122**

Seaview Marina

Seaview Marina uses LPG to heat its showers and ablution blocks.

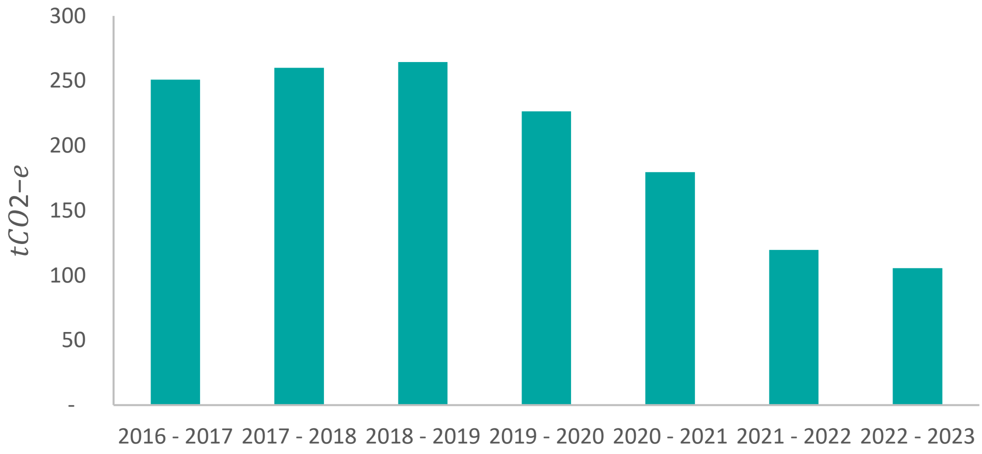
Figure 4: LPG emissions, Seaview Marina



3.2.2 Mobile combustion

Emissions from transport fuels (the operation of Council's vehicle fleet) continue to reduce, in line with Council's electrification of its fleet. By the end of the 2022/2023 financial year, about 50% of Council's vehicle fleet was electric.

Figure 5: Mobile combustion, HCC transport fuel use



3.2.3 Industrial processes

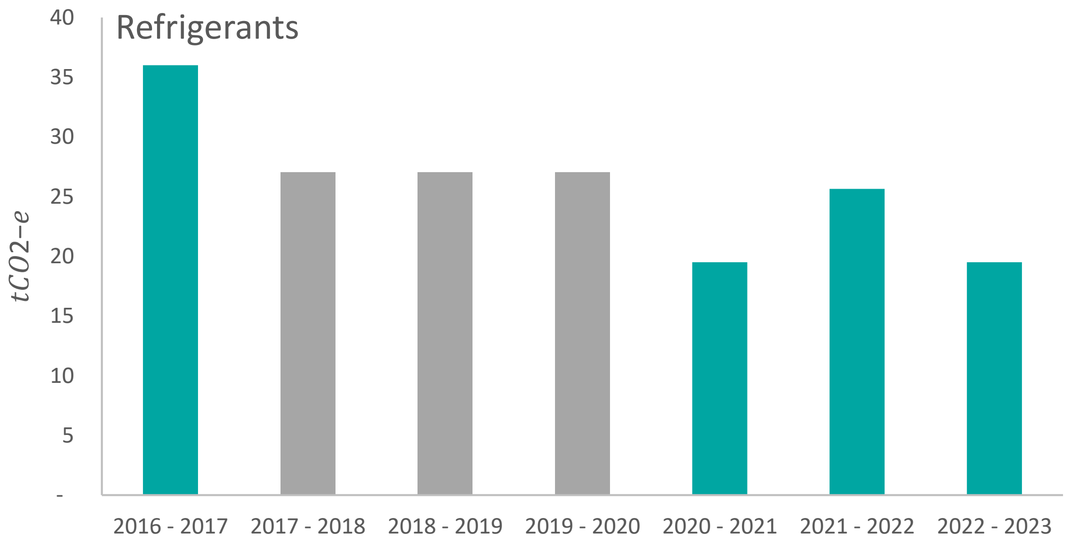
Scope 1 emissions associated with Seaview Wastewater Treatment plant, other than stationary combustion, are included here and estimated to be 5,748 tCO_{2-e}. Due to inconsistent monitoring and reporting from Wellington Water, the estimated tonnage of carbon emissions was derived by factoring current population growth onto actual reported figures supplied in the 2020-2021 financial year report.

3.2.4 Direct fugitive emissions

Refrigerants

Emissions associated with refrigerant use is calculated to have decreased compared to the previous year. There was a reported leakage of the 134a refrigerant in a plant room at the HCC main administration building. The refrigerant itself has a high emission factor because of its global warming potential (GWP 1300), but in terms of emissions, it is significantly less compared to the previous financial year's results. Note that 2017/18 – 2019/20, highlighted in grey, are averages of those years for which we have data.

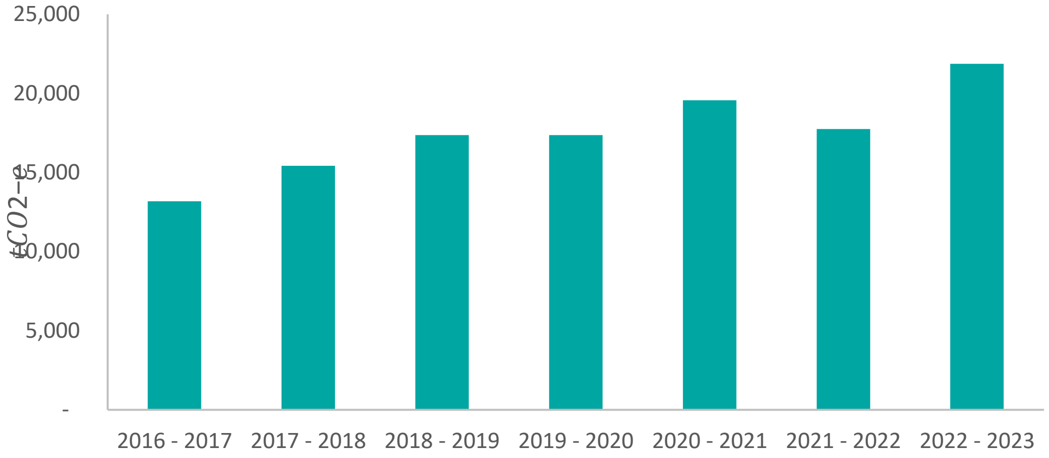
Figure 6: Refrigerant emissions



Open landfill emissions

The emissions associated with Silverstream landfill (Stage 2) have increased, due to the increase in the amount of waste disposed. Please refer to Appendix 1 for more detail.

Figure 7: Open landfill fugitive emissions



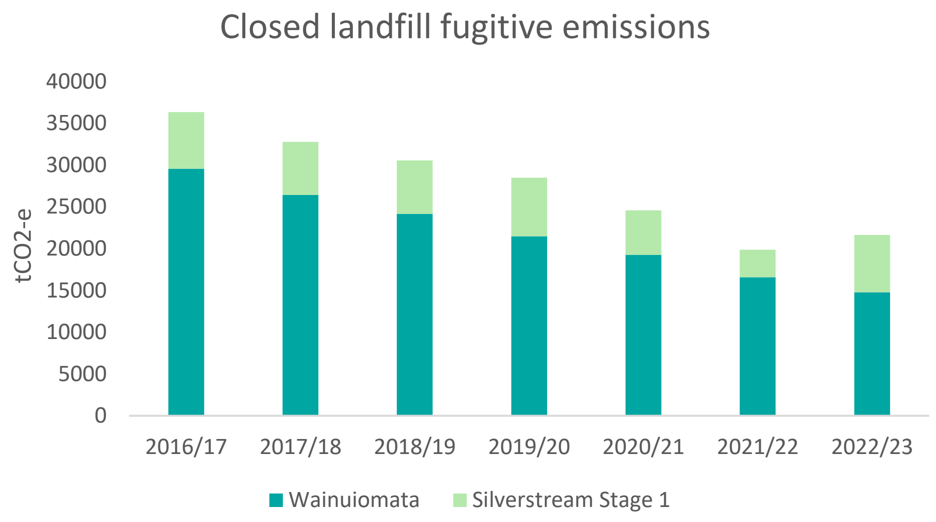
Closed landfill fugitive emissions

Emissions from the closed Silverstream landfill (Stage 1) increased due to technology limitations, i.e. there was insufficient gas extraction and destruction capacity, despite the power plant and flare operating as expected. Note that LMS is planning to install a new engine, and new wells may be considered for Stage 1, which is expected to mitigate this issue in the future (as emissions from both Stage 1 and Stage 2 are combusted in the on-site power plant).

Please refer to Appendix 1 for more detail.

Financial year	Fugitive emissions estimate in t CO_2e (emissions destroyed by combustion in brackets)		
	Silverstream		Wainuiomata
	Stage 1 & 1a	Stage 2	
2016/17	6,814 (24,713)	13,182 (42,583)	29,545 (0)
2017/18	6,375 (23,137)	15,416 (53,106)	26,412 (0)
2018/19	6,375 (23,137)	17,362 (58,805)	24,173 (0)
2019/20	6,995 (25,390)	17,356 (67,228)	21,487 (0)
2020/21	5,350 (19,416)	19,559 (58,766)	19,249 (0)
2021/22	3,328 (20,231)	17,757 (87,024)	16,563 (0)
2022/23	6,845 (14,611)	21,865 (100,095)	14,772 (0)

Figure 8: Closed landfill fugitive emissions

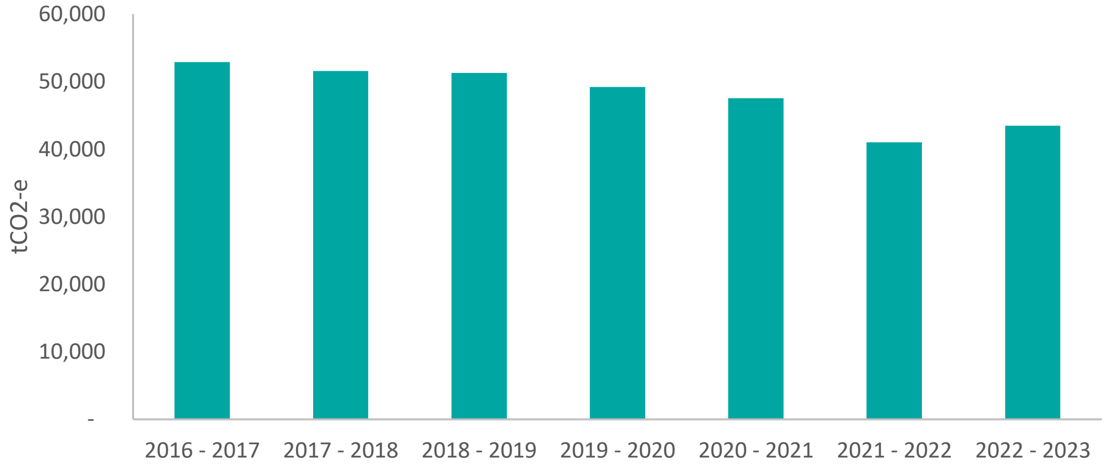


3.2.5 Biogenic emissions

As below, biogenic methane emissions increased compared to the previous year, but note that biogenic emissions are not additional to those noted elsewhere (e.g. section 3.2.4). Please refer to Appendix 1 for more detail on biogenic emissions.

There is significant work under way to continuously improve methane capture (e.g. new wells) and destruction (e.g. new engines) at Silverstream landfill.

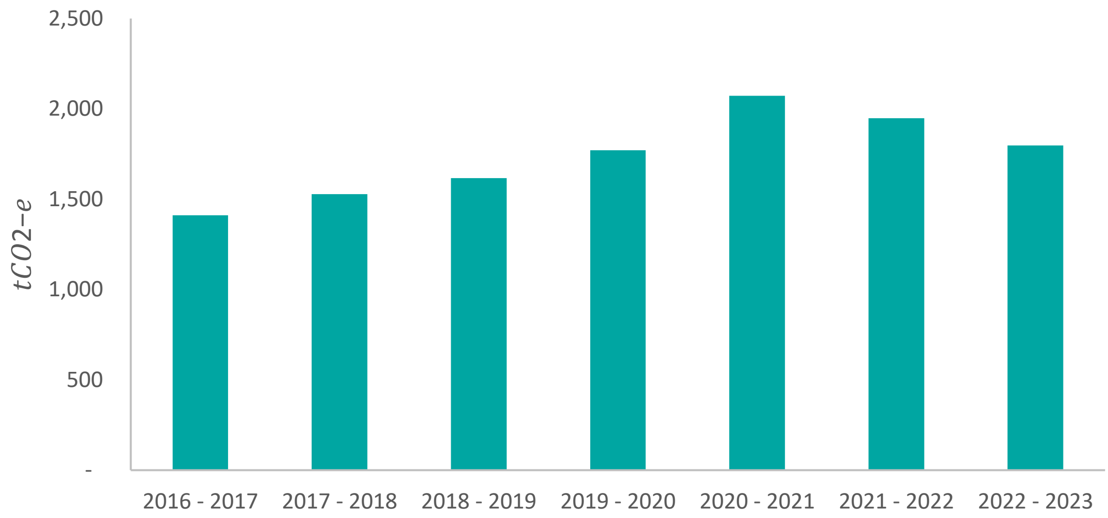
Figure 9: Total fugitive landfill emissions: biogenic



3.3 SCOPE 2 – INDIRECT EMISSIONS FROM IMPORTED ENERGY

The below figure shows emissions associated with invoiced electricity consumption.

Figure 10: Electricity use



Note that emissions associated with electricity consumption can fluctuate from year to year, depending on the carbon intensity of New Zealand's electricity generation.

Emissions for the previous years have been re-calculated, as updated emission factors have been released by the Ministry for the Environment.

Electricity consumption associated with Seaview Wastewater Treatment Plant cannot be compared to prior years and are estimated to be 973 tCO_{2-e} for the 2022/2023 year, based on previous year estimates.

3.4 SCOPE 3 – UPSTREAM INDIRECT EMISSIONS

3.4.1 Purchased goods and services

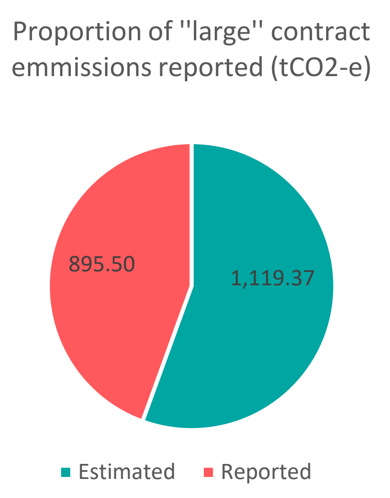
Contracts

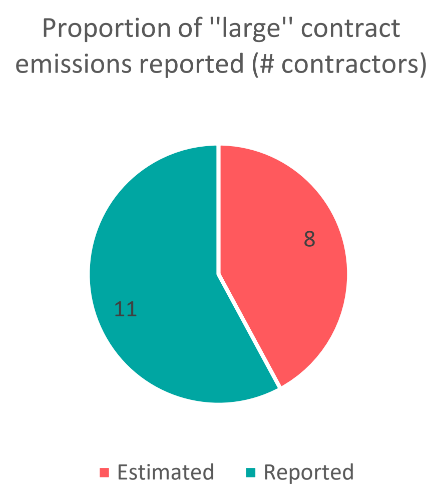
For most contracts and purchases services, emissions have been estimated based on spend and MOTU factors. However, for some larger contracts over $250,000 per year in spend (see Figure 11), it was possible to obtain actual emissions data, as reported by contractors and suppliers. One example is the emissions associated with kerbside rubbish and recycling collection, with Waste Management NZ as the supplier of that service. However, note that the data underlying this figure excludes contracts for certain services, such as gas, electricity, and Wellington Water, as these are addressed elsewhere.

This year, total emissions for this category have been estimated at 9,707 tCO_{2-e}. Within that, 2,015 tCO_{2-e} are associated with major contracts (see Figure 11).

Note also that, compared to the previous year, there has been a significant increase in emissions associated with contracts, which includes Naenae Pool as a major building and construction project.

Figure 11: Emissions associated with major operational contracts and services

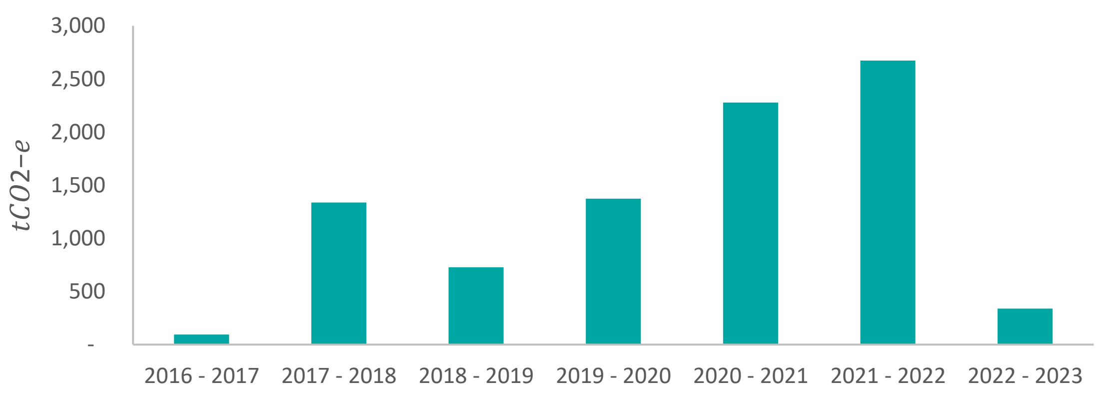




Urban Plus

These emissions are primarily derived from the construction activity that Urban Plus limited undertakes (via suppliers that undertake services and activities for Urban Plus). Due to only having financial figures that combines the demolition and construction costs, this is likely an overestimation of emissions. Urban Plus also accounts for the costs of a project upon completion, which accounts for some of the annual variation in these emissions. Work is being undertaken to reduce operational emissions of the properties (via Homestar), but it is not apparent if the embodied emissions will be reduced. Urban plus emissions remain low as existing housing projects reach completion stages.

Figure 12: Urban Plus emissions from purchased goods and services



3.4.2 IT networking and data storage

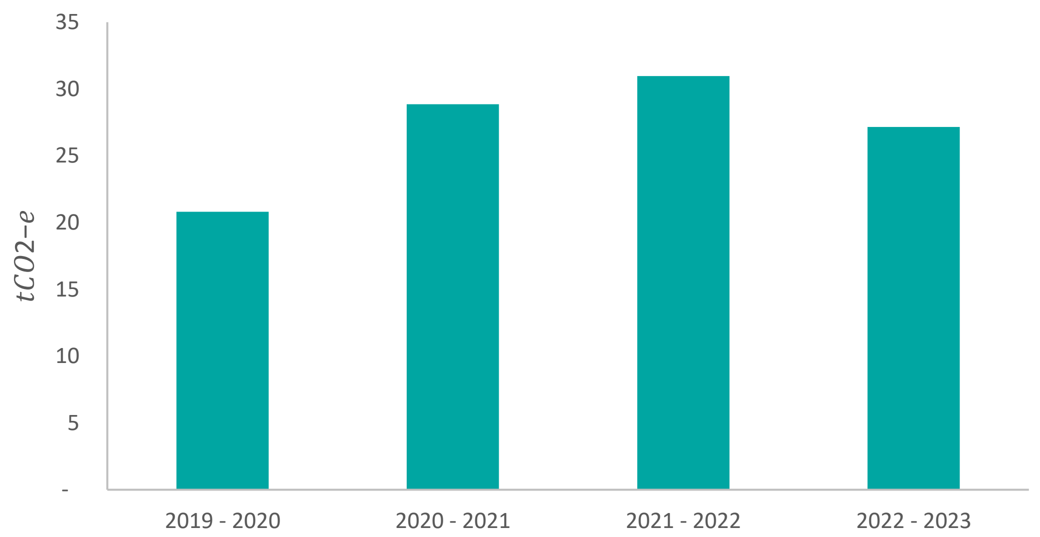
HCC uses Microsoft (MS) Azure for cloud-based information sharing and storage. Microsoft's ''Azure" emissions dashboard accounts for HCC's cloud usage. In 2020 HCC switched from on-premise storage (CM9/TRIM) to cloud storage (SharePoint/Te Pātaka), which utilises Microsoft's offshore servers in Australia. This resulted in data migration from the old system TRIM to SharePoint. Collection and transfer of new data onto SharePoint increased cloud storage capacity. Hence, only the last four years of data is shown here, as there is uncertainty around the emissions associated with IT networking and data storage prior to that point.

The movement, storage, and increased cloud capacity for data results in energy use and translates to increased emissions from storage systems, which is evident in the increase in emissions between 2019/20 and 2021/22.

In addition, the offshore MS storage facility in Australia manages storage for all businesses and organisations in the Oceania region, and there is uncertainty around whether the emissions data is representative of HCC's emissions or emissions for the Oceania region.

As a result of the limited data and uncertainty, emissions associated with IT networking and data storage have been excluded from HCC's total reported emissions.

Figure 13: IT network and storage emissions



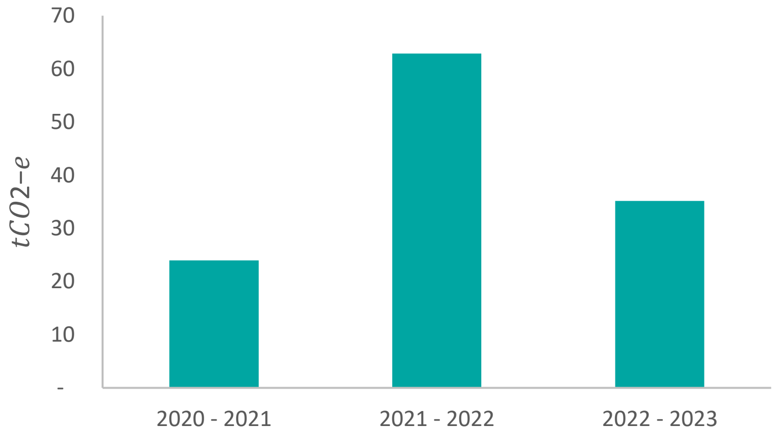
3.4.3 Capital goods

Cars (vehicle purchases)

The embodied emissions of purchased cars is estimated to reduce gradually, as HCC converts its fleet to electric.

Note that HCC's fleet has not grown but has reduced since 2019. Hence, emissions reported here are associated with vehicle purchases per financial year, to replace vehicles, in line with Council's vehicle fleet policy and replacement guidance.

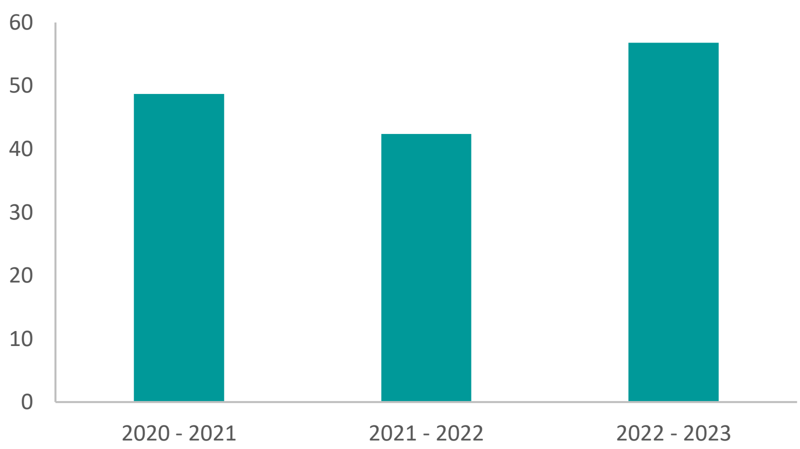
Figure 14: Embodied Emissions of Cars



3.4.4 Waste from facilities

Emissions associated with HCC's facility waste has increased moderately. This emission source is provided as an information item only, as emissions are captured under Scope 1 (Silverstream landfill fugitive emissions).

Figure 15: Facility waste

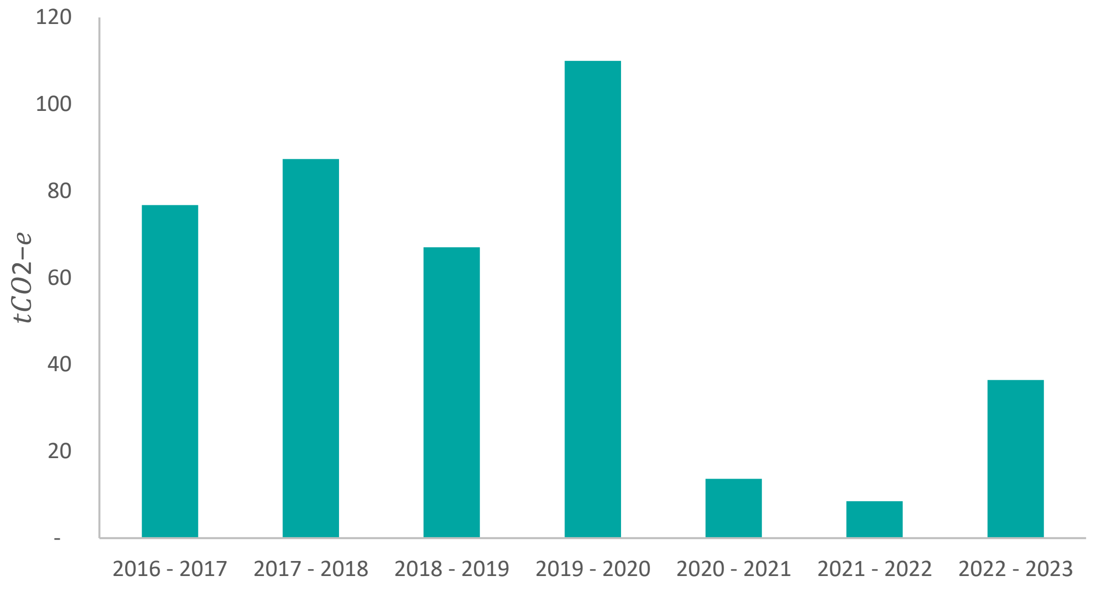


3.4.5 Business travel

Corporate flights

Since the end of the COVID-19 pandemic, emissions from corporate flights have again increased. While there has been an increase in these emissions for 2022/23 and physical attendance at conferences may increase again, it does not appear likely that emissions will return to pre-pandemic levels, due to the general acceptance of online and remote working technologies (e.g. MS Teams).

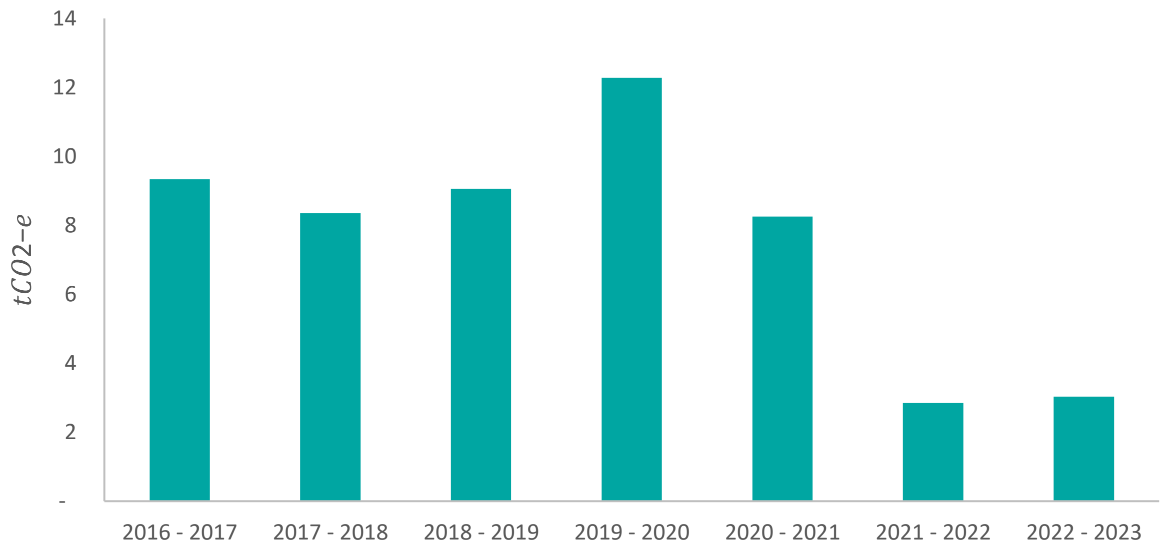
Figure 16: Corporate flight emissions



Rental cars and taxis

Emissions associated with rental car and taxi use has remained low.

Figure 17: Rental car and taxi emissions



3.4.6 Employee commuting

The emissions associated with HCC's employees commuting are estimated to be 344 tCO_{2-e}, for this inventory a staff survey was produced specifically for commute emissions calculations (total tonnage is extrapolated, based on the survey results).[1]

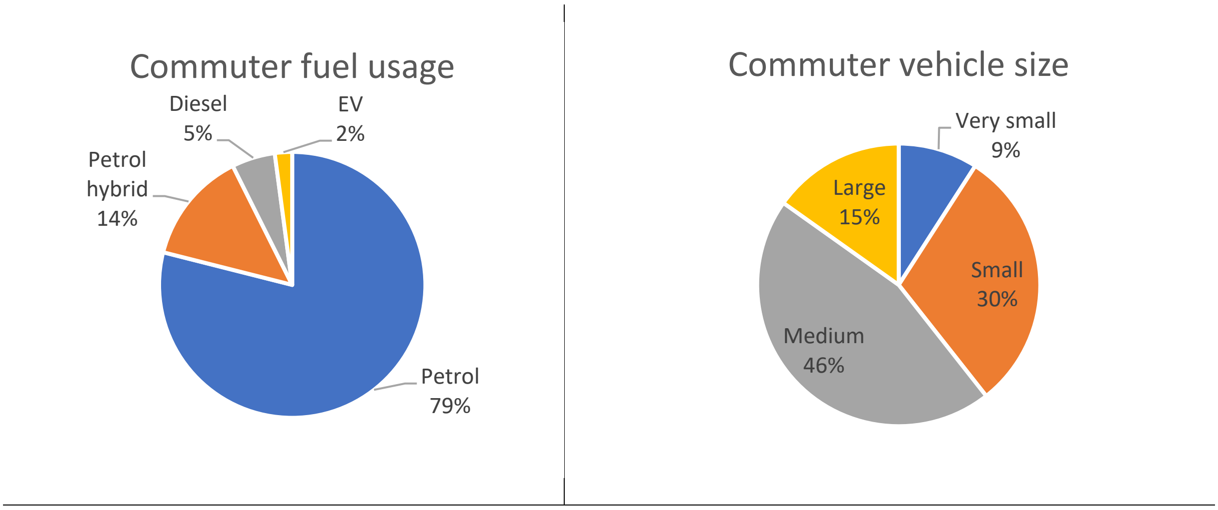
Notable insights include:

- 5% respondents use public transport at least once per week.
- 20% of reported commutes are on public transport.
- 4% reported commutes are through active transport.
- 9% respondents have a multimodal commute.
- 62% of respondents drive a personal car to work daily.

Most of HCC staff seem to commute from within the Hutt Valley, with a mean commute distance of 26.7 km.

With regard to staff using motor vehicles to travel to and from work, the majority of vehicles are petrol and diesel vehicles. The use of EVs is still low.

Figure 18: Vehicle technologies, and vehicle size



3.4.7 Employees working from home

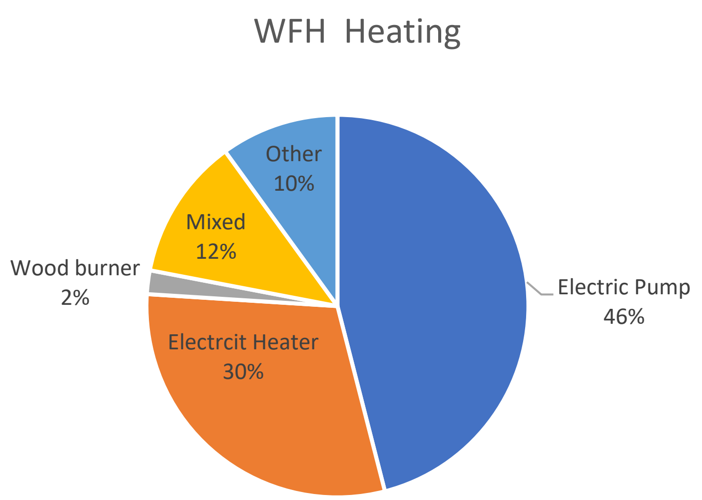
Emissions associated with staff working from home have been estimated at 2.12 TtCO_{2-e}, which is significantly less than the emissions associated with commuting (345 tCO_{2-e}). Emissions are primarily associated with space heating. According to survey data, 62% of staff working from home typically use electric heat pumps and electric heaters, and emissions could

[1] The number of respondents differed (was higher than) last year's survey results. While results are extrapolated so that we derive emissions totals across all staff, results are not fully comparable and are an estimate only for this emission category.

be reduced by staff switching away from gas to alternative technologies for heating, such as heat pumps.

Based on these findings, there appear to be emissions benefits associated with working from home and hybrid/flexible working arrangements, including by reducing transport emissions through reduced commuting. However, those benefits also need to be viewed in light of other benefits associated with staff working in the office (e.g. relationship building, face to face interactions).

Figure 19: Heating technologies used by staff at home



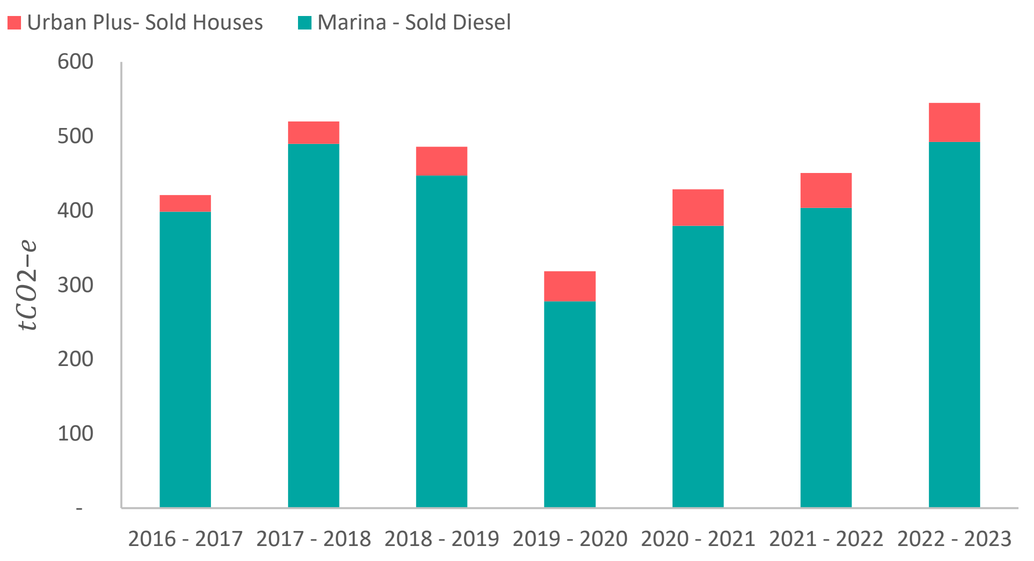
3.5 SCOPE 3 – DOWNSTREAM INDIRECT EMISSIONS

3.5.1 Use of sold products

Hutt City Council only has two sold products, including diesel from the Marina to boat users, and UPL selling houses. The latter are a small emission source through the occupant's usage of energy for heating and cooking.

Emissions associated with sold houses could be lower than is estimated here. This is because UPL builds homes to Homestar 6 as a minimum, and no longer installs fossil gas for any home and water heating, and cooking. Average TOITU figures do not reflect actual occupant emissions per household. The amount of diesel sold to boat users is subject to demand. The emergence of electrified boat options is yet to have an impact as traditional fuelled boats remain popular. Emissions associated with sold diesel may reduce through the adoption of electric boats in the medium to long term, which the Seaview Marina may choose to incentivise/promote in the future.

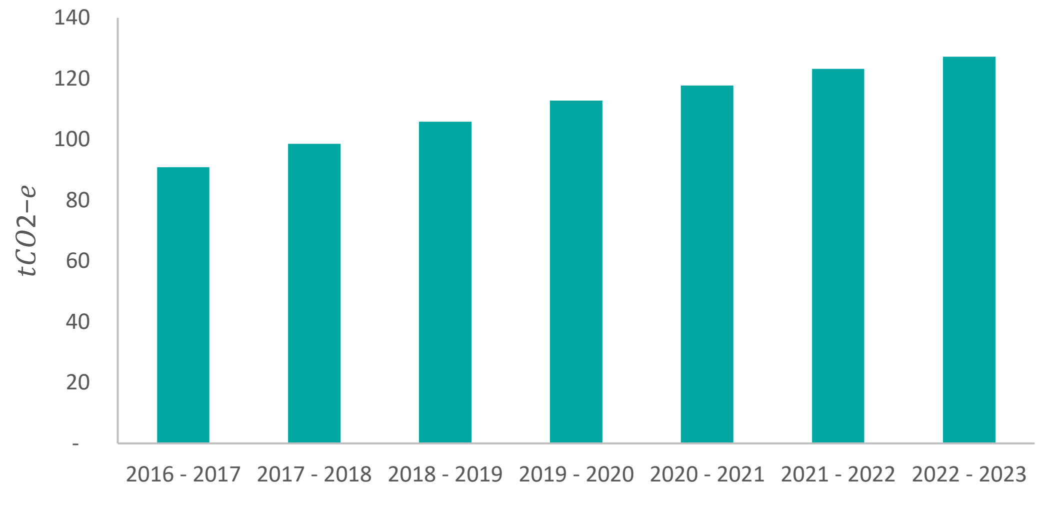
Figure 20: Indirect Emissions - sold houses & sold diesel



3.5.2 Downstream leased assets

These emissions are related to occupants living in houses owned by Urban Plus, these are estimated to have increased due to the increasing number of rentals owned by UPL.

Figure 21: Downstream leased assets



3.5.3 Public investments

Hutt City Council does not currently have a green investment policy, in contrast Auckland, Dunedin, Palmerston North, Waikato Regional, and Christchurch City Councils have already adopted binding policies to divest from fossil fuels.

3.6 LAND USE, LAND USE CHANGE, FORESTRY

Council owns forest land in Lower Hutt, some of which results in net carbon sequestration (e.g. post-1989 native forests). While some of the forests have been registered under the NZ Emissions Trading Scheme, the resulting carbon credits are intended to be used to facilitate emissions reductions (through the sale of carbon credits, and the use of proceeds for implementing carbon emission reductions and facilitating additional sequestration through planting). Therefore, for the purposes of this carbon footprint report, land use, land use change and forestry has been excluded, to avoid double counting.

3.1 COUNCIL CONTROLLED ORGANISATION EMISSIONS

Note that the following sections and associated emissions are represented within their appropriate category above and provided as an information item only.

3.1.1 Wellington Water

Wellington Water (WW) where not able to provide an updated emission report for this financial year. Although WW is a council-controlled organization, it is 100% responsible to account for its operational emissions. HCC continues to work with WW to have updated data for the purpose of future reports.

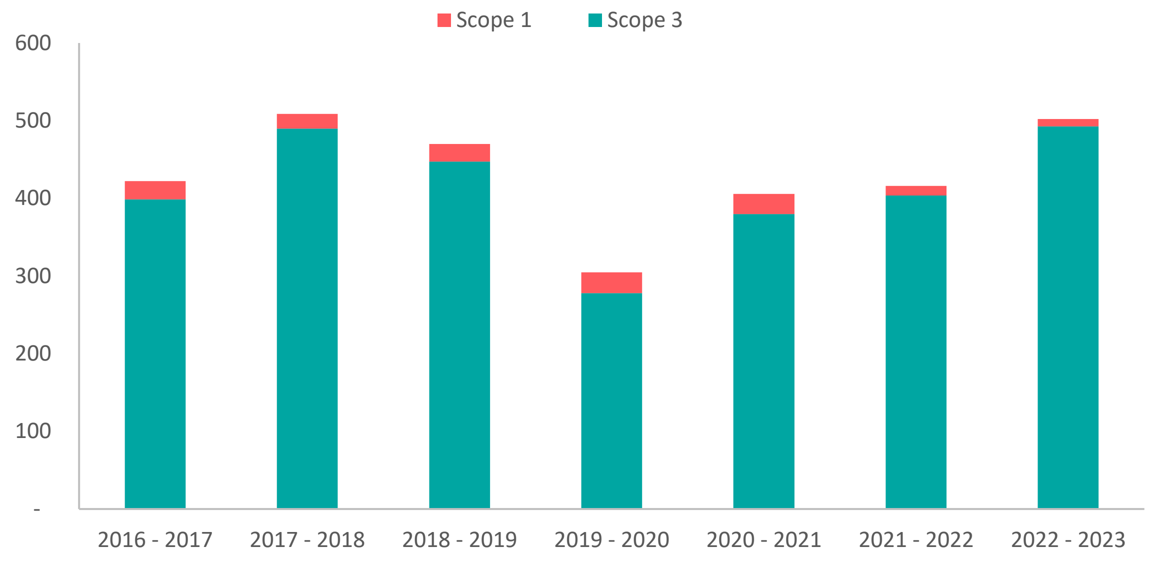
WW's emissions have last been provided for the 2020/21 financial year, estimated at 3,534 tonnes, and there have been no significant changes in technology or fuel sources used since. However, Lower Hutt's population has grown, so their footprint from 2020/21 financial year may underestimate emissions for 2022/23.

3.1.1 Seaview Marina

The majority of Seaview Marina's carbon footprint is associated with diesel sold to marina customers (Scope 3). Scope 1 for the marina includes diesel used for the ute and travel lift, and LPG bottles for the showers.

Note that the Seaview Marina's Scope 2 emissions (electricity) are invoiced directly to Hutt City Council and included in Hutt City Council's Scope 2 emissions (refer section 2.2) and are therefore not included below.

Figure 22: Seaview Marina emissions

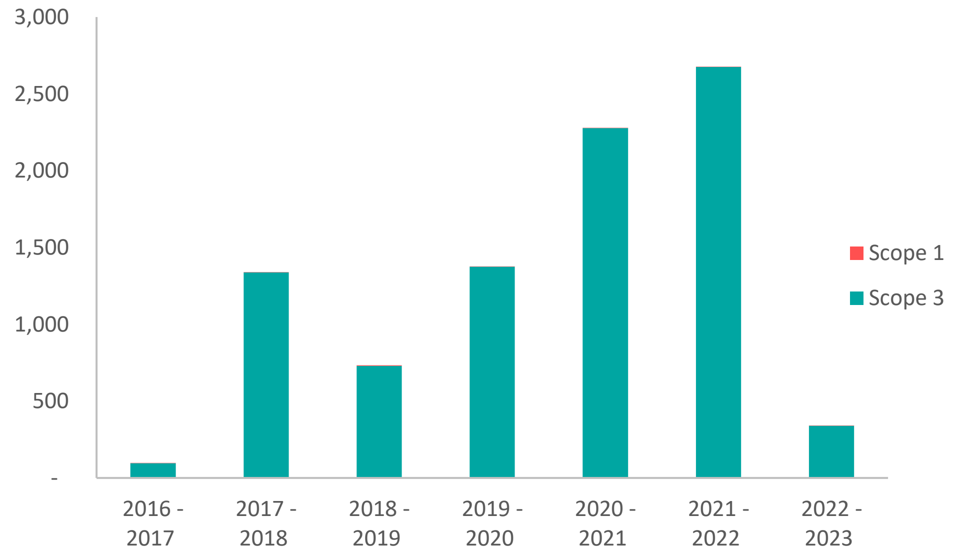


3.1.2 Urban Plus Limited

As below, almost the entirety of Urban Plus's emission profile is estimated to originate from its emissions associated with the buildings it constructs (refer sections 3.4.1 and 3.5.1). Therefore, the timing of the completion of builds will heavily influence the emissions profile. Existing housing projects have reached final stages hence emissions for this financial year remain low.

Note that Urban Plus's Scope 2 emissions (electricity) are invoiced directly to Hutt City Council and included in Hutt City Council's Scope 2 emissions (refer section 2.2) and are therefore not included below.

Figure 23: Scope 1 & Scope 3 Urban Plus Emissions



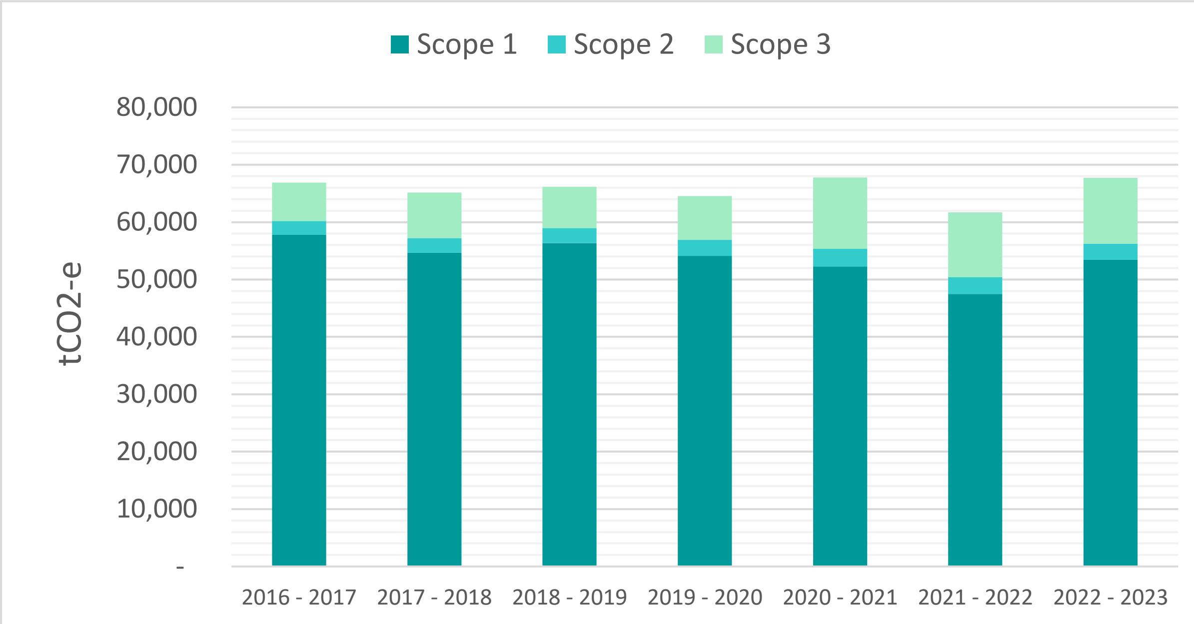
4. PERFORMANCE ASSESSMENT

4.1 PERFORMANCE COMPARED TO THE BASE YEAR

In light of changes to emissions reporting methodologies, and changes in scope, where possible emission results have been recalculated to enable a comparison.

Compared to the base year, emissions have increased slightly, this is largely due to the emissions increases associated with Silverstream landfill Stage 2, lack of sufficient destruction of gas at the closed Silverstream Stage 1, and a significant increase in emissions associated with contracts, which includes Naenae Pool as a major building and construction project.

Figure 24:: Hutt City Council's annual emissions



4.2 PERFORMANCE COMPARED TO PRIOR REPORTS

Hutt City Council's total carbon footprint for 2022/23 has been estimated at 67,702 tCO_{2-e}. As noted above, in light of changes to emissions reporting methodologies, and changes in scope, where possible emission results have been recalculated to enable a comparison.

Overall emissions have increased compared to the previous year, largely due to increases in open and closed landfill emissions, and emissions associated with contracted services.

Note that emissions associated with IT networking and data services have been excluded from the reported total emissions, as there is uncertainty in the emissions reported by Microsoft, and with data limited to the last four years. This approach also applies to LULUCF, as the focus of the report is on gross emissions, and because any credits arising from forests registered under the NZ Emissions Trading Scheme are scheduled to be sold, with revenue to be used to facilitate emission reductions or additional carbon sequestration through planting.

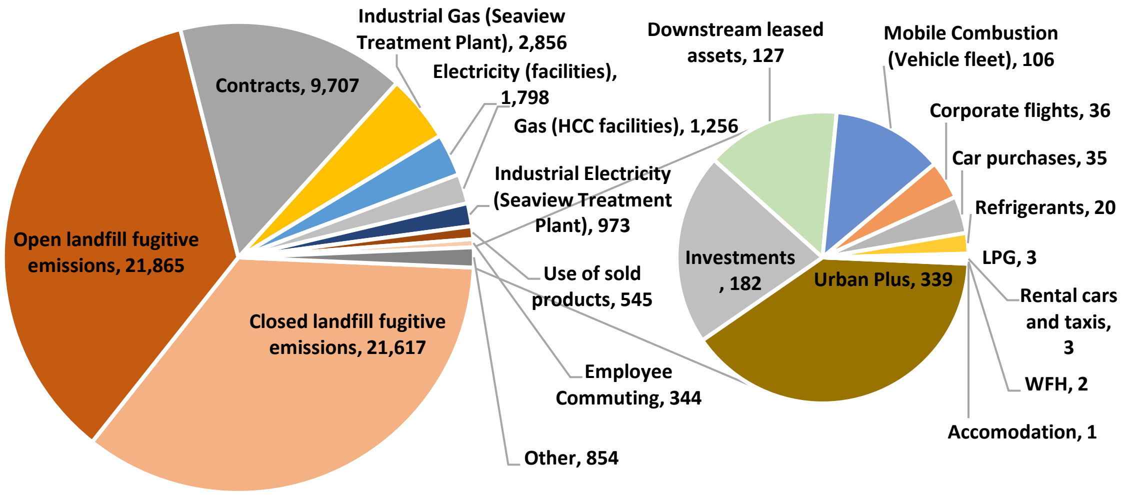
Increases in emissions have been recorded for Silverstream landfill (associated with an increase in the amount of waste received due to development activity in the city), and to a much lesser extent corporate flights, and employee commuting post the Covid-19 pandemic. Reductions in emissions have occurred in the Council's transport fleet, with 64% of vehicles now electric (compared to 58% as at March 2023).

There has also been a significant increase in emissions associated with contracts, which includes Naenae Pool as a major building and construction project. However, note that the majority of emissions associated with contracted services is still estimated by applying industry-wide emission factors to the amount of money spent in various categories. Hence, there is significant uncertainty associated with those estimates.

Lastly, industrial, and invoiced emissions for Wellington Water are based on the 2022 financial year report as the council-controlled organization was not able to provide updated data. The results are only used as a means for estimating the entities' emissions, and to avoid distorting the results if these emissions were to be excluded.

The following figure shows a detailed breakdown of emissions for 2022/23.

Figure 25: Hutt City Council emissions profile for 2022/23



Hutt City Council's largest emission sources are the open Silverstream landfill (Stage 2), and the closed Wainuiomata landfill and Silverstream landfill Stage 1/1A. Emissions from contracted services is the next biggest emission source, followed by a range of smaller sources.

4.3 PERFORMANCE COMPARED TO CARBON REDUCTION AND CLIMATE RESILIENCE PLAN 2021-2031

Hutt City Council (HCC) has in place its Carbon Reduction and Climate Resilience Plan 2021-31, with an organisational target to reduce emissions to net zero by 2050, and various actions to give effect to this target. Hutt City Council provides quarterly updates to its Climate Change and Sustainability Committee on progress regarding the implementation of this plan.

The latest report with a full overview on the status of each action is available online (refer report number CCASC2023/4/270, page 143) .

APPENDIX 1 - ACTIVE AND CLOSED LANDFILL ASSESSMENT

Tonkin+Taylor

6 December 2023
Job No: 82948.017

Hutt City Council
By email: jorn.scherzer@huttcity.govt.nz

Attention: Jörn Scherzer

Dear Jörn

Hutt City carbon footprint - active and closed landfill assessment

Tonkin &Taylor Ltd (T+T) are pleased to provide an estimate of the carbon emissions from selected waste disposal sites within the Hutt City area. This work was requested by Hutt City Council (HCC) for inclusion in HCC's 2023 carbon footprint inventory.

1 Estimated carbon emissions

Carbon emissions have been estimated for Silverstream (Stages 1, 1a and 2), along with Wainuiomata closed landfill. The emissions are summarised in Table 1.1 below.

Table 1.1: Estimated emissions

Financial year	Fugitive emissions estimate in t CO_2e (emissions destroyed by combustion in brackets)		
	Silverstream		Wainuiomata
	Stage 1 & 1a	Stage 2	
2016/17	6,814 (24,713)	13,182 (42,583)	29,545 (0)
2017/18	6,375 (23,137)	15,416 (53,106)	26,412 (0)
2018/19	6,375 (23,137)	17,362 (58,805)	24,173 (0)
2019/20	6,995 (25,390)	17,356 (67,228)	21,487 (0)
2020/21	5,350 (19,416)	19,559 (58,766)	19,249 (0)
2021/22	3328 (20,231)	17,757 (87,024)	16,563 (0)
2022/23	6845 (14,611)	21,865 (100,095)	14,772 (0)

Note – The Silverstream emissions are after extraction and destruction is taken into account. No rounding undertaken to above figures at request of HCC, so that rounding can be applied elsewhere in inventory.

Commentary on the changes in emissions since last year is as follows:

- Stage 1/1a – Gas extraction has become increasingly challenging for this area of the landfill, with wells failing to produce gas (eg due to collapse or blockage) and the encroachment of Stage 2 partially over the top of Stage 1a. In addition, when engines were off line during the year, extraction from Stage 2 was prioritised.

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- Stage 2 – emissions have increased year on year from Stage 2, as would be expected for an active landfill - each year, gas is produced by the new waste deposited, plus all the previously deposited waste. Destruction efficiency is approximately similar to 2021/22, but volume of emissions destroyed has increased due to additional wells and improvements to the wellfield operations.
- Wainuiomata – generation is declining at this closed landfill, which is reflected in the emissions.

The fugitive emissions through the landfill cap and from the gas engines/flare are separated in Table 1.2 below. UEF calculations for 2022/23 are enclosed in Appendix A.

Table 1.2: Proportion of fugitive emissions through cap and from engines and flare

Financial year	Silverstream fugitive emissions separated by pathway (t CO_2e)			
	Stage 1 & 1a		Stage 2	
	Through cap	From engines and flare	Through cap	From engines
2021/22	1472	1856	7833	9923
2022/23	5384	1461	10,744	11,122

2 Location of diffuse emissions

Since 2010, surface monitoring of methane emissions has been undertaken regularly across Silverstream Stages 1/1a and 2. The frequency of monitoring has varied between weekly and monthly over the years and is currently undertaken fortnightly. This monitoring only allows concentrations of methane emitted to be measured, not volumes.

From the body of information gathered, the emissions pathways for landfill gas to escape to atmosphere are typically through:

- Cracks between extraction wells and the clay cap: As the landfill moves, so cracks regularly develop, generally hairline in size, through which gas can escape.
- Exposed leachate gravels in Stage 2: these gravels line the base and sides of the landfill, ensuring downward migration of leachate. They also collect landfill gas. A temporary inhibitor is installed where the gravels daylight, which comprises a polyethylene membrane and compacted clay. On occasions this inhibitor is damaged or disturbed, causing emissions.

An ongoing regime of maintenance is in place to remediate the above pathways.

3 Flare down time

Flare and gas engines down time is automatically accounted for in the emissions estimate as the emissions are calculated on the flow of gas through the flare and gas engines. Flare down time, as reported by the operator, LMS, is detailed in Table 3.1 below.

Table 3.1: Flare downtime (July 2022 to June 2023)

Month	Report Month Hours (see note)	Flare operating (hrs)	Flare downtime (hrs)	Flare downtime (% of month hrs)
July	744	619	125	17%
August	744	743	1	0%
September	720	697	23	3%
October	744	523	221	30%
November	720	587	133	18%
December	744	215	529	71%
January	744	360	384	52%
February	672	545	127	19%
March	744	252.6	491.4	66%
April	721	665.1	55.9	8%
May	744	620	124	17%
June	720	720	0	0%

Notes

1) The above readings are made by the operator as close to the month end as possible, which is why the monthly hours do not always equate to 30/31 days.
2) The flare is only operated when required to take excess not consumed by the power plant (the gas is preferentially directed to the power plant to convert into electricity).

4 Flare vs gas engines destruction

The volumes of gas destroyed by the flare vs the gas engines is detailed on Table 4.1 below (obtained from LMS records). The destruction efficiency of the engines is taken to be 90% and we understand that the destruction efficiency of the flare is much higher (although for the purposes of the calculated emissions in Table 1.1, has been assumed to be 90%).

Table 4.1: Volumes of gas through the flare vs gas engines (July 2022 to June 2023)

Month	Volume (m^3) of gas through		% of gas volume through the flare
	Gas engines	Flare	
July	713,711	212,293	23%
August	572,350	399,564	41%
September	535,263	342,035	39%
October	742,132	61,297	8%
November	750,011	184,317	20%
December	942,100	81,541	8%
January	780,862	144,701	16%
February	699,369	217,756	24%
March	940,131	92,701	9%
April	621,719	248,268	29%
May	688,572	204,911	23%
June	566,625	368,859	39%

Note: % gas volume through flare = volume of gas through flare divided by sum of gas volume through flare and gas engines.

5 Landfill gas composition

Spot checks throughout the year have been made for Silverstream Stages 1/1a and 2. No monitoring wells are installed at Wainuiomata Closed Landfill.

Gas composition data from Silverstream Stage 1/1a and 2 are enclosed as Appendix B.

6 Data sources

- Wainuiomata
  - Landfill gas generated (at 50% methane) has been estimated from Figure 3.1 of the Landfill Emissions Report[1], using the T+T Model (Red) line.
  - Wainuiomata has no gas extraction system, however, a 10% oxidation of methane when passing though the cap has been assumed.
  - A flare trial was undertaken at the end of 2022, which extracted landfill gas from about 10% of the landfill. Only one well consistently extracted gas over the course of a week (approximately 90m^3/hr), the other wells did not produce sufficient gas to flare. The results of the trial indicate that the estimate in Figure 3.1 of the Emissions Report is likely to represent a likely worst case for gas generation.
- Silverstream, Stage 1 and 1a
  - Silverstream Stage 1/1a landfill gas is extracted to create electricity that is fed into the national grid. A flow logger was installed on 18th October 2019 and has recorded an average flow of 147m3/hr for the year.
- Silverstream Stage 2

[1] T+T (March 2021) Wainuiomata closed landfill emissions investigation: Task 2 – Gas generation modelling, draft letter report, prepared on behalf of Hutt City Council.

- Carbon emissions have been estimated using the data from the UEF assessments for calendar years 2016 to 2022. For 2023, an interim UEF assessment has been used to estimate the gas generation and flow.

7 Applicability

This report has been prepared for the exclusive use of our client, Hutt City Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
....	....
Chris Hillman Principal Environmental Engineer	Ed Breese Project Director

6-Dec-23
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Appendix A UEF calculations

Project: Silverstream Landfill Project No: 82948.028
Description: 2022 UEF Calculation 24/01/2023
Computed: MEKL Page 1 of 5

01 SCHOLL CANYON MODEL SINGLE WASTE PROFILE - UEF Calculation

The generation of landfill gas is estimated by the Scholl Canyon model, which is a first order decay model. The calculation procedures permits the modelling of:

- single waste/time input profiles
- single gas production per unit weight (Lo)
- changes in the decay parameters to account for the effects of capping a landfill
- capping is presumed to occur at a set period following the placement of any particular unit of waste - this is appropriate for relatively large landfills, where the construction of an effective capping system is likely to occur at intermediate stages throughout a long operational period on large landfills, particularly in climates with high rainfall.

Cap placement definition - after a set period following waste placement

The Scholl Canyon Model is implemented in the USEPA model LandGem. In LandGem the data for incoming waste is provided in discrete annual tonnages. By default this is split into 10 equally spaced placements through the year. In this implementation the unit of time is flexible and the number of increments within this unit of time is also flexible.

LandGem and time units

Reference

DEPARTMENT OF THE ARMY U.S. Army Corps of Engineers CEMP-RT Washington, DC 20314-1000 ETL 1110-1-160 Technical Letter No. 1110-1-160 17 April 1995 "Engineering and Design LANDFILL OFF-GAS COLLECTION AND TREATMENT SYSTEMS"

Collection/Destruction only (UEF Regulations Clause 23C)

Waste parameters

Potential CH_4 generation capacity of the waste (2015 Default) $L_o := 60.815 \cdot m^3 \cdot tonne^{-1}$

CH_4 generation decay rate constant (Default) $k := 0.039 \cdot yr^{-1}$

Time to reach anaerobic conditions, yrs.
(LandGem assumes a lg of 1 year) $Anaerobic_{lag} := 0.50$ year

The number of increments in a year.
20 provides a reasonable continuum for the generation rate.
Landgem uses 10 increments. $inc := 20$

Oxidation factor $Ox := 10\%$

Flare parameters

Destruction efficiency $D_{flare} := 0.9$

Destroyed methane

Total volume of methane destroyed in 2022 $Q := 1056.003 \cdot m^3 \cdot hr^{-1}$

$Q = 9256724.6\ m^3 \cdot yr^{-1}$

Silverstream UEF Calculation 2022 new Lo and k 6- mth lag.mcdx

Landfill waste input profile

Waste =

Date	Tonnes/yr
2010	10479.04
2011	76677.88
2012	83024.9
2013	110564.8
2014	118480.92
2015	111319.14
2016	117370.18
2017	117480.74
2018	122418.96
2019	135603.915
2020	140066.02
2021	142393.16
2022	167695.777
2023	0

$Date := \left(Waste^{\langle 0 \rangle}\right) \cdot yr$

$Anwaste := Waste^{\langle 1 \rangle} \cdot tonne$

Start date for analysis $\quad Start := Date_0 \quad Start = 2010\ yr$

Counter for the number of years over which waste is received at the landfill $\quad Incom := \text{length}\left(Waste^{\langle 0 \rangle}\right) \quad Incom = 14$ years

Waste placement distribution

The number of increments in a year. 20 provides a reasonable continuum for the generation rate.

$inc = 20$ as defined at the beginning of the worksheet

Function to take anaerobic lag into account. Function defines that waste must be in place for 6 months before it produces LFG.

$$
\begin{aligned}
Anwastelag := \; & \text{for } i \in 1 .. (Incom - 1) \\
& \quad Anwastelag_i \leftarrow \frac{Anwaste_i}{2} + \frac{Anwaste_{i-1}}{2} \\
& \text{for } i \in 0 \\
& \quad Anwastelag_i \leftarrow \frac{Anwaste_i}{2} \\
& Anwastelag
\end{aligned}
$$

Function to distribute the waste placement across the years of incoming waste

Placed waste is apportioned over the relevant year in accordance with the number of increments in the year. The waste is placed at the end of each time increment.

$$
\begin{aligned}
WastePlaced := \; & \text{for } i \in 0 .. (Incom - 2) \\
& \quad \text{for } j \in 1 .. (inc) \\
& \quad \quad wastePlaced_{i \cdot inc + j} \leftarrow \frac{Anwastelag_i}{inc} \\
& \text{for } i \in Incom - 1 \\
& \quad \text{for } j \in 1 .. \left(\frac{inc}{2} + 1\right) \\
& \quad \quad wastePlaced_{i \cdot inc + j} \leftarrow \frac{2 \cdot Anwastelag_i}{inc} \\
& \text{for } i \in Incom - 1 \\
& \quad \text{for } j \in \left(\frac{inc}{2} + 1\right) .. inc \\
& \quad \quad wastePlaced_{i \cdot inc + j} \leftarrow 0 \cdot tonne \\
& wastePlaced
\end{aligned}
$$

Date of waste placement

Function to determine the date on which the waste is placed

$$
\begin{aligned}
DatePlaced := \; & \text{for } i \in 0 .. (Incom - 1) \\
& \quad \text{for } j \in 0 .. (inc) \\
& \quad \quad datePlaced_{i \cdot inc + j} \leftarrow Date_i + \frac{j}{inc} \cdot yr \\
& datePlaced
\end{aligned}
$$

Methane generation

Estimated total methane gas flow rate

If the date of placement exceeds the time of interest, terminate the calculation and return the gas production rate.

ti = Time from waste placement

Value of k is dependent upon capping from time of placement

$$
Gen(time) := \left\| \begin{array}{l} q \leftarrow 0 \cdot m^3 \cdot hr^{-1} \\ \text{for } i \in 0 .. \text{last}(DatePlaced) \\ \quad \left\| \begin{array}{l} ti \leftarrow time - DatePlaced_i \\ \text{if } ti < -1 \cdot yr \\ \quad \| \; q \leftarrow q + 0 \cdot m^3 \cdot hr^{-1} \\ \text{else} \\ \quad \left\| \begin{array}{l} \Delta q \leftarrow 2 \cdot k \cdot L_o \cdot WastePlaced_i \cdot e^{-k \cdot (ti)} \\ q \leftarrow q + \Delta q \end{array} \right. \end{array} \right. \\ q \end{array} \right.
$$

Results

Methane generation rate
(LFG gen at 50% methane)

$$Gen(2022\ yr) = 5558652.539\ m^3\ yr^{-1}$$

$$Gen(2022 \cdot yr) = 634.129\ m^3\ hr^{-1}$$

Estimated collection efficiency

$$
Col(time) := \begin{array}{l} \text{if } Q > Gen(time) \cdot (1 - Ox) \\ \quad \| \; 0.9 \\ \text{else} \\ \quad \left\| \; D_{flare} \dfrac{Q}{Gen(time) \cdot (1 - Ox)} \right. \end{array}
$$

$$Col(2022 \cdot yr) = 0.9$$

$$UEF(time) := 0.91 \cdot (1 - Col(time))$$

Unique emission factor

$$UEF(2022 \cdot yr) = 0.091$$

Project: Silverstream Landfill
Description: 2023 UEF Calculation
Computed: MEKL

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01 SCHOLL CANYON MODEL SINGLE WASTE PROFILE - UEF Calculation

The generation of landfill gas is estimated by the Scholl Canyon model, which is a first order decay model. The calculation procedures permits the modelling of:

- single waste/time input profiles
- single gas production per unit weight (Lo)
- changes in the decay parameters to account for the effects of capping a landfill
- capping is presumed to occur at a set period following the placement of any particular unit of waste - this is appropriate for relatively large landfills, where the construction of an effective capping system is likely to occur at intermediate stages throughout a long operational period on large landfills, particularly in climates with high rainfall.

Cap placement definition - after a set period following waste placement

The Scholl Canyon Model is implemented in the USEPA model LandGem. In LandGem the data for incoming waste is provided in discrete annual tonnages. By default this is split into 10 equally spaced placements through the year. In this implementation the unit of time is flexible and the number of increments within this unit of time is also flexible.

LandGem and time units

Reference

DEPARTMENT OF THE ARMY U.S. Army Corps of Engineers CEMP-RT Washington, DC 20314-1000 ETL 1110-1-160 Technical Letter No. 1110-1-160 17 April 1995 "Engineering and Design LANDFILL OFF-GAS COLLECTION AND TREATMENT SYSTEMS"

Collection/Destruction only (UEF Regulations Clause 23C)

Waste parameters

Potential CH_4 generation capacity of the waste (2015 Default) — $L_o := 79.18 \cdot m^3 \cdot tonne^{-1}$

CH_4 generation decay rate constant (Default) — $k := 0.063 \cdot yr^{-1}$

Time to reach anaerobic conditions, yrs.
(LandGem assumes a lg of 1 year) — $Anaerobic_{lag} := 0.50 \ year$

The number of increments in a year.
20 provides a reasonable continuum for the generation rate.
Landgem uses 10 increments. — $inc := 20$

Oxidation factor — $Ox := 10\%$

Flare parameters

Destruction efficiency — $D_{flare} := 0.9$

Destroyed methane

Total volume of methane destroyed in 2022 — $Q := 1213.259 \cdot m^3 \cdot hr^{-1}$

$Q = 10635201.2 \ m^3 \cdot yr^{-1}$

Silverstream UEF Calculation 2023 Jan-Jun.mcdx

Landfill waste input profile

$Waste =$

Date	Tonnes/yr
2010	10479
2011	76678
2012	83025
2013	110565
2014	118481
2015	111319
2016	117370
2017	117481
2018	122419
2019	135604
2020	140066
2021	142393
2022	167696
2023	181216
2024	0

$Date := \left(Waste^{\langle 0 \rangle}\right) \cdot yr$

$Anwaste := Waste^{\langle 1 \rangle} \cdot tonne$

Start date for analysis $Start := Date_0$ $Start = 2010\ yr$

Counter for the number of years over which waste is received at the landfill $Incom := \text{length}\left(Waste^{\langle 0 \rangle}\right)$ $Incom = 15$ years

Waste placement distribution

The number of increments in a year. 20 provides a reasonable continuum for the generation rate.

$inc = 20$ as defined at the beginning of the worksheet

Function to take anaerobic lag into account. Function defines that waste must be in place for 6 months before it produces LFG.

$$
\begin{aligned}
Anwastelag :=\ & \text{for } i \in 1..(Incom - 1) \\
& \quad Anwastelag_i \leftarrow \frac{Anwaste_i}{2} + \frac{Anwaste_{i-1}}{2} \\
& \text{for } i \in 0 \\
& \quad Anwastelag_i \leftarrow \frac{Anwaste_i}{2} \\
& Anwastelag
\end{aligned}
$$

Function to distribute the waste placement across the years of incoming waste

Placed waste is apportioned over the relevant year in accordance with the number of increments in the year. The waste is placed at the end of each time increment.

$$
\begin{aligned}
WastePlaced :=\ & \text{for } i \in 0..(Incom - 2) \\
& \quad \text{for } j \in 1..(inc) \\
& \quad\quad wastePlaced_{i \cdot inc + j} \leftarrow \frac{Anwastelag_i}{inc} \\
& \text{for } i \in Incom - 1 \\
& \quad \text{for } j \in 1..\left(\frac{inc}{2} + 1\right) \\
& \quad\quad wastePlaced_{i \cdot inc + j} \leftarrow \frac{2 \cdot Anwastelag_i}{inc} \\
& \text{for } i \in Incom - 1 \\
& \quad \text{for } j \in \left(\frac{inc}{2} + 1\right)..inc \\
& \quad\quad wastePlaced_{i \cdot inc + j} \leftarrow 0 \cdot tonne \\
& wastePlaced
\end{aligned}
$$

Date of waste placement

Function to determine the date on which the waste is placed

$$
\begin{aligned}
DatePlaced :=\ & \text{for } i \in 0..(Incom - 1) \\
& \quad \text{for } j \in 0..(inc) \\
& \quad\quad datePlaced_{i \cdot inc + j} \leftarrow Date_i + \frac{j}{inc} \cdot yr \\
& datePlaced
\end{aligned}
$$

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Computed: MEKL

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Methane generation

Estimated total methane gas flow rate

If the date of placement exceeds the time of interest, terminate the calculation and return the gas production rate.

ti = Time from waste placement

Value of k is dependent upon capping from time of placement

$$Gen(time) := \begin{array}{l} q \leftarrow 0 \cdot m^3 \cdot hr^{-1} \\ \text{for } i \in 0..\text{last}(DatePlaced) \\ \quad ti \leftarrow time - DatePlaced_i \\ \quad \text{if } ti < -1 \cdot yr \\ \quad\quad q \leftarrow q + 0 \cdot m^3 \cdot hr^{-1} \\ \quad \text{else} \\ \quad\quad \Delta q \leftarrow 2 \cdot k \cdot L_o \cdot WastePlaced_i \cdot e^{-k \cdot (ti)} \\ \quad\quad q \leftarrow q + \Delta q \\ q \end{array}$$

Results

Methane generation rate
(LFG gen at 50% methane)

$$Gen(2023\ yr) = 11851818.513\ m^3\ yr^{-1}$$

$$Gen(2023 \cdot yr) = 1352.05\ m^3\ hr^{-1}$$

Estimated collection efficiency

$$Col(time) := \begin{array}{l} \text{if } Q > Gen(time) \cdot (1 - Ox) \\ \quad 0.9 \\ \text{else} \\ \quad D_{flare} \dfrac{Q}{Gen(time) \cdot (1 - Ox)} \end{array}$$

$$Col(2023 \cdot yr) = 0.897$$

Unique emission factor

$$UEF_{default} := 0.91$$

$$UEF(time) := UEF_{default} \cdot (1 - Col(time))$$

$$UEF(2023 \cdot yr) = 0.0934$$

Silverstream UEF Calculation 2023 Jan-Jun.mcdx

Appendix B Gas composition data

Stage 1

Date	Gas Meter	Time	USER	Stage 1 CH4 (%)	FLOW Stage 1 (NM3/H)	Comments
3/06/2022	HIRE GA5000	13:58	SSIM	51.5	176	Stage 1 CO2-29.6, O2-2, CO 2, H2S-129, Balance 16.8, total flow 4509358
10/06/2022	HIRE GA5000	13:01	HAMU	49.2	200.9	Stage 1 CO2-29.1, O2-1.9, CO 0, H2S-FILTERED, Balance 19.9, total flow 4542058
17/06/2022	HIRE GA5000	14:25	hamu	44.1	179.09	Stage 1 CO2-26.3, O2-13.1, CO 0, H2S-FILTERED, Balance 29.6, total flow 4572640
27/06/2022	GA 5000	14:59	SELO	44	166.4	Stage 1 CO2 - 32.1, O2 - 0.7, CO- 1, H2S - Filtered, Balance - 23.2, Total flow - 4611234
6/07/2022	ga 5000	13:33	hamu	43.1	190.8	
15/07/2022	GA5000	13:55	HAMU	34.7	179.3	
1/08/2022	GA5000	12:55	HAMU	37.2	161.5	Stage 1 CO2 - 29.2, O2 - 1.3, CO- 5, H2S - Filtered, Balance - 32.5, Total flow - 4726714
2/08/2022	GA5000	16:10	HAMU	39.7	185.9	Stage 1 CO2 - 30.1, O2 - 0.9, CO- 4, H2S - Filtered, Balance - 29.4, Total flow - 4731295
3/08/2022	ga5000	16:10	hamu	38.1	163.2	Stage 1 CO2 - 29, O2 - 1.5, CO- 4, H2S - Filtered, Balance - 31.4, Total flow - 4735430
6/09/2022	T+T GA	16:16	HAMU	37.1	211.9	Stage 1 CO2-27.3, O2-3.3, CO 130, H2S-FILTERED, Balance 25.5, total flow 4875988
9/09/2022	T+T GA	12:00	JATA	29.7	236.6	Stage 1 CO2-25.2, O2-3.0, CO 5, H2S-FILTERED, Balance 42.1, total flow 4887970
21/09/2022	GA5000	12:00	JATA	45.1	127	
29/09/2022	GA5000	2:45	JATA	45.5	170.4	
7/10/2022	T+T GA	11:26	HAMU	47.9	1.03.4	Stage 1 CO2-27.7, O2-2.0, CO 1, H2S-FILTERED, Balance 22.5, total flow 5011111
12/10/2022	GA5000	14:45	HAMU	47	135.1	
17/10/2022	GA5000	12:00	JATA	45.8	166.8	
31/10/2022	GA5000	11:42	JATA	57.4	171	Stage 1 CO2-31.1, O2-0.5, CO 2, H2S-FILTERED, Balance 10.0, total flow 5097603
7/11/2022	GA5000	12:12	LAMC	52.1	159.5	Stage 1 CO2-29.3, O2-0.9, CO 5, H2S-119, Balance 17.73, total flow 5122503
8/11/2022	GA5000	11.08	LAMC	51.1	140.4	Stage 1 CO2-28.9, O2-1.4, CO 2, H2S-FILTERED, Balance 18.6, total flow 5126127
15/11/2022	GA5000	14:20	LAMC	44.1	179.1	Stage 1 CO2-26.2, O2-2.4, CO 3, H2S-FILTERED, Balance 27.3, total flow 5153682
22/11/2022	GA 5000	10:50	LAMC	53.2	170.2	Stage 1 CO2-29.9, O2-0.8, CO 2, H2S-FILTERED, Balance 16.1, total flow 5181901
25/11/2022	GA 5000	13:15	LAMC	48.4	160.7	Stage 1 CO2-26.3, O2-2.5, CO 2, H2S-FILTERED, Balance 27.5, total flow 5246501
9/12/2022	GA5000	11:48	LAMC	43.7	170.8	Stage 1 CO2-28.7, O2-1.2, CO 2, H2S-FILTERED, Balance 21.6, total flow 5194059
16/12/2022	GA5000	15:40	LAMC	50.3	170.9	Stage 1 CO2-28.6, O2-1.2, CO 2, H2S-FILTERED, Balance 19.9, total flow 5270362
23/12/2022	GA5000	8:40	LAMC	48.4	186.1	Stage 1 CO2-28.3, O2-1.8, CO 2, H2S-FILTERED, Balance 21.5, total flow 5302159
11/01/2023	GA5000	12:30	LAMC	59.7	104.1	Stage 1 CO2-30.2, O2-1.1, CO 2, H2S-FILTERED, Balance 9.0, total flow 5368936
16/01/2023	GA5000	11:30	LAMC	51.5	153.6	Stage 1 CO2-28.6, O2-1.4, CO 3, H2S-FILTERED, Balance 18.5, total flow 5384900
24/01/2023	GA5000	12:47	LAMC	53.8	104.7	Stage 1 CO2-29.9, O2-0.8, CO 3, H2S-FILTERED, Balance 15.6, total flow 5414608
8/02/2023	GA5000	1:39	LAMC	52.3	164.7	Stage 1 CO2-29.7, O2-1.0, CO 3, H2S-FILTERED, Balance 17.0, total flow 5473176
17/02/2023	GA5000	2:17	LAMC	53.6	143.2	Stage 1 CO2-29.9, O2-1.3, CO 2, H2S-FILTERED, Balance 15.3, total flow 5505100
20/02/2023	GA5000	1:42	LAMC	54.2	0	Stage 1 CO2-30.7, O2-0.8, CO 3, H2S-FILTERED, Balance 14.3, total flow 5508170
24/02/2023	GA5000	12:50	LAMC	58.6	136.5	Stage 1 CO2-30.6, O2-1.0, CO 2, H2S-FILTERED, Balance 9.9, total flow 5518443
17/03/2023	GA5000	12:45	LAMC	58.5	125.8	Stage 1 CO2-31.8, O2-0.4, CO 2, H2S-FILTERED, Balance 9.3, total flow 5599898
24/03/2023	GA5000	12:00	LAMC	54.9	153.7	Stage 1 CO2-30.3, O2-1.1, CO 1, H2S-FILTERED, Balance 13.8, total flow 5612240
31/03/2023	GA5000	1:50	LAMC	57.1	147.2	Stage 1 CO2-30.4, O2-0.7, CO 1, H2S-FILTERED, Balance 11.9, total flow 5637242
6/04/2023	GA5000	11:27	LAMC	51.1	210.5	Stage 1 CO2-30.3, O2-1.0, CO 0, H2S-FILTERED, Balance 17.7, total flow 5661672
17/04/2023	GA5000	12:47	LAMC	45.2	183.8	Stage 1 CO2-50.7, O2-1.1, CO 4, H2S-FILTERED, Balance 12.2, total flow 5710366
12/05/2023	GA5000	2:00	LAMC	50.7	196.9	Stage 1 CO2-28.1, O2-0.8, CO 1, H2S-FILTERED, Balance 25.9, total flow 5710367
19/05/2023	GA5000	3:00	LAMC	55.6	155.9	Stage 1 CO2-30.8, O2-0.5, CO 1, H2S-FILTERED, Balance 13.1, total flow 5843182
30/05/2023	GA5000	2:30	LAMC	51.4	171.8	Stage 1 CO2-29, O2-1.0, CO 0, H2S-FILTERED, Balance 18.6, total flow 5888697
15/06/2023	GA5000	12:30	LAMC	45.8	0	Stage 1 CO2-31.2, O2-0.7, CO 3, H2S-FILTERED, Balance 22.3, total flow 5928082
22/06/2023	GA5000	12:15	LAMC	47.8	213.3	Stage 1 CO2-28.3, O2-1.8, CO 0, H2S-FILTERED, Balance 22.1, total flow 5947858
27/06/2023	GA5000	11:35	LAMC	49.7	188.7	Stage 1 CO2-29.6, O2-0.9, CO 1, H2S-FILTERED, Balance 19.8, total flow 5971241
4/07/2023	GA5000	1:15	LAMC	47.5	169.7	Stage 1 CO2-28, O2-1.5, CO 0, H2S-FILTERED, Balance 24.9, total flow 6001685
12/07/2023	GA5000	10:28	LAMC	46.2	185	Stage 1 CO2-28.2, O2-1.1, CO 1, H2S-FILTERED, Balance 24.4, total flow 6033151
21/07/2023	GA5000	2:00	LAMC	43.6	0	Stage 1 CO2-27.9, O2-0.8, CO 1, H2S-FILTERED, Balance 27.7, total flow 6058302
26/07/2023	GA5000	1:50	LAMC	44.1	0	Stage 1 CO2-28.0, O2-0.6, CO 0, H2S-FILTERED, Balance 27.3, total flow 6058302
10/08/2023	GA5000	2:40	LAMC	50.1	162.7	Stage 1 CO2-28.4, O2-1.1, CO 0, H2S-FILTERED, Balance 20.3, total flow 6098384
16/08/2023	GA5000	3:30	LAMC	49.2	164.7	Stage 1 CO2-29.2, O2-0.9, CO 1, H2S-FILTERED, Balance 20.7, total flow 61121146
23/08/2023	GA5000	10:34	LAMC	45.5	129.4	Stage 1 CO2-27.9, O2-1.0, CO 1, H2S-FILTERED, Balance 25.6, total flow 6144455
5/09/2023	GA5000	1:30	LAMC	46.7	145.3	Stage 1 CO2-27.4, O2-1.9, CO 1, H2S-FILTERED, Balance 23.9, total flow 6185037
11/09/2023	GA5000	2:30	LAMC	48	132.9	Stage 1 CO2-26.4, O2-2.2, CO 2, H2S-FILTERED, Balance 23.4, total flow 6204149
5/10/2023	GA5000	10:40	LAMC	62.9	0	Stage 1 CO2-31.0, O2-0.4, CO 3, H2S-FILTERED, Balance 5.8, total flow 6248057
2/11/2023	GA5000	1:00	BRLI	53.4	135.5	Stage 1 CO2-22.7, O2-7.1, CO 1, H2S-FILTERED, Balance 16.8, total flow 6312426
14/11/2023	GA5000	12:50	LAMC	54.1	125.4	Stage 1 CO2-27.5, O2-2.1, CO 0, H2S-FILTERED, Balance 16.3, total flow 6349280
29/11/2023	GA5000	2:00	LAMC	52.6	152.3	Stage 1 CO2-27.9, O2-1.9, CO 0, H2S-FILTERED, Balance 17.6, total flow 6403600

Stage 2

	Portable Meter									Fixed Meters			
Date	CH4 (%)	CO2 (%)	O2 (%)	CO (PPM)	H2S (PPM)	Bal (%)	Gas Meter	Time	USER	Total Flow Stage 2	FLOW Stage 2 (NM3/H)	CH4 (%)	Comments
3/06/2022	43.7	37.5	2.1	5	330	16.6	HIRE GA5000	13:58	SSIM	20974243	1231		
10/06/2022	47.9	35.1	2	5	0	14.9	HIRE GA5000	13:01	HAMU	2118646	1113		
17/06/2022	47.8	39.7	1	5	FILTERED	11.5	HIRE GA5000	14:25	hamu	21373854	1205		
27/06/2022	36.6	40.1	1.3	6	FILTERED	22	GA 5000	14:59	SELO	21659543	1189		
6/07/2022	35.5	32.7	2.3	5	filtered	29.6	ga 5000	13:33	hamu	21940478	1220		
15/07/2022	35.7	37.2	1.7	6	FILTERED	25.4	GA5000	13:55	HAMU	22190956	1223		
1/08/2022	35.2	37.2	1.9	6	FILTERED	25.4	GA5000	12:55	HAMU	22709096	1313	46.27	
2/08/2022	36.5	37.7	1.4	5	filtered	24.5	GA5000	16:10	HAMU	22742195	1338	48.23	
3/08/2022	37.1	35.1	2.3	5	filtered	25.5	ga5000	16:10	hamu	22773547	1285	47.59	
6/09/2022	34.1	26.5	3.3	2	FILTERED	36.3	T+T GA	16:16	HAMU	23799890	1468	49.07	
9/09/2022	36.6	38.1	0.8	12	FILTERED	24.4	T+T GA	12:00	JATA	23878241	1308	48.07	
21/09/2022	47.5	38.2	0.9	12	431	13.4	GA5000	12:00	JATA	24217792	1291	18.15	
29/09/2022	49.5	37.6	0.9	11	430	12	GA5000	2:45	JATA	24429056	1381	48.21	
7/10/2022	45.5	35.2	1.4	5	filtered	17.9	T+T GA	11:26	HAMU	24693721	806	N/A	
12/10/2022	48.9	36	1.2	6	1	13.9	GA5000	14:45	HAMU	24831769	1085	47.81	
17/10/2022	50	37.7	1	7	47	11.2	GA5000	12:00	JATA	24957521	1246	49.51	
31/10/2022	51.2	38.1	0.7	8	FILTERED	10	GA5000	11:42	JATA	25356812	1201	50.35	
7/11/2022	50.2	39.5	0.9	11	500	9.5	GA5000	12:12	LAMC	25564470	1282	49.58	
8/11/2022	49.9	39.4	0.7	6	FILTERED	10	GA5000	11.08	LAMC	25594137	1093	49.7	
15/11/2022	53.1	41	0.5	7	FILTERED	5.4	GA5000	14:20	LAMC	25801836	1065	50.95	
22/11/2022	53.1	40.1	0.7	6	FILTERED	6.1	GA 5000	10:50	LAMC	26003079	1280	51.7	
25/11/2022	51.5	39.8	0.8	7	FILTERED	7.9	GA 5000	13:15	LAMC	26094230	1303	49.99	
9/12/2022	49.2	36.6	1.3	6	FILTERED	12.9	GA5000	11:48	LAMC	26539939	1424	47.98	
16/12/2022	53.5	39.6	0.5	7	FILTERED	6.4	GA5000	15:40	LAMC	26739908	1407	51.47	
23/12/2022	50.3	37.5	1.1	6	FILTERED	11.1	GA5000	8:40	LAMC	27000728	1486	48.35	
11/01/2023	51.8	39.3	0.5	7	FILTERED	8.4	GA5000	12:30	LAMC	27641732	919.2	50.19	
16/01/2023	47	36.4	1	6	FILTERED	15.5	GA5000	11:30	LAMC	27799546	1472	47.82	
24/01/2023	48	37.5	0.5	7	FILTERED	14	GA5000	12:47	LAMC	28069729	947.6	45.57	
8/02/2023	49.9	39.1	0.7	7	FILTERED	10.3	GA5000	1:39	LAMC	28565525	1439	49.49	
17/02/2023	50.4	38.1	0.6	8	FILTERED	10.9	GA5000	2:17	LAMC	28841742	1387	49.75	
20/02/2023	50.3	38.1	0.7	8	FILTERED	11	GA5000	1:42	LAMC	28938327	1298	50.16	
24/02/2023	47.4	36.8	0.9	7	FILTERED	14.9	GA5000	12:50	LAMC	29071348	1449	46.83	
17/03/2023	51.8	39.1	0.3	6	FILTERED	8.8	GA5000	12:45	LAMC	29744885	1130	51.28	
24/03/2023	46.7	36.3	0.8	6	FILTERED	16.2	GA5000	12:00	LAMC	29976577	1394	47.3	
31/03/2023	50.5	37.8	0.7	7	FILTERED	11	GA5000	1:50	LAMC	30189679	1087	50.12	
6/04/2023	51.7	37.6	1	4	FILTERED	9.7	GA5000	11:27	LAMC	30349897	1333	50.36	
17/04/2023	49.4	36.8	0.6	5	FILTERED	13.1	GA5000	12:47	LAMC	30651839	941.5	49.98	
12/05/2023	46.9	28	2.2	1	FILTERED	22.8	GA5000	2:00	LAMC	31366097	1018	40.09	
19/05/2023	52.9	39.1	0.6	6	FILTERED	7.3	GA5000	3:00	LAMC	31535075	829.5	51.5	
30/05/2023	50.5	37.5	0.9	9	FILTERED	11.1	GA5000	2:30	LAMC	31817285	1208	49.4	
9/06/2023	48.4	38.5	0.8	11	FILTERED	12.3	GA5000	2:00	LAMC	32121968	1291	48.19	
15/06/2023	50.1	37.9	1.1	10	FILTERED	11	GA5000	12:30	LAMC	32273243	1374	48.75	
22/06/2023	50	36.4	0.9	7	FILTERED	12.7	GA5000	12:15	LAMC	32490410	1158	48.39	
27/06/2023	50.8	38.1	1	7	FILTERED	10.1	GA5000	11:35	LAMC	32643643	1305	49.3	
4/07/2023	50.6	37.5	0.9	7	FILTERED	11	GA5000	1:15	LAMC	32849736	1121	49.22	
12/07/2023	50.1	38.2	0.8	9	FILTERED	10.9	GA5000	10:28	LAMC	33085017	1293	49.15	
21/07/2023	50.7	37.9	0.9	7	FILTERED	10.5	GA5000	2:00	LAMC	33377049	1383	48.72	
26/07/2023	48.7	37.6	1.1	8	FILTERED	12.6	GA5000	1:50	LAMC	33546938	1278	47.65	
10/08/2023	50.2	38.3	1	9	FILTERED	10.5	GA5000	2:40	LAMC	34061338	1320	48.82	
16/08/2023	50.6	40.2	0.5	10	FILTERED	8.6	GA5000	3:30	LAMC	34251995	1380	50.25	
23/08/2023	49.7	38.2	1	8	FILTERED	11.1	GA5000	10:34	LAMC	34468512	1280	48.12	
5/09/2023	50.9	38.4	0.8	9	FILTERED	9.9	GA5000	1:30	LAMC	34888900	1364	49.38	
11/09/2023	51.1	39	0.9	9	FILTERED	9.1	GA5000	2:30	LAMC	35088083	1355	49.7	
5/10/2023	52	37.5	0.9	10	FILTERED	9.6	GA5000	10:40	LAMC	35840640	1334	50.51	
2/11/2023	57.8	31.1	4.7	10	FILTERED	6.4	GA5000	1:00	BRLI	36683334	1396	48.55	
14/11/2023	55.7	36.6	0.9	5	FILTERED	6.8	GA5000	12:50	LAMC	37060036	1324	47.72	
29/11/2023	55.4	36	1.2	3	FILTERED	7.4	GA5000	2:00	LAMC	37538785	1321	47.14	

APPENDIX 2 – INDEPENDENT REVIEW OF REPORT

LUMEN

Engineering for
a better future

14 March 2024

Shane Gogo
Advisor - Energy & Carbon
Hutt City Council
Shane.Gogo@huttcity.govt.nz

Dear Shane,

Hutt City Council – Organisational Carbon Footprint: Peer review

I have completed my peer review of the council's Organisational Carbon Footprint report, for the council's financial year which runs July 2022 to June 2023.

I have reviewed the overall methodology, calculations, emissions factors, and source data. Below are my findings.

1. Summary of findings

1.1 Discrepancy found in how embodied emissions from cars (capital goods) were being calculated vs how the standard followed (GHGP) suggests they should be calculated. Recommend removing the depreciation calculation and only account for capital investments made during the financial year.

- This has been sufficiently addressed. 14/3/24

1.2 Embodied emissions from cars were incorrectly categorised as purchased goods rather than capital goods.

- This has been sufficiently addressed. 14/3/24

1.3 Emissions from Seaview marina was excluded due to lack of updated data; however, this makes comparison difficult. Recommend leaving in the last reported data and including a disclaimer to explain.

- This has been sufficiently addressed. 14/3/24

1.4 IT – as recognised, the data from Microsoft seems to be out by at least a factor of 1000. Recommend not using until more reliable data is available.

- This has been sufficiently addressed. 14/3/24

1.5 Employee commuting current approach does not extrapolate the sample data to the population. Recommend extrapolation using FTE.

- This has been sufficiently addressed. 14/3/24

Yours sincerely,

George Gray
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