UCT's Hasso Plattner d-school Afrika building received a 6-Star Green Star Design rating in 2023; Photo credit: Paris Brummer.

Carbon Footprint Assessment Report

Year of assessment: 2023

Report Issued: November 2024

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GLOSSARY OF TERMS

Capex	Capital Expenditure
CO_2e	Carbon Dioxide Equivalent
Covid-19	Coronavirus Disease 2019
DEFRA	Department of Environment, Food and Rural Affairs (UK)
DFFE	Department of Forestry, Fisheries and Environment (SA)
GHG	Greenhouse Gas
GSB	Graduate School of Business
HVAC	Heating, Ventilation And Cooling
IPCC	Intergovernmental Panel on Climate Change
LPG	Liquid Petroleum Gas
$kgCO_2e$	Kilograms of Carbon Dioxide Equivalent
kWh	Kilowatt Hours
NGER	National Greenhouse Gas Emissions Reporting
tCO_2e	Tonnes of Carbon Dioxide Equivalent

1. EXECUTIVE SUMMARY

This report provides the 2023 financial year carbon footprint report of the University of Cape Town (UCT). The scope covers all of the campuses and facilities under UCT's operational control as well as the emission-generating activities of its students and staff. Emissions are reported as Scope 1 (direct emissions), Scope 2 (indirect emissions from purchased electricity) and Scope 3 (other indirect emissions). Emissions are reported in accordance with the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard; the most widely recognised global methodology for greenhouse gas accounting and reporting.

1.1. Results

UCT's 2023 carbon footprint is relatively consistent with results from 2022 with an overall decrease of 7% compared to 2022. In 2020 emissions had dropped significantly due to the impact of the Covid-19 lockdowns and later as restrictions started to lift, emissions began to rise again into 2021 and 2022. Since then, Scope 1 emissions have increased from 3% to 6% of UCT's total carbon footprint, primarily due to increased diesel combustion in generators as the hours of load shedding rose substantially in 2023. Scope 2 emissions associated with electricity use across UCT's campuses remained mostly unchanged, while Scope 3 emissions saw notable changes within two emissions categories: air travel and construction.

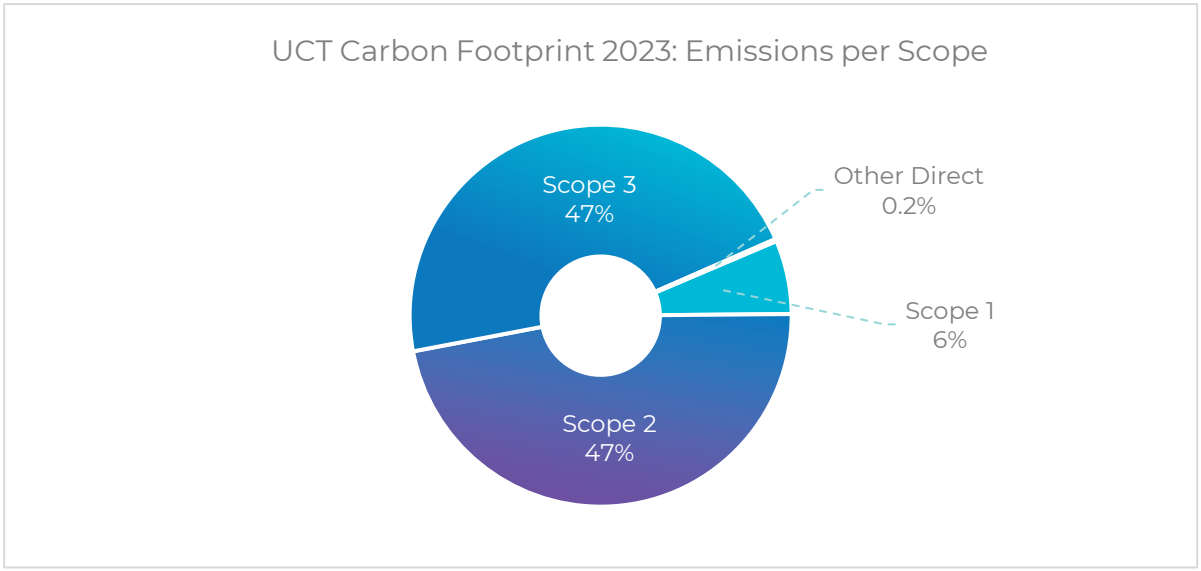

Figure 1.1: UCT 2023 Carbon Footprint Emissions by Scope

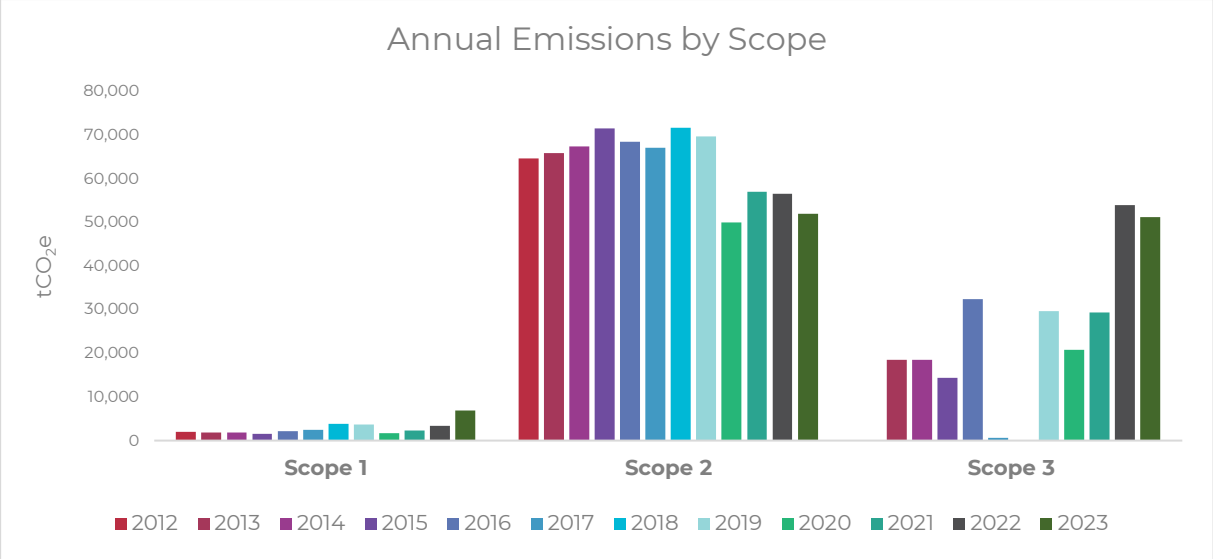

Figure 1.2: UCT Annual Emissions by Scope

Scope 1

Scope 1 emissions have doubled since UCT's previous financial year, primarily due to an increase in generator diesel use from 395,000 litres in 2022 to 1,3 million litres in 2023, resulting in a 252% increase in stationary diesel combustion emissions. A trend seen across most organisations in the country is a transfer of emissions from Scope 2 to Scope 1, as increased load shedding lowers the use of grid electricity and raises the demand for back-up generator power. Refer to the detailed analysis per scope to see these fluctuations with respect to UCT's carbon footprint.

Scope 2

As expected, with increased hours of load shedding in 2023, electricity consumption has decreased resulting in an 8% reduction in emissions in Scope 2. Total megawatt hours across the institution have decreased from 56,048 MWh in 2022 to 55,405 MWh in 2023. However, part of this decrease in the calculated emissions is attributed to the application of a slightly lower emission factor of 0.985 $kgCO_2e$ per kWh for 2023 activity, while the emission factor applied to 2022 activity was 1.01 $kgCO_2e$ per kWh.

Scope 3

Indirect emissions are reported in Scope 3 and are divided into 15 categories. UCT now reports 6 of the categories, based on relevance and access to data. Within the category "Purchased Goods and Services", UCT reports three sub-categories: Water Consumption, Paper Purchased and Food Provisions.

The most significant change in UCT's Scope 3 emission results in 2023 is the reduction of embedded emissions within materials and services used for construction, which decreased 61% year-on-year. A notable increase is seen in emissions associated with air travel, which are 36% higher than they were in 2022. Increased air travel emissions may be partly related to an improved emissions estimation methodology applied for this assessment. In the figure below, this increase is visible in the larger light-blue segment labelled "business travel" which also includes emissions associated with car hire, staff-reimbursed travel and travel allowances.

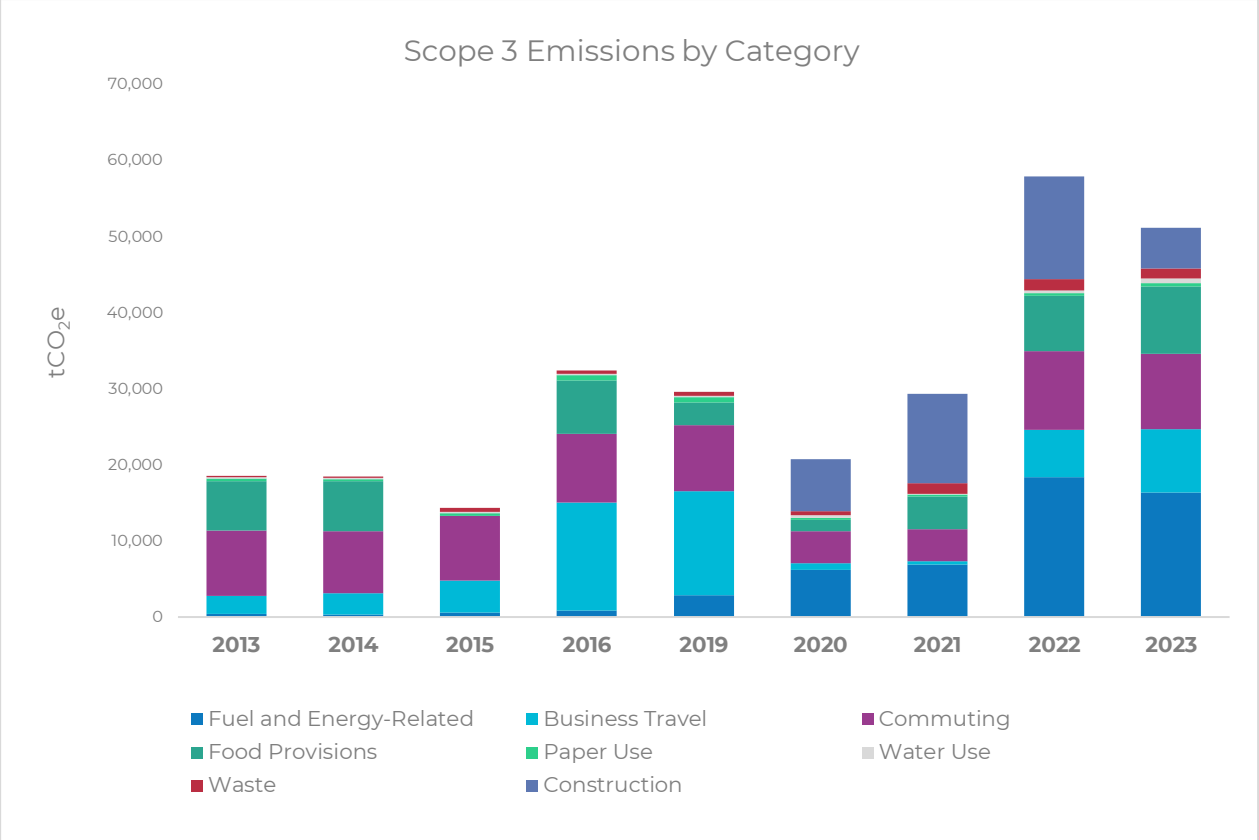

Figure 1.3: Annual Scope 3 Emissions per Financial Year, by emissions category.
Note: Scope 3 emissions were not reported in 2012 or 2018, while minimal sources were reported in 2017.

1.2. Targets

UCT has set the following target:

Net Zero emissions by 2050 (Scope 1 and 2)

- This requires a 2 – 5% reduction in emissions per annum from 2020 onwards.
- The baseline year from which these reductions must be shown has been changed to 2019, because 2020 was a year of COVID lockdowns with very little activity on campus
- So far UCT shows a total reduction of 20% since 2019, with an average 5% decrease per annum

Due to the impact of Covid-19 lockdowns which caused decreased activity throughout UCT, the 2020 emissions were unusually low and did not reflect the "normal" operating conditions of the institution. As expected, activity began to rise the following year and consequently these emissions increased by 16% in 2021, with most activity returning to pre-lockdown levels in 2022. It is therefore more appropriate to use 2019 as the baseline from which reductions are being measured off. One can thus see an overall 20% reduction of UCT's Scope 1, 2 and Other Direct emissions between 2019 and 2023, averaging 5% per annum.

Emissions	tCO_2e		% Change
	2019	2023	2019 vs 2023
Scope 1, 2 and Other Direct	73 417	59 034	-20%

Table 1.1: % Change in Scope 1, 2 and Other Direct Emissions since 2020

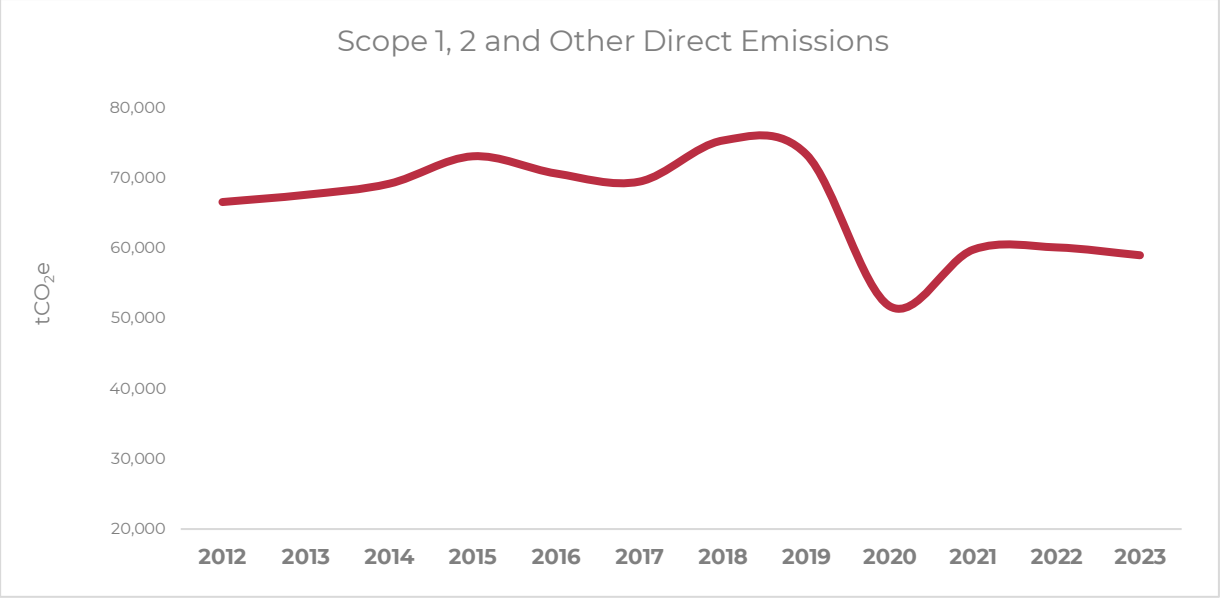

Figure 1.4: Annual Fluctuations in Scope 1, 2 and Other Direct Emissions

Due to regular annual reporting of emissions since 2012, UCT is also able to track progress since that initial baseline assessment year. The following table indicates the current reduction of 11% in Scope 1, 2 and Other Direct emissions since 2012:

Emissions	tCO_2e		% Change
	2012	2023	2012 vs 2023
Scope 1, 2 and Other Direct	66 622	59 034	-11%

Table 1.2: Reduction in Scope 1, 2 and Other Direct Emissions since 2012

1.3. Recommendations

GCX has made various recommendations regarding carbon management and data management, which are detailed in the section "Recommendations" toward the end of this report, summarised as follows:

Data Management
There are still good opportunities for UCT to improve data quality and, therefore, the accuracy of emission results. Scope 2 data accuracy has improved into 2023 due to updated information from the GSB. Scope 3 data related to air travel has improved significantly as it now includes flight routes and classes, rather than expenditure. UCT has also begun the process of measuring the institution's carbon footprint earlier in the year to allow additional time for data collection and screening, which facilitates improved data accuracy and completeness.

Carbon Management
Carbon management strategies should focus on the greatest source of emissions over which UCT has operational control, which is currently the electricity consumption at Main Campus. Solar panels are installed at three locations across UCT's campuses which have already reduced emissions by 143 tCO_2e in 2022 and 2023 combined. Further rollout of solar PV is underway with a total of 500kWp being installed in 2024 across 4 buildings on various campuses. Further soalr PV will also be installed at the Faculty of

Health Sciences Campus in 2025. This will have an increasing positive impact on emissions over time. Additional recommendations regarding data and carbon management are discussed in Section 5.

2. INTRODUCTION

GCX was appointed by UCT to undertake the institution's 2023 financial year greenhouse gas assessment. This assessment follows annual consecutive inventories that have been measured since 2012. Using an Excel-based log, GCX indicated what data was required for the calculation of UCT's 2023 carbon footprint. The required data was collected by UCT from the relevant institutional departments and uploaded to an online filing system shared with GCX. Upon receipt of each data set, GCX reviewed and queried it to ensure it was applicable and comprehensive based on previous years' collections. Some updates were made where necessary. The following report discusses and illustrates UCT's greenhouse gas inventory results, followed by details of the methodology, assumptions and limitations, as well as recommendations for carbon management and data management at UCT going forward. Further details including all GHG Protocol reporting requirements, tables, figures and activity data have been provided in the additional report spreadsheet "*GCX_UCT_CFA Report_2023.xlsx*".

2.1. Boundaries

2.1.1. Temporal Boundary

An organisational carbon footprint covers a selected 12 month period. This assessment covers UCT's most recent financial year: 1 January – 31 December 2023.

2.1.2. Organisational Boundary

Emissions were consolidated using the operational control approach. Operational control exists when a company has the full authority to implement operating policies at the operation of the GHG emitting activities. UCT maintained the same organisational boundary as previous assessments, which encompasses 6 primary campuses / facilities as tabulated below. At the Graduate School of Business, UCT has operational control of the business school and conference centre, but the Protea Breakwater Lodge Hotel is under the operational control of a separate hotel operator. The UCT facilities on site are metered as part of the Protea Breakwater Lodge Hotel facility.

Facilities Included
Main Campus
Medical Campus
Off Campus Residences & Other Admin Buildings
Graduate School of Business
Hiddingh Campus
ICTS on Main

Table 2: UCT Organisational Boundary

The number of employed staff and enrolled students at UCT fluctuates annually and the final audited figures for the periods measured in this assessment were as follows:

Group	Population
Students	29 033
Staff	4 768
Total	**33 801**

Table 3: Populations of Students and Staff per Reporting Period

2.1.3. Operational Boundary

The diagram below outlines the extensive direct and indirect emission sources that can form the operational boundaries of an organisational carbon footprint. The footprint boundary was consolidated using the operational control approach. This apportions all activities and associated emissions under UCT's operational control into Scope 1 and 2, and those not under UCT's operational control into Scope 3.

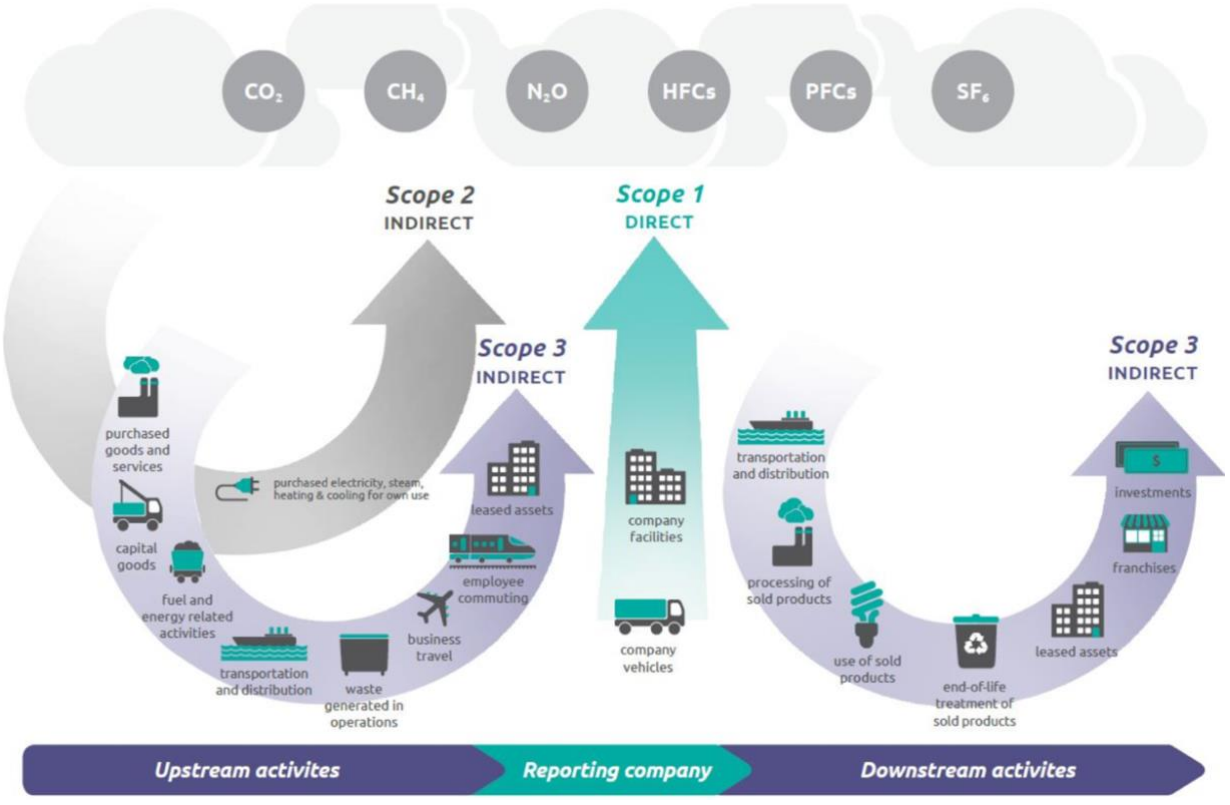

Figure 2: Operational Boundaries by Scope, Activity and Greenhouse Gas
Source: WRI, WBCSD GHG Protocol Corporate Accounting and Reporting Standard, Revised Edition, 2004

The following table lists all of the potential sources in the figure above, and indicates the complete operational boundary encompassed in this UCT carbon footprint assessment.

SCOPE 1			
Source	**Source Category**	**Explanation**	**Boundary**
Direct Emissions on site	Mobile Combustion	Fuel combusted in Company owned/controlled vehicles	✓
	Stationary Combustion	Fuel combusted onsite on company owned/controlled equipment	✓
	Fugitive emissions	Intentional or unintentional release of GHG	✓
	Process Emissions	GHG emissions from physical or chemical processing	NA
	Waste treatment emissions	Methane or other GHG emissions from waste processing. Company owned/controlled Waste Water treatment, landfills etc.	NA
Scope 2			
Source	**Source Category**	**Explanation**	
Indirect emissions from energy use	Purchase of Energy (heat, steam, Electricity) generated off site		✓
Out of Scopes			
Source	**Source Category**	**Explanation**	
Emissions on site	Fugitive emissions	Intentional or unintentional release of GHGs not included under the Kyoto Protocol	✓
	Biofuels	CO2 only. CH4 and N20 reported in Scope 1	NA
Scope 3			
Source	**Source Category**	**Explanation**	
Upstream Emissions	Purchased Goods and Services	Embedded emissions in purchased goods and services: Water Consumption, Paper Purchased, Food Provisions.	✓
	Capital Goods	Embedded emissions in purchased capital goods and equipment: Construction.	✓
	Fuel and energy related sources (not included in Scope 1&2)	T&D losses of purchased electricity, emissions from energy generated that is sold to end users, upstream emissions of purchased fuels & energy	✓
	Upstream transport and distribution	Transportation of goods/products to the company by a 3rd party. Transport of goods between company facilities by a 3rd party	X
	Waste generated in operations	Emissions from waste treatment at sites not owned by the company. Can include waste transport	✓
	Business travel	Transport of employees for the purposes of business activities	✓
	Employee Commuting	Emissions from transport of employees between home and work in vehicles not owned by the company	✓
	Upstream leased assets	Operation of leased assets by the company and not reported in Scope 1&2	NA
Downstream Emissions	Downstream Transport and distribution	Transportation of products sold by the reporting company, between the company and the end consumer. Transport is carried out by a 3rd party in vehicles not owned by the company and is not paid for by the reporting company	X
	Processing of sold products	Processing of intermediate product sold by the company	X
	Use of sold products	Emissions as a result of end use of products (Products that directly consume Electricity, emit GHGs or form GHGs from their use)	X
	End of life treatment of sold products	Waste disposal and treatment of EoL products	X
	Downstream leased assets	Operation of leased assets owned by the company and leased to other entities	X
	Franchises	Operation of franchises	NA
	Investments	Applicable to development, and private financial institutions. Operation of investments	X

Table 4: UCT 2023 Carbon Footprint Operational Boundary

3. RESULTS SUMMARY

3.1. Absolute Emissions

UCT's 2023 financial year results are tabulated below, alongside 2022 results for an annual comparison.

SCOPE	CATEGORY	tCO_2e		% Change	% of Total
		2022	2023	2023 vs 2022	2023
SCOPE 1	UCT-owned vehicles: UCT Shuttle	907	1 062	17%	1.0%
	UCT-owned vehicles: Vehicle Fleet	528	639	21%	0.6%
	Fugitive Emissions (Kyoto gases)	867	1 463	69%	1.3%
	Stationary Combustion: LPG	48	19	-61%	0.02%
	Stationary Combustion: Diesel for Generators	1 052	3 707	252%	3.4%
	Energy Generation: On-site Solar	0	0	-	-
SUB-TOTAL SCOPE 1		**3 402**	**6 889**	**102%**	**6%**
SCOPE 2	Electricity: Main Campus	32 698	29 106	-11%	26%
	Electricity: Medical Campus	10 613	9 753	-8%	8.9%
	Electricity: Off Campus residences	11 054	10 718	-3%	9.7%
	Electricity: GSB	748	963	29%	0.9%
	Electricity: Hiddingh	508	540	6%	0.5%
	Electricity: ICTS on Main	988	856	-13%	1%
SUB-TOTAL SCOPE 2		**56 608**	**51 935**	**-8%**	**47%**
SCOPE 3	Category 3: Fuel and Energy-Related Activities	18 341	16 372	-11%	15%
	Category 6: Business Travel - Land	332	274	-17%	0.2%
	Category 6: Business Travel - Air	5 946	8 072	36%	7%
	Category 7: Employee Commuting	10 327	9 853	-5%	9%
	Category 1: Purchased Goods & Services: Food	7 254	8 864	22%	8.0%
	Category 1: Purchased Goods & Services: Paper	355	429	21%	0.4%
	Category 1: Purchased Goods & Services: Water	365	667	83%	0.6%
	Category 5: Waste Generated in Operations	1 484	1 281	-14%	1.2%
	Category 2: Capital Goods: Construction	13 493	5 323	-61%	5%
SUB-TOTAL SCOPE 3		**57 896**	**51 136**	**-12%**	**46%**
OTHER DIRECT	Fugitive Emissions (non-Kyoto gases)	144	209	45%	0.2%
TOTAL EMISSIONS		**118 051**	**110 170**	**-7%**	**100%**

Table 5: UCT 2023 Carbon Footprint Results Summary, relative to 2022 Results

Avoided Emissions
This is the second year that UCT has reported the use of renewable electricity. Although a small amount was generated in 2021, the data related to it was unavailable at that time and was excluded from the 2021 assessment. Due to the generation of 93,370 kWh of renewable electricity from solar panels installed at three locations at UCT-controlled facilities, Scope 2 emissions in 2023 were reduced by 92 tonnes of CO_2e.

Emissions by Scope
The 2023 financial year's emissions are displayed by Scope in the pie chart below, showing the significant impact of Scope 2 and 3 on the institution's carbon footprint with only 6% of emissions arising from Scope 1.

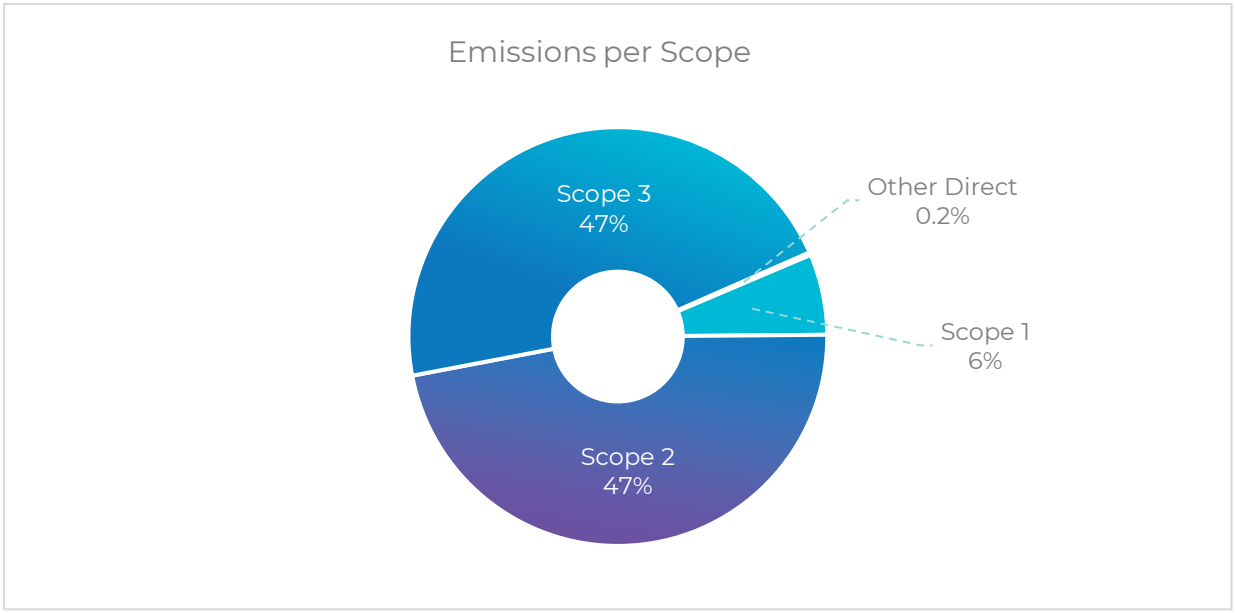

Figure 3: UCT's 2023 Total Carbon Footprint Emissions per Scope

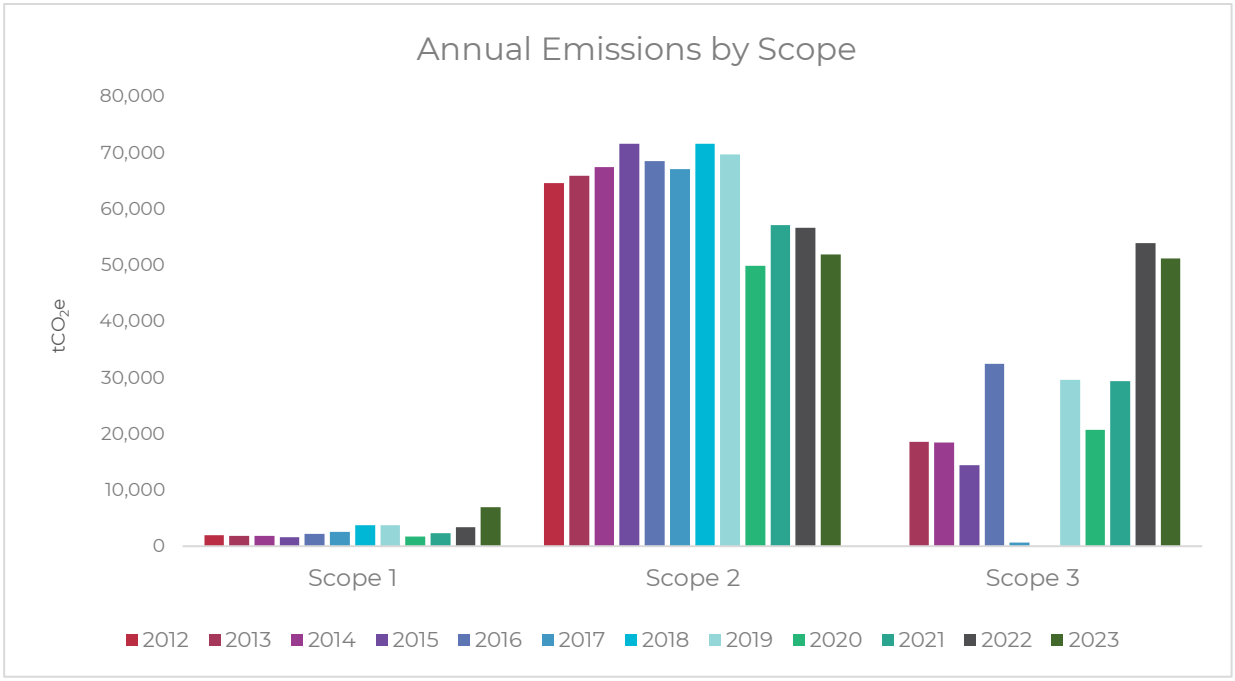

Figure 4: Annual Emissions by Scope

3.2. Intensity Metrics

There can be notable fluctuations in Scope 3 emissions, across different organisations and within the same institution year-on-year, due to changes in data availability or through broadening the boundary of Scope 3 categories included in an assessment. Therefore, tracking emission fluctuations over time is best conducted by reviewing only Scope 1, 2 and Other Direct emissions (fugitive emissions from non-Kyoto gases). Emission intensity results are compared with UCT's original baseline 2012 assessment in the table below, which shows a 16% decrease in emissions per square metre, and a 20% reduction in emissions per capita since 2012.

Intensity Metrics	Financial year		% Change
	2012	2023	2012 vs 2022
Gross Area (m^2)	649 494	684 125	5%
tCO_2e / m^2 / annum	0.103	0.086	-16%
Population	30 579	33 801	11%
tCO_2e / capita / annum	2.180	1.75	-20%

Table 6: UCT 2012 and 2023 Intensity Metrics Comparison

The figure below illustrates the annual tracking of these metrics since UCT began measuring emissions in 2012. Emissions per square metre (green) are illustrated on the left axis, while emissions per capita (purple) are shown on the right. Both metrics dropped in 2020 due to Covid-19 lockdowns and rose thereafter, although both remain below pre-lockdown levels.

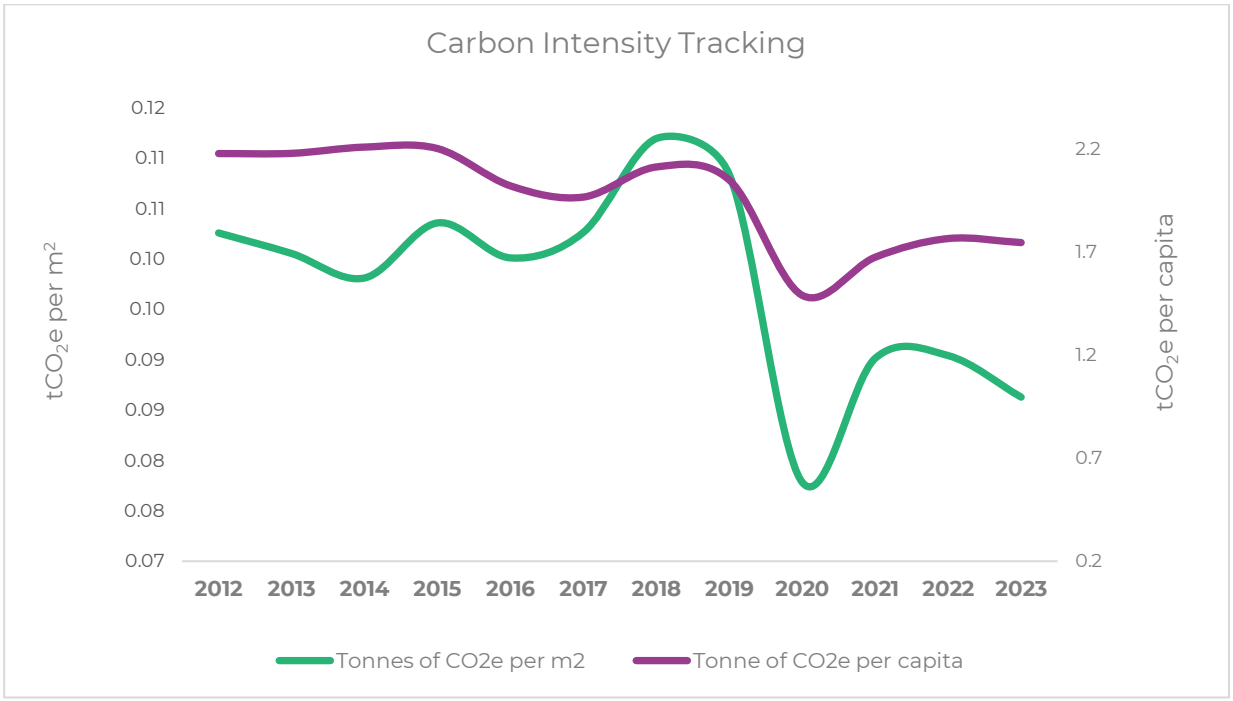

Figure 5: Annual Fluctuations in GHG Emissions Intensity Metrics

3.3. Scope 1

The figure below provides a breakdown of UCT's Scope 1 emissions per source. Direct emissions dropped significantly in 2020 due to the Covid-19 lockdowns. During 2021 and 2022 emissions rose to pre-lockdown levels. However, in 2022 the emissions profile shifted such that fewer fugitive refrigerant gases escaped, but notably more emissions resulted from diesel used in generators. This emissions profile has continued with a large increase in emissions from diesel used in generators into 2023, as well as larger quantities of fugitive refrigerant gases, altogether resulting in a doubling in Scope 1 emissions between 2022 and 2023. The sections below expand on the results of each Scope 1 emission source for the 2023 financial year. Notably the refrigerant gas related emissions are still less than the pre-lockdown values from 2019 and 2018.

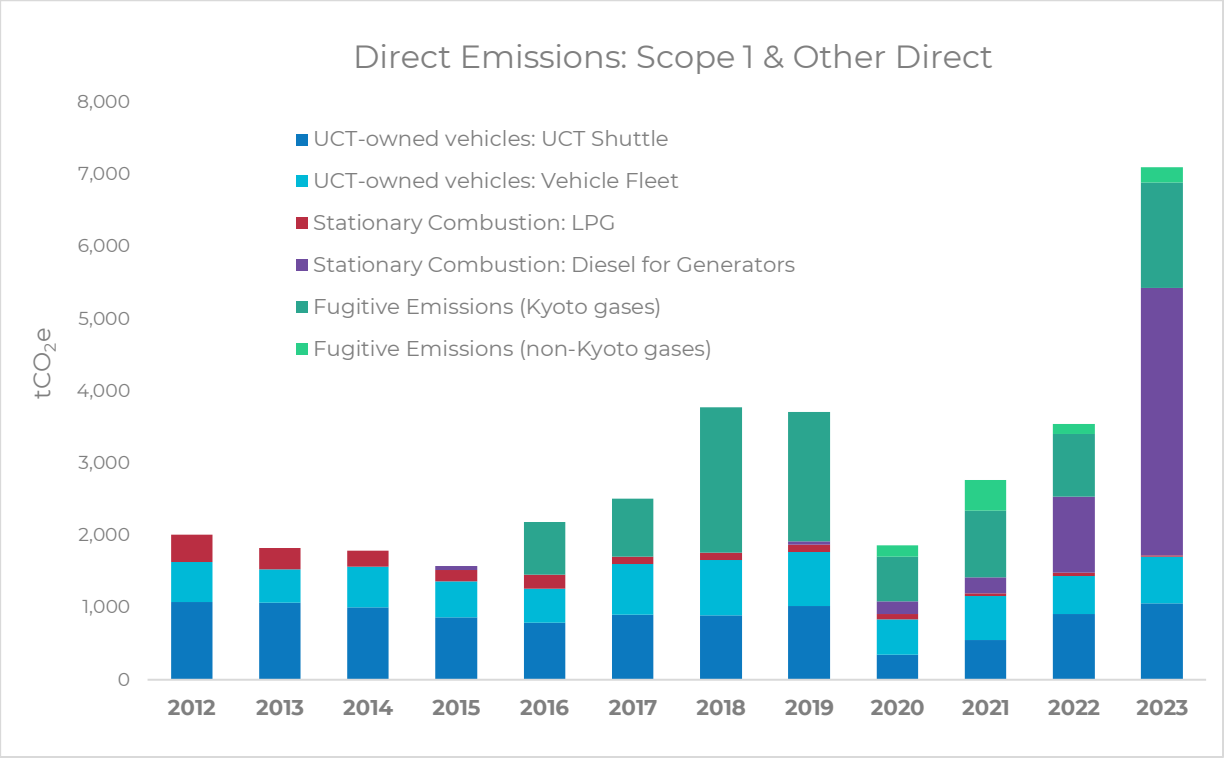

Figure 6: Annual Fluctuations in Scope 1 (Direct) GHG Emissions per Source

SCOPE 1	tCO₂e											
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
UCT Shuttle	1 076	1 068	1 006	861	790	902	889	1 025	348	547	907	1 062
Vehicle Fleet	557	465	556	503	475	697	769	748	486	612	528	639
Fugitive Emissions	-	-	-	-	733	807	2 012	1 793	782	1 342	1 011	1 672
LPG combustion	372	289	230	160	191	102	105	95	71	40	48	19
Diesel combustion	-	-	-	53	-	-	-	50	177	223	1 052	3 707
TOTAL	**2 005**	**1 823**	**1 792**	**1 577**	**2 188**	**2 507**	**3 774**	**3 711**	**1 864**	**2 763**	**3 547**	**7 099**

Table 7: Annual Scope 1 GHG Emissions per Source (including Other Direct emissions)

3.3.1. Shuttle Emissions

UCT Shuttle emissions arise from the mobile combustion of fuel in its shuttle fleet vehicles, which help to transport students and staff to and from campuses. The fleet includes 28 buses and 2 minibuses. Emissions are reported separately for UCT's vehicle fleet and the UCT shuttle fleet, as this will aid the institution's carbon management strategy. In 2023 the shuttle fleet required a total of 363,213 litres of diesel, which resulted in 1,062 tonnes of CO_2e emissions. The figure below illustrates how shuttle activity has started rise again after the sharp decline during 2020 and 2021 lockdowns, but are lower than 2019 levels.

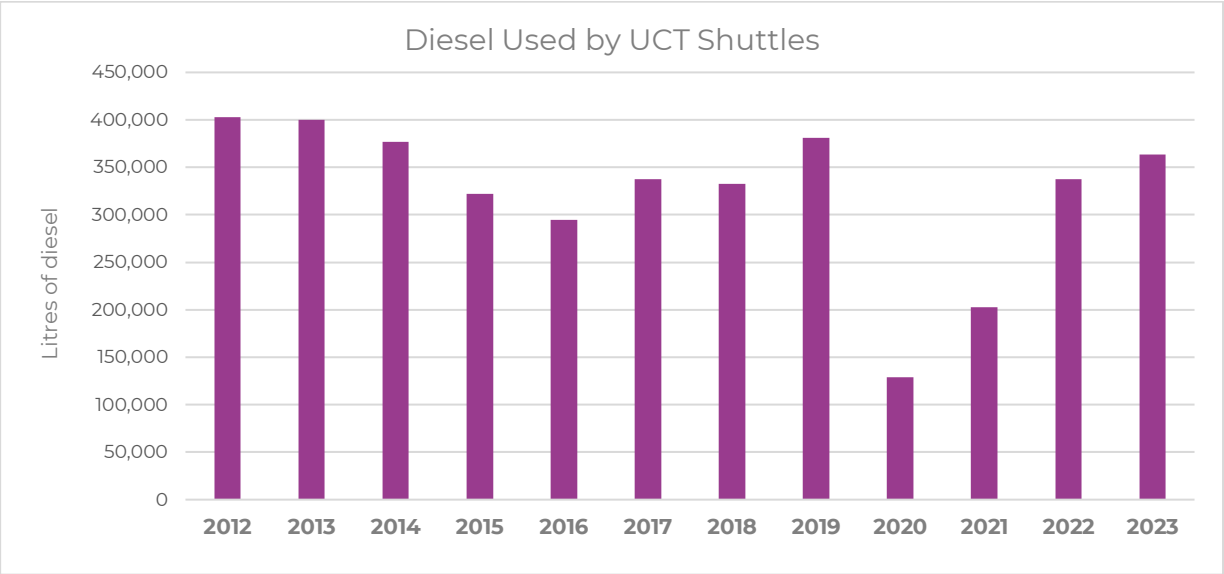

Figure 7: UCT Shuttle Fuel Use per Annum

3.3.2. Vehicle Fleet Emissions

UCT's fleet of various vehicle types, which utilise both petrol and diesel, required a total of 110,017 litres of diesel and 131,808 litres of petrol during 2023. This mobile combustion resulted in 639 tonnes of CO_2e of direct emissions. This contributes 9% of direct emissions and fleet emissions have increased by 21% relative to 2022, but substantially lower than 2018 and 2019 levels.

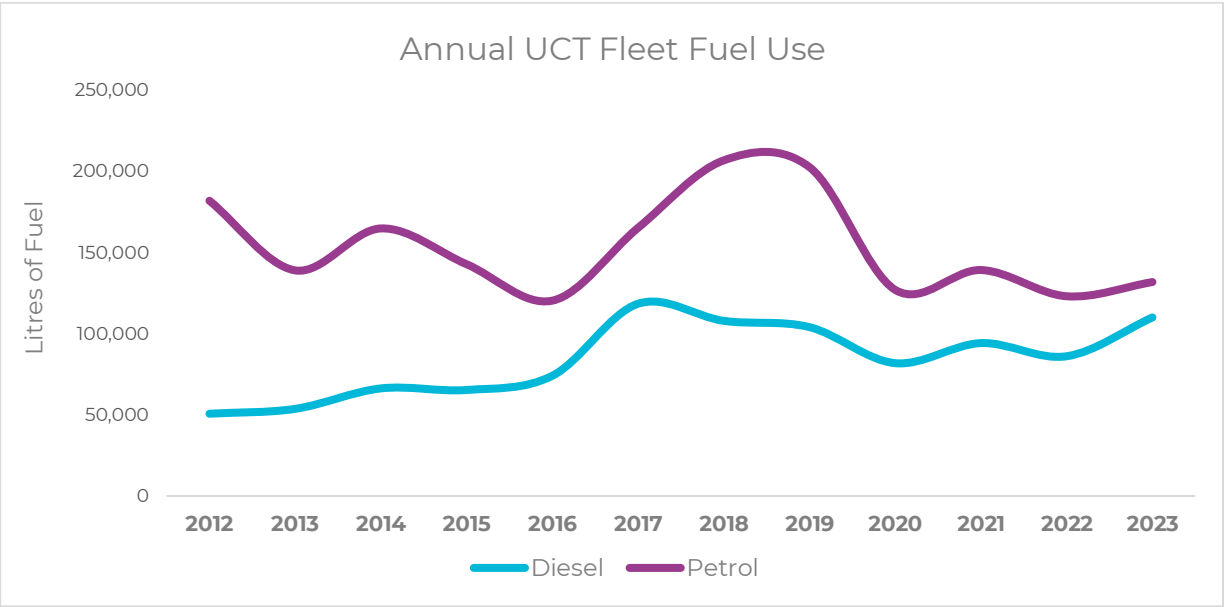

Figure 8: UCT Vehicle Fleet Fuel Use per Annum

3.3.3. Refrigerant Gas Emissions

Fugitive refrigerant gas emissions refers to various types of gases used in HVAC, air-conditioning, refrigeration systems and heat pumps that escape into the atmosphere due to system leaks. Refrigerant gases have high global warming potentials, which means they have a negative impact on the atmosphere and easily raise total greenhouse emissions in an inventory such as UCT's. HCFCs such as R22 (freon) are ozone depleting substances which should be avoided for use in air-conditioning systems. UCT's use of R22 has declined over time while the use of HFC's such as R410A have remained quite high. The refrigerant gas A32 was utilised for the first time in 2023, which has a lower global warming potential than all the other gases used at UCT's facilities. For a list of gases used and their respective global warming potentials, please refer to the accompanying report *GCX_UCT_CFA Report_FY23.xlsx*. Overall levels are lower than 2018 and 2019 pre-lockdown levels.

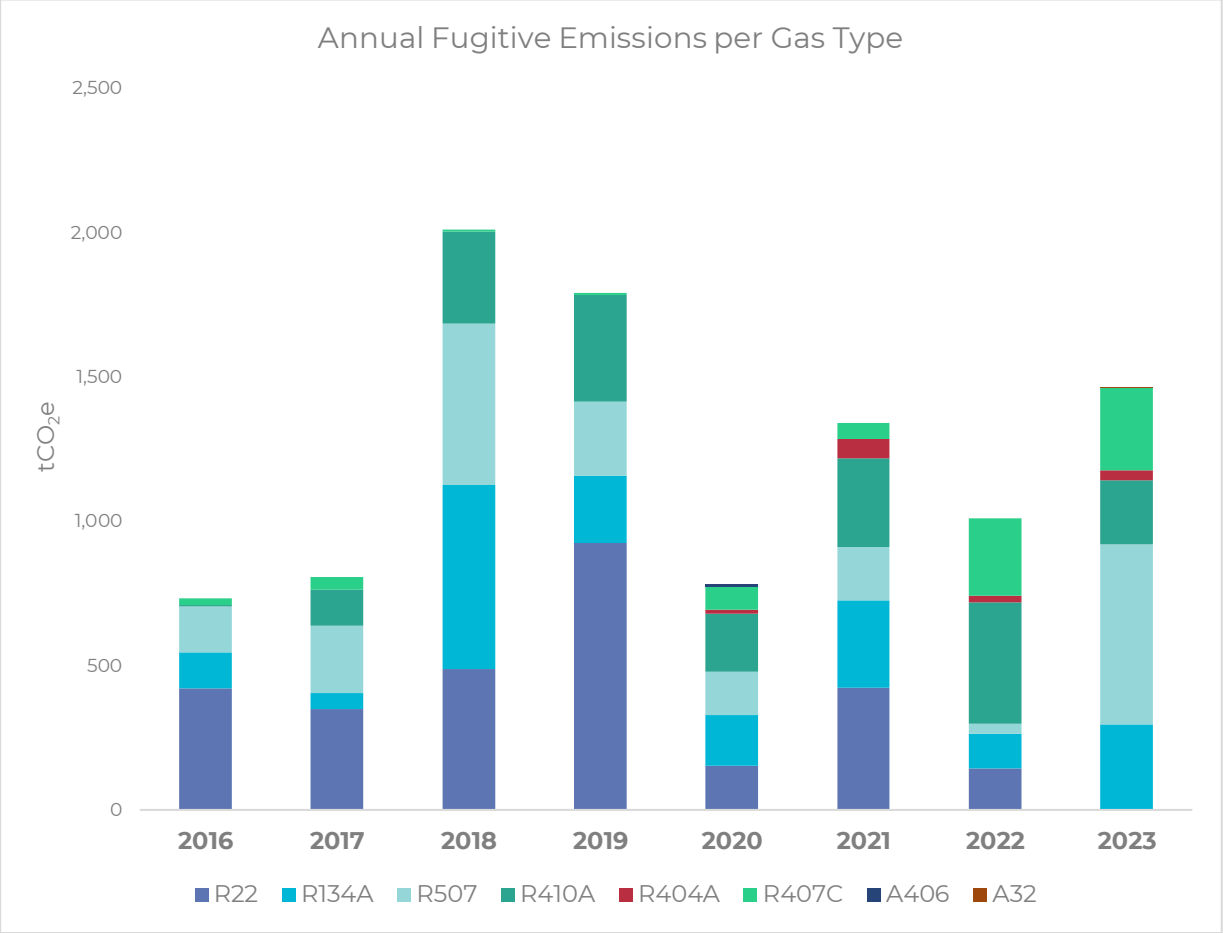

Figure 9: Annual Fugitive Emissions per Gas Type

3.3.4. Stationary Combustion Emissions

When fuel is combusted for the purpose of energy generation in stationary (non-mobile) equipment such as generators or cooking equipment, greenhouse gases are released into the atmosphere. UCT makes use of LPG (Liquid Petroleum Gas) in cooking equipment and water heaters, as well as diesel in back-up power generators.

The figure below illustrates the impact of load shedding on UCT's diesel use in generators. Over the course of 2023 South Africa experienced 6,950 hours of load shedding. UCT required 1,394,650 litres of diesel to provide back-up power when needed during load shedding. The increased consumption also reflects

the use of additional equipment as the institution procured and installed a few more generators during the reporting year.

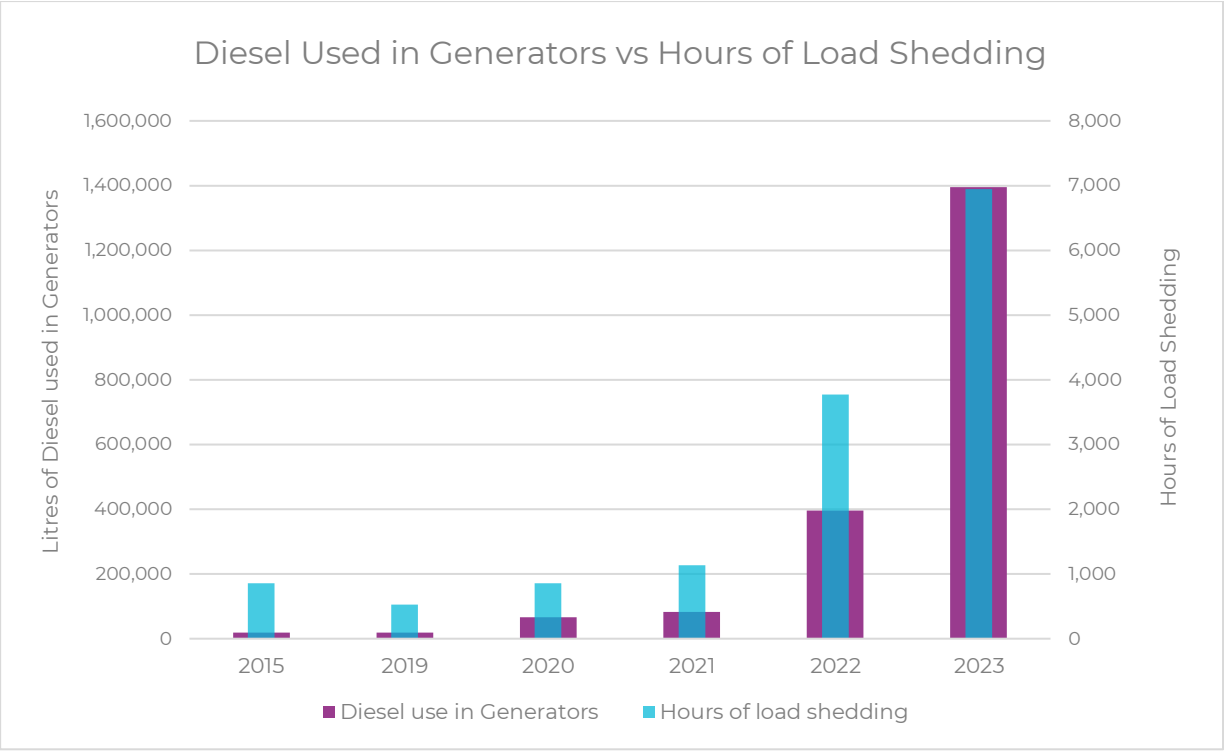

Figure 10: Annual Diesel Consumption and Hours of Load Shedding

Aside from generators, stationary fuel combustion at UCT also includes the use of LPG. Where LPG was purchased by UCT, the associated emissions are reported as stationary combustion emissions. With UCT's shift from LPG water heaters to heat pumps, and more centralised cooking practices, LPG use has steadily declined year-on-year. With a significant decrease between 2022 and 2023, emissions arising from the stationary combustion of LPG totalled 19 tonnes of CO_2e, which contributed only 0.3% to direct emissions.

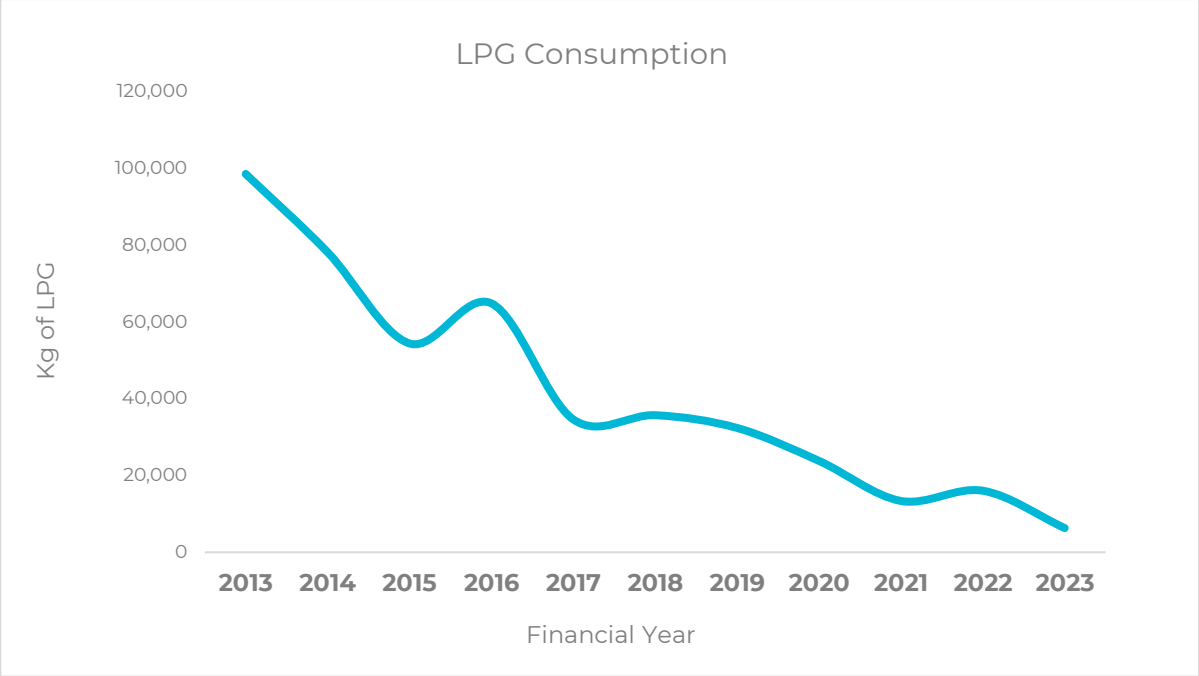

Figure 11: Annual LPG Consumption

3.4. Scope 2

Scope 2 emissions are indirect greenhouse gas emissions associated with the production of purchased electricity. Although UCT does not produce these emissions, the institution does have operational control over the quantity of electricity used. Emission results are determined based on annual emission factors released by South Africa's Department of Forestry, Fisheries and the Environment in their Grid Emission Factors Report released in 2023 (available here). UCT's 2023 Scope 2 emissions are derived from an emission factor of 0.985 kgCO_2e per kWh. The figure below illustrates Scope 2 emissions per UCT campus / facility during each financial year to date.

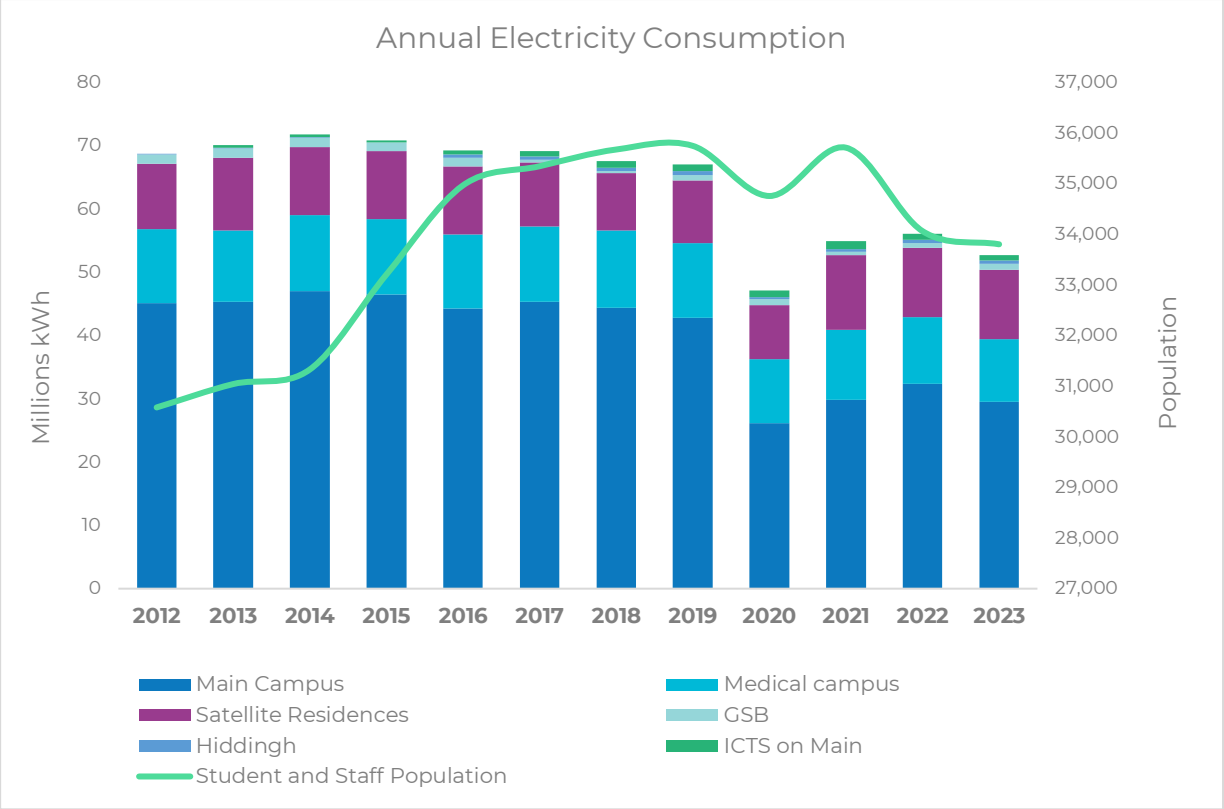

Figure 12: Annual Electricity Consumption Fluctuations per Campus vs UCT Population

This figure shows a slight decrease in total kWh of electricity consumed between 2022 and 2023. Challenges with accurate electricity data collection at the Graduate School of Business have been overcome. Confidence in these 2023 results is improved and a corrected figure for UCT's 2022 assessment was also provided, and the amended emission results are displayed throughout this report. The table below lists the associated emissions per year showing the small decrease is Scope 2 emissions since 2022. This is influenced by the hours of load shedding during 2023, which increased sharply relative to 2022.

Campus	tCO_2e											
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Main Campus	42 394	42 583	44 226	46 933	43 774	44 001	47 024	44 512	27 750	31 077	32 698	29 106
Medical campus	11 044	10 648	11 241	12 027	11 654	11 477	12 993	12 238	10 734	11 475	10 613	9 753
Satellite Residences	9 702	10 729	10 141	10 850	10 633	9 885	9 585	10 375	8 980	12 202	11 054	10 718
GSB	1 363	1 417	1 393	1 387	1 382	327	301	839	980	611	748	963
Hiddingh	116	116	112	0	527	504	622	602	381	464	508	540
ICTS on Main	0	342	335	372	534	834	1 096	1 141	1 076	1 241	988	856
	64 617	**65 835**	**67 447**	**71 569**	**68 505**	**67 028**	**71 621**	**69 706**	**49 902**	**57 069**	**56 608**	**51 935**

Table 8: Annual Scope 2 Emissions per Facility

Main Campus continues to contribute the largest share of Scope 2 emissions at 56%. It also makes up 26% of total 2023 greenhouse gas emissions. As such, this should be a primary focus in UCT's carbon management strategy. Although Scope 2 provides UCT with a carbon management challenge, it also provides the greatest opportunity of all emission sources for UCT to implement emission reduction initiatives that can significantly impact the overall carbon footprint.

Population numbers referred to in this report reflect the number of enrolments at UCT. This year we observe a correlating decrease in both the electricity used and the staff and student population during

2023. In some cases administration staff are working remotely, which is also reducing energy consumption.

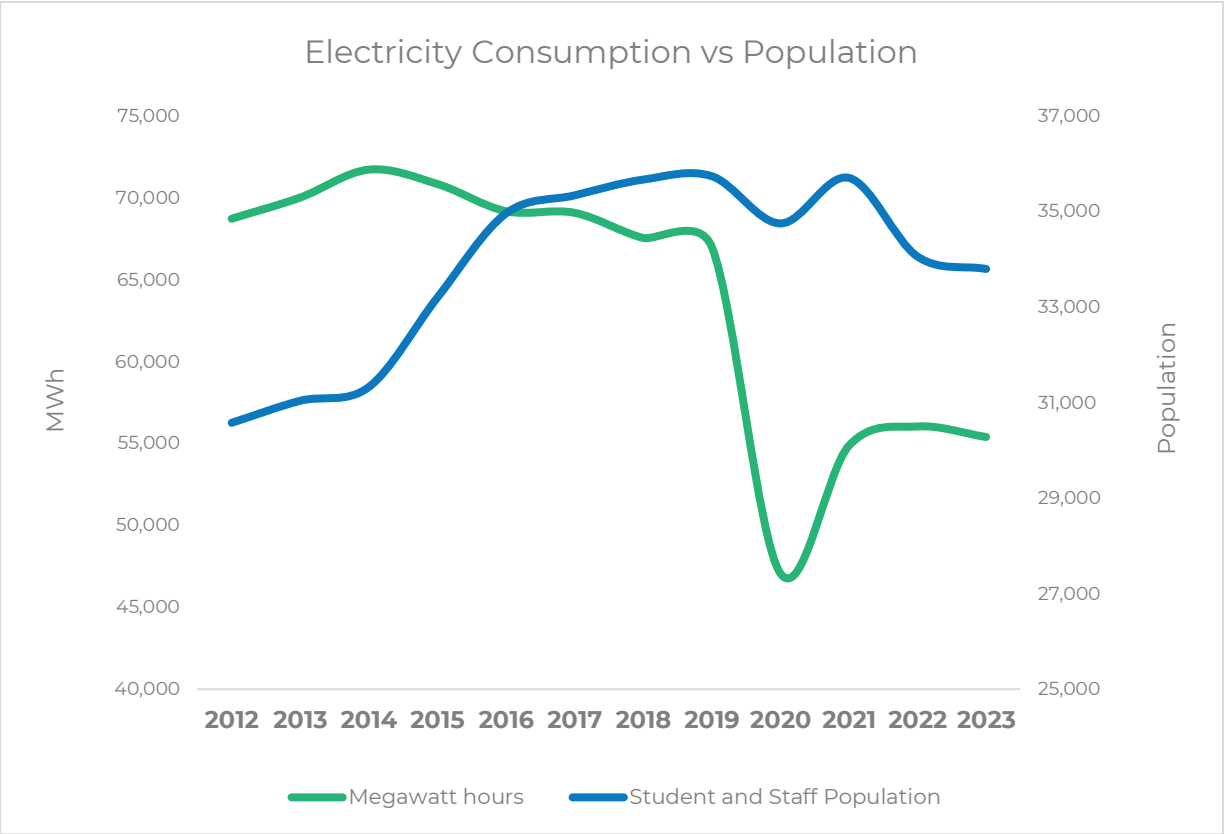

Figure 13: Annual Fluctuations in Electricity Consumption vs Population

3.5. Scope 3

Indirect emission sources arising from activities upstream and downstream from an organisation are reported within the 15 categories of Scope 3. Unlike Scope 1 and 2 sources, reporting Scope 3 emissions is optional. However, there is value in accounting for these. Certain categories would be considered relevant to an organisation's carbon footprint, depending on the nature of the business or activities that they conduct. UCT currently reports 6 of these categories (where food, water and paper supply fall into the same category "Purchased Goods and Services"), which is a robust boundary and encompasses some material emissions-generating activities. The results for 2023 are discussed below.

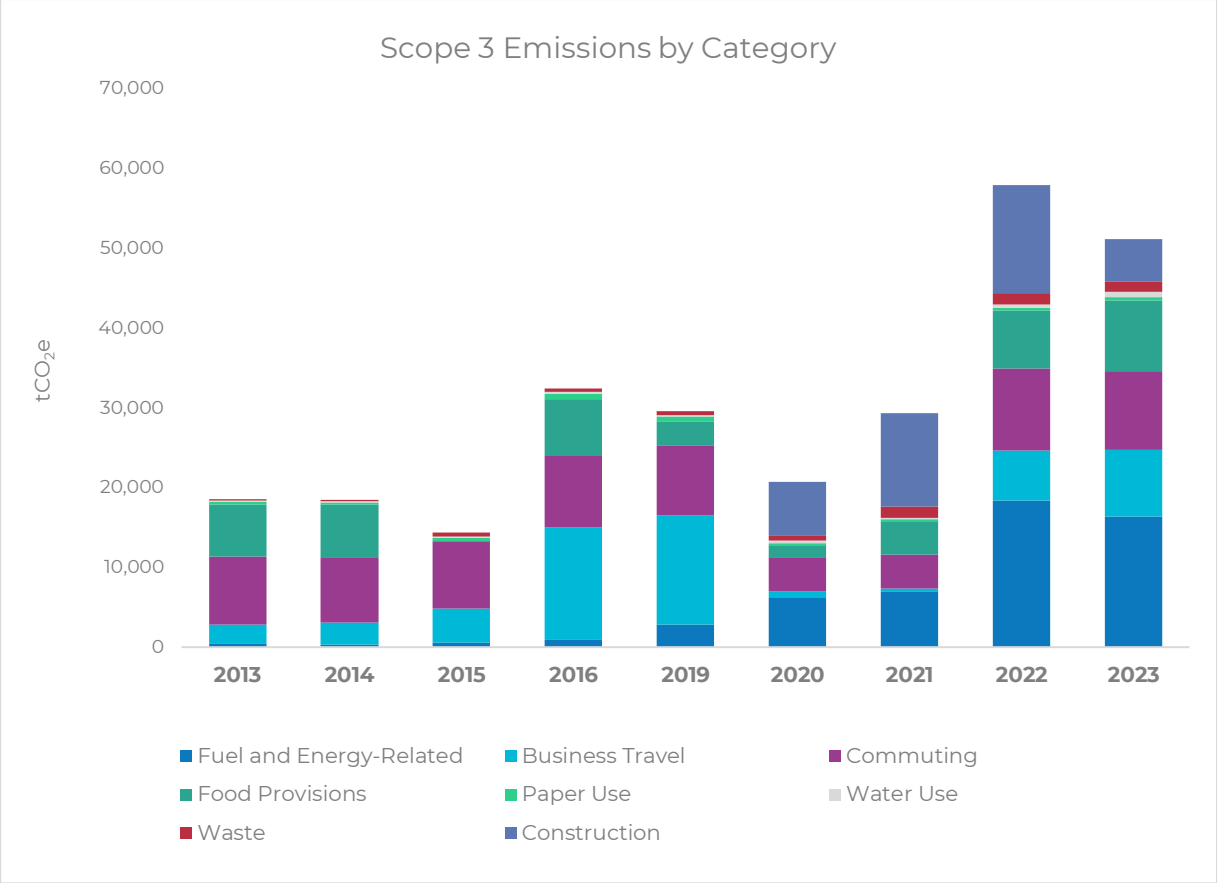

Figure 14: Annual Scope 3 Emissions per Emission Category
Note: Scope 3 emissions were not reported in 2012 or 2018, while minimal sources were reported in 2017

Scope 3 emissions have decreased by 12% overall since 2022. Fuel and Energy-Related Activity emissions have decreased as a function of reduced Scope 2 emissions, as this accounts for the upstream portion of emissions arising from the production, processing and transport of fuel (such as coal) before it is combusted to produce electricity.

Emissions associated with air travel have increased by 36% between 2022 and 2023. This may reflect increased travel activity but is more likely to be a result of the improved accuracy in the applied methodology for 2023: emissions were calculated based on actual flight routes and classes for a portion of activity for which flight reports were available. To account for the balance of flight activity for which primary data was not available, the calculated results were extrapolated based on the remaining expenditure. UCT's 2022 flight emissions were estimated based 100% on expenditure and estimated costs per passenger kilometre, where challenges still existed in isolating expenditure on flights only.

Scope 3	tCO_2e											
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Fuel and Energy-Related Activities	-	409	341	581	890	-	-	2 842	6 232	6 920	18 341	16 372
Business Travel - Land	-	385	124	262	228	-	-	304	48	42	332	274
Business Travel - Air	-	2 021	2 628	3 996	13 902	-	-	13 424	763	395	5 946	8 072
Employee Commuting	-	8 566	8 217	8 465	9 071	-	-	8 671	4 245	4 219	10 327	9 853
Purchased Goods & Services: Food	-	6 485	6 549	0	7 022	-	-	2 970	1 467	4 253	7 254	8 864
Purchased Goods & Services: Paper	-	386	305	382	667	-	-	708	271	249	355	429
Purchased Goods & Services: Water	-	121	139	138	194	174	-	179	321	147	365	667
Waste Generated in Operations	-	175	143	558	452	506	-	506	584	1 384	1 484	1 281
Capital Goods: Construction	-	-	-	-	-	-	-	-	6 798	11 758	13 493	5 323
TOTAL	-	18 547	18 446	14 382	32 427	680	-	29 605	20 729	29 366	57 896	51 136

Table 9: Scope 3 emissions per category

3.5.1. Fuel- and Energy-Related Emissions

This category includes emissions related to the upstream production and transport of the fuels and energy purchased and consumed by UCT, referred to as "Well-to-Tank" (WTT) emissions for fuels consumed, as well as "Transmission and Distribution Loss" emissions related to electricity consumed. The scope was increased in 2022 to include WTT emissions associated with electricity generation and electricity lost during transmission and distribution within the municipal grid, and WTT emissions associated with commuting. The results in this category are entirely dependent on the activity, so when electricity use, business travel and commuting activity decrease, the emissions in this category will decrease too.

3.5.2. Construction Emissions

This category covers the upstream embedded greenhouse gas emissions in the materials used to construct UCT's capital goods. The quantified result is based on secondary expenditure data and, as such, should be considered a general estimate of emissions. Ideally primary data will be logged in the form of material quantities and supplier-specific emission factors to enable more accurate quantification of construction emissions, and to account for any green building practices. While in 2022 UCT spent R256 million on construction, this quantity dropped by 62% in 2023 to R96 million. The resulting estimated greenhouse gas emissions have reduced accordingly.

3.5.3. Purchased Goods and Services Emissions

Food Provisions

UCT food supply activity includes food that is supplied to first-tier residences by the number of breakfasts, lunches and dinners, as well as bakery and food items supplied by vendors that operate on campus. Based on the data provided, upstream emissions embedded within food provisions increased 22% between 2022 and 2023, primarily due to a greater quantity of campus vendor food items sold during the most recent reporting year.

Water Consumption

Water data was supplied via SAP, in addition to consumption data from UCT's Graduate School of Business and from UCT residences. This is the first year that data was provided for UCT residences and this enables a more complete greenhouse gas emission result associated with water consumption at the institution. GCX continues to apply a South Africa-specific emission factor for water supply, which is more appropriate than that which was applied in assessments prior to 2020. The emission factor is updated annually based on updates to the country's grid emission factor. Water use emissions increased from 365 tCO_2e in 2022 to 667 tCO2e in 2023 due to the new inclusion of residence water consumption data.

Paper Purchased

UCT purchases office paper and custodial paper, as well as paper and books used for exams. Greenhouse gas emissions are embodied in these papers during the production and transportation of the material. Paper use emissions increased 21% between 2022 and 2023.

3.5.4. Commuting Emissions: Staff and Students

Commuting Emissions are based on a survey taken in 2014. However, the data is updated based on the updated populations of students and staff commuting to and from campus. As expected, due to many students remaining at home during 2020 and much of 2021, emissions dropped during those years and have increased into 2022. The increase into 2022 was exaggerated by the addition of WTT emissions to this category's total. Total emissions decreased by 5% into 2023 as a function of slightly lower population numbers.

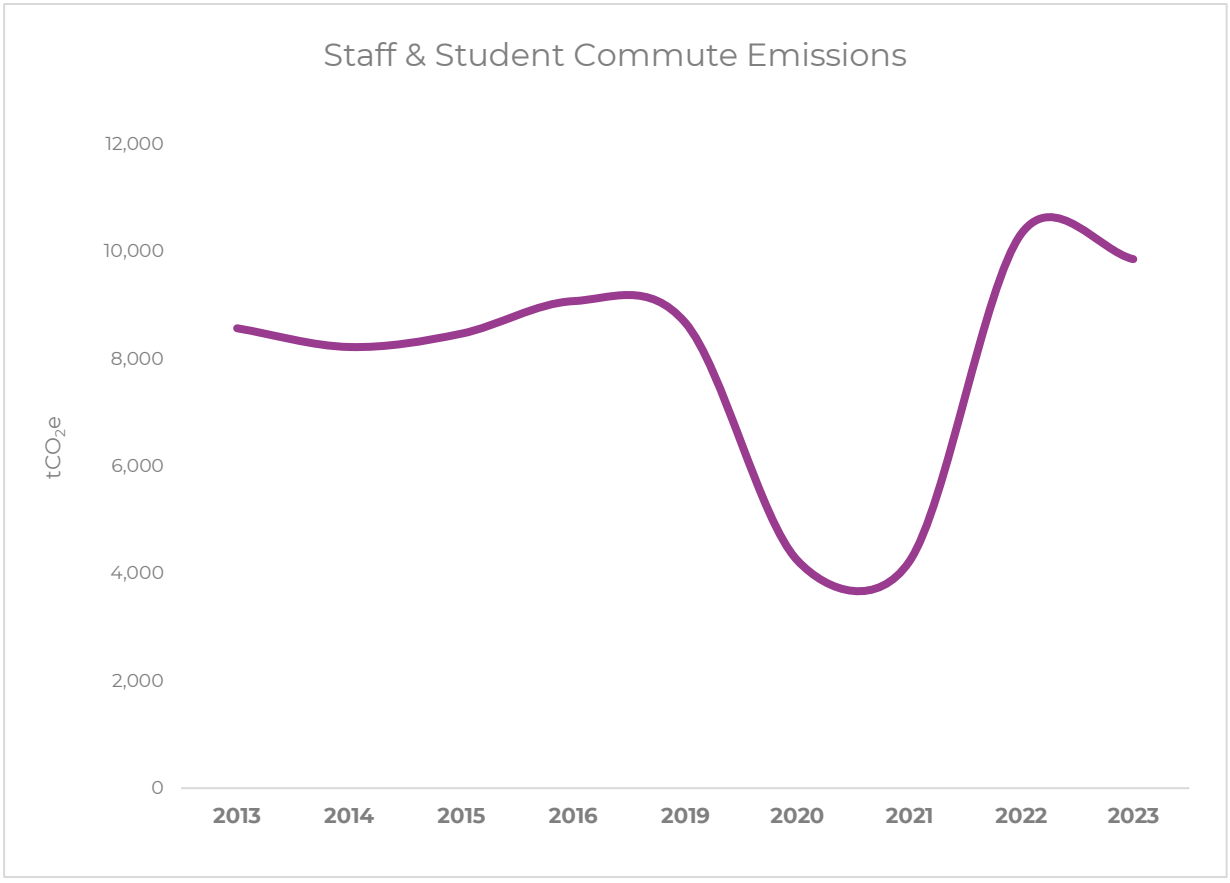

Figure 15: Annual Commuting Emissions Fluctuations

3.5.5. Business Travel Emissions

UCT's business travel emissions include air travel, car hire (local and international), staff reimbursed travel and travel allowances. Emissions associated with air travel have increased by 36% between 2022 and 2023. This may reflect increased travel activity but is more likely to be a result of the improved accuracy in the applied methodology for 2023: emissions were calculated based on actual flight routes and classes for a portion of activity for which flight reports were available. To account for the balance of flight activity for which primary data was not available, the calculated results were extrapolated based on the remaining expenditure. UCT's 2022 flight emissions were estimated based 100% on expenditure and estimated costs per passenger kilometre, where challenges still existed in isolating expenditure on flights only. The values are still more than half of the 2017, 2018 and 2019 pre-lockdown levels.

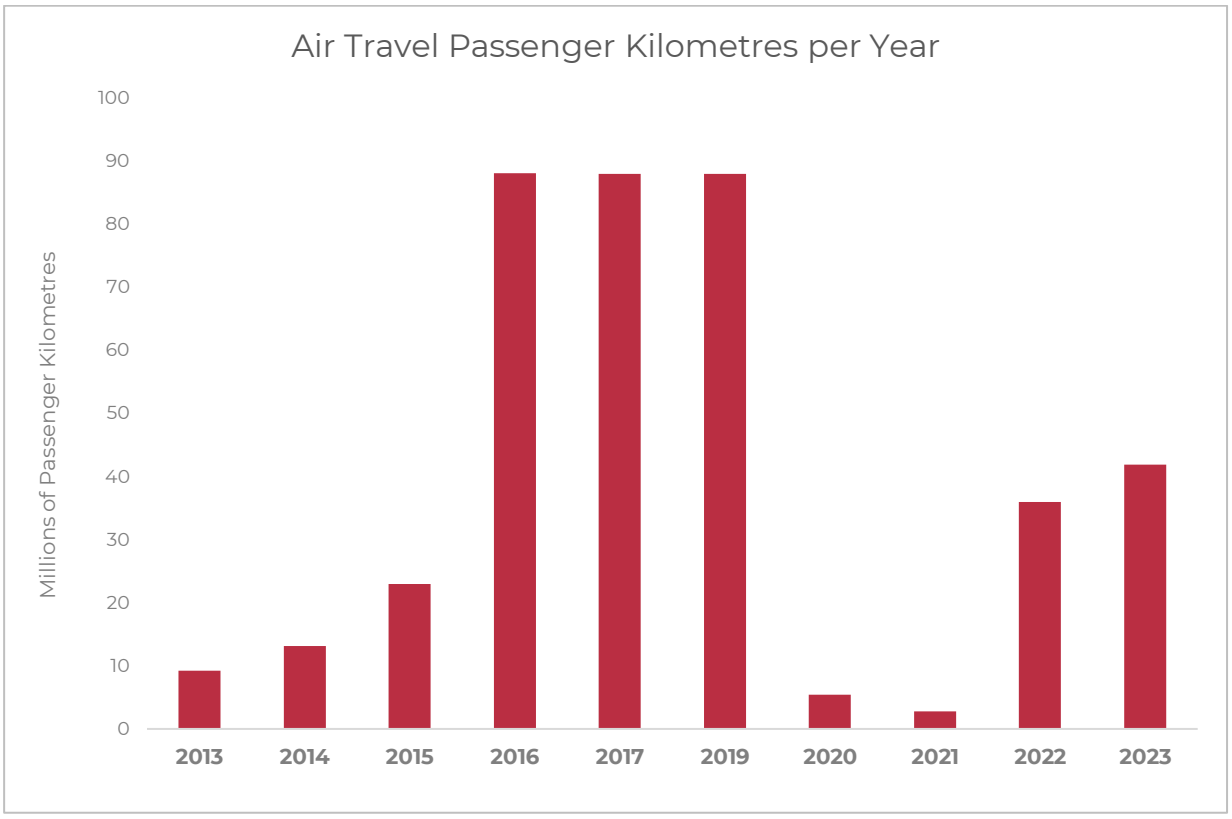

Figure 16: Annual Air Travel Emission Fluctuations

3.5.6. Waste Generated Emissions

Indirect emissions from waste generation occur due to disposal, treatment method and transport of waste types. In 2023, 78% of UCT's waste generated was sent to landfill, which is exactly consistent with previous years. The university has several recycling initiatives in place which reduce overall emissions from this source. Total waste emissions decreased 14% between 2022 and 2023.

4. TARGETS

UCT has set the following targets:

Net Zero emissions by 2050 (Scope 1 and 2)

- This requires a 2 – 5% reduction in emissions per annum from 2020 onwards.
- The baseline year from which these reductions must be shown has been changed to 2019, because 2020 was a year of COVID lockdowns with very little activity on campus
- So far UCT shows a total reduction of 20% since 2019, with an average 5% decrease per annum

Due to the impact of Covid-19 lockdowns which caused decreased activity throughout UCT, the 2020 emissions were unusually low and did not reflect the "normal" operating conditions of the institution. As expected, activity began to rise the following year and consequently these emissions increased by 16% in 2021, with most activity returning to pre-lockdown levels in 2022. It is therefore more appropriate to use 2019 as the baseline from which reductions are being measured off. One can thus see an overall 20% reduction of UCT's Scope 1, 2 and Other Direct emissions between 2019 and 2023, averaging 5% per annum.

Emissions	tCO_2e		% Change
	2019	2023	2019 vs 2023
Scope 1, 2 and Other Direct	73 417	59 034	-20%

Table 10: % Change in Scope 1, 2 and Other Direct Emissions since 2019

Due to UCT's practice of annual carbon footprint measurement since 2012, it is also possible to track the changes in Scope 1, 2 and Other Direct emissions since that initial assessment year. The trend below clearly illustrates the impact of Covid-19 on 2020 and 2021 emissions, followed by a slight normalisation into 2022.

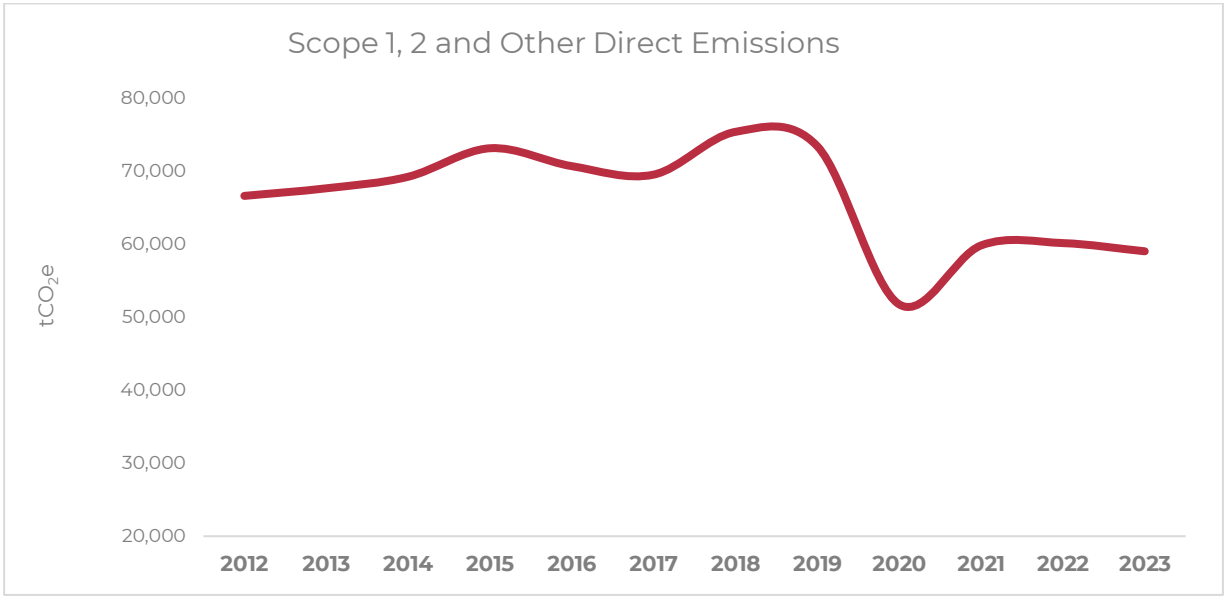

Figure 17: Annual Fluctuation in Scope 1, 2 and Other Direct Emissions

Looking at the change in emissions since UCT's first assessment, the institution's greenhouse gas emissions have declined by 11% since 2012. This should take into account that generator diesel emissions were not reported until 2015 and fugitive refrigerant gas emissions were not reported until 2016. However, the majority of these emissions arise from Scope 2, which has been reported relatively consistently throughout the years.

Emissions	tCO_2e		% Change
	2012	2023	2012 vs 2023
Scope 1, 2 and Other Direct	66 622	59 034	-11%

Table 11: % Change in Emissions since 2012

Renewable Electricity at UCT

Thanks to the generation of 93,370 kWh of renewable electricity from solar panels installed at three locations at UCT-controlled facilities, Scope 2 emissions have been reduced by 92 tonnes of CO_2e in 2023. Scope 2 provides the greatest opportunity for emission reductions at UCT and the most effective approach for the institution to maintain its reduction target. Further solar PV installations are being installed and the impact will be tracked in all UCT greenhouse gas inventories going forward.

5. RECOMMENDATIONS

5.1. Carbon Management

Carbon footprint assessment results can inform where an organisation should focus its reduction efforts, in terms of emission sources and facilities. There are certain parameters that should be taken into account, including:

- The relative contribution of an emission source to UCT's overall carbon footprint
- The control that UCT has over an emissions-generating activity
- Confidence in the existing data and results

Scope 2

Scope 2 emissions amounted to 51,935 tCO_2e which contributed 47% of UCT's most recent greenhouse gas inventory. Of this, 56% are accounted for by electricity consumption on Main Campus. **Electricity consumption at Main Campus still offers the greatest opportunity for emission reductions within UCT's carbon footprint**. Although these are indirect emissions which take place off-site, the consumption of grid electricity at the facilities within the assessment boundary is under UCT's operational control. Although some improvements can be made in terms of clarifying the Scope 2 boundary, data quality and completeness is improving. With the rollout of various solar PV installations on UCT campuses, future inventories will continue to take into account avoided emissions related to the use of renewable energy. If UCT continues on a journey to transition from grid to renewable electricity use, combined with energy efficiency initiatives throughout its campuses for lighting and air conditioning, these avoided emissions will further displace Scope 2 emissions over time.

Scope 1 and 3

Although Scope 1 contributes a smaller portion of UCT's total carbon footprint, there are still opportunities for reducing emissions, as well as reducing the institution's overall environmental impact.

Shuttle and vehicle fleets:

UCT has done a detailed investigation into the feasibility of converting its shuttle and vehicle fleet to electric vehicles. Under the current high carbon intensity grid-conditions and UCT's lack of space for a very large centralised solar PV installation, it is not currently environmentally advantageous to roll out electric buses. The technical and financial feasibility also showed that this is also not feasible in the current market conditions. This will be reviewed in future as the grid and ebus market evolve in South Africa. UCT's can also focus on route and driving efficiency to reduce overall fuel consumption.

Fugitive refrigerant gases:

UCT has introduced A32 refrigerant gas into campus systems, which has a lower-than-average global warming potential. UCT should aim to completely phase out the use of R22 and any other HCFC gases for refrigeration or air-conditioning purposes due to their ozone-depleting qualities. Although they are not ozone-depleting substances, HFCs also have very high global warming potentials, which means that even small gas refills in air-conditioning systems can significantly increase UCT's Scope 1 emissions. Alternative, climate-friendly refrigerant gases should be considered such as hydrocarbons, ammonia or carbon dioxide.

Paper use:

The majority (73%) of paper in 2023 was for office use rather than custodial, and this is where UCT can focus on reducing paper use. Overall the contribution of total paper emissions to UCT's footprint is less than 1%, so these efforts would be in light of the broader environmental impact of paper use, more than its impact on the atmosphere. Still, by utilising recycled paper, these emissions can be reduced significantly alongside the general environmental impact of using primary / virgin material office paper.

Waste generation:

78% of UCT's waste is sent to landfill. Although waste emissions only contribute 1.2% of total greenhouse gas emissions, the amount of material sent to landfill is contributing to South Africa's overfilled landfill crisis, which UCT can help mitigate by investigating alternative waste management solutions.

5.2. Data Management

The following recommendations offer suggestions to improve data quality and access for future greenhouse gas assessments. Refer to Appendix A – "Methodology" for the current system of data management as it was applied to the 2023 inventory.

Overall, UCT has already begun collecting data earlier in the year, compared to previous assessments. This allows more time for data screening and checking, which leads to higher levels of data accuracy and completeness.

Electricity consumption: The boundary of facilities included in this assessment was drawn as accurately as possible with the information provided. However, campus-level electricity data does not show exactly which erfs are included. Although a Master Erven and Property Areas lists were provided, it is not entirely clear which of the erfs are covered in the campus-level data, and the erf lists don't completely align. Various facilities were not assigned an area metric (m^2). Ideally UCT will develop a comprehensive list of erf numbers where electricity consumption is under UCT's operational control, and submit consumption data at an erf level. Currently this is being considered as part of an existing 5-year data management plan by UCT.

For this 2022 inventory, data provided for electricity use at the GSB seemed too low. The initial data provided for 2023 seemed similarly low. Upon querying, a more accurate data set was produced which aligns far better with historic data from the GSB.

Diesel used in generators: Data quality remains improved through the submission of an Excel-based data log of fuel purchases. Previous assessments relied on incomplete PDF invoice collections and the conversion of fuel expenditure to fuel quantities based on diesel prices at the time.

Business Travel: Data quality has improved significantly due to the submission of travel consultant reports from a selection of UCT's travel agencies. This enabled the determination of summarised passenger kilometres per flight haul and class where data was available, which is a notable improvement relative to previous years' data which was 100% based on expenditure. However, reports were not available from all UCT travel agencies and where it was missing, the existing data was extrapolated based on the difference in expenditure. Going forward, UCT should aim to access reports from more, if not all, travel agencies.

Construction: The data provided for this second assessment of UCT's construction footprint was well documented. However, accounting for construction emissions based on expenditure provides a very broad estimate of the actual impact. Improving the quality of this data can help UCT to better understand and manage this source of emissions in future. Ideally, UCT will collect data that includes the types and quantities (by weight) of materials used for construction, for future assessments.

Food supply: Emission factors are derived from a pertinent UCT-based study that focused on specific catering items at the university. This provides high specificity but the study should be conducted again to obtain more up-to-date results rather than referring to emission factors developed in 2013 which no longer reflect the exact procurement processes currently followed at the institution. UCT should also obtain more accurate information regarding the number of food vendors operating on campus during each financial year. Ideally data will be submitted by all vendors to cover the sale volumes from each. Data should also be disaggregated as it was is past data sets, by the number of breakfasts, lunches and dinners provided.

Commute survey: UCT should conduct a new survey of staff and students to obtain a more updated breakdown of travel to and from campus. The survey can also be expanded to ask additional questions that will further inform emissions estimates to include emissions from home working where relevant.

Water Use: A water metering system has been installed, although GCX has suggested that due to notable annual fluctuations in reported water use that does not align with other activity changes, UCT should investigate the accuracy of data outputs from this system.

APPENDIX A - METHODOLOGY

The operational control approach was used to consolidate all emissions within the specified boundary.

Carbon emissions were measured in accordance with the GHG Protocol Corporate Standard (WRI & WBCSD, 2004).

As per the GHG Protocol, all Scope 1 and Scope 2 emissions were included in the report. Emissions from non-Kyoto gases (such as Freon/R22) were measured and classified as out of scope Product Use Emissions. Although optional, selected Scope 3 emissions were also included.

All emissions were expressed as CO2 equivalents (CO2e), and account for carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O).

All emission factors used were from UK Government GHG Conversion Factors for Company Reporting 2023, using IPCC AR5 GWPs, unless stated otherwise. Specific sources are listed on the tab "EF" in the accompanying Excel report *GCX_UCT_CFA Report_FY23.xlsx*.

All activity data was submitted to GCX by UCT. Where the data required for calculating greenhouse gas emissions was not readily available in the submitted activity data, GCX analysed the relevant data set to isolate the consumption data required. Various assumptions were made to reach a best estimate of final consumption values. Assumptions are listed in the "Assumptions" tab in the accompanying Excel report *GCX_UCT_CFA Report_FY23.xlsx*.

SCOPE 1

Stationary combustion

Emissions associated with stationary combustion relate to diesel purchased for use in generators to supply energy on site, as well as LPG purchased for use at various locations. Diesel data was provided in the form of fuel quantities purchased during 2023. LPG data was supplied as the total kilograms of gas purchased during 2023. Emission factors applied to estimate the associated greenhouse gas emissions are sourced from the latest Methodological Guidelines for Quantification of GHG Emissions, October 2022 (DFFE, South Africa) Tier 2 Country-Specific with Global Warming Potentials from the IPCC AR5 for stationary combustion per fuel type. These emission factors were selected in order to align with UCT's annual NGER submission results.

Fugitive Emissions

Fugitive emissions from refrigerant gases that escaped from air-conditioning systems are reported in Scope 1, except for emissions associated with refills of R22 gas, which is not a Kyoto gas and is reported out of scopes. Several different refrigerant gas types were refilled during each reporting period. Refills are conducted by various service providers across UCT facilities. The emission factors / Global Warming Potentials applied to estimate the associated CO2 equivalent emissions were sourced from UK Government Conversion Factors for greenhouse gas (GHG) reporting V1.1, 2023, AR5.

Vehicle Fleet

As opposed to UCT's assessment periods prior to 2022 (for which expenditure data was provided to estimate fleet emissions), actual fuel consumption figures were made available for UCT's 2023 fleet activity, pertaining to diesel and petrol used in UCT-owned and long-term leased vehicles. It was confirmed historically that the SAP reports submitted did include Bidvest vehicle activity. However, it is now thought that it may have also contained the ABSA vehicle activity, which was reported additionally. As such, fleet emissions may have been overestimated in reporting years prior to 2022. Eqstra vehicles data was submitted separately for 2023, which also provided fuel quantities per fuel type. No data is available related to the quantities of lubricant used in these vehicles.

Emission factors applied to estimate the associated greenhouse gas emissions are sourced from the latest Methodological Guidelines for Quantification of GHG Emissions, October 2022 (DFFE, South Africa) Tier 2 Country-Specific with Global Warming Potentials from the IPCC AR5, for mobile combustion per fuel type.

UCT Shuttle

Emissions are reported separately for UCT's vehicle fleet and the UCT shuttle fleet, as this will aid the institution's carbon management strategy. UCT's shuttle fleet now includes 32 vehicles. The fuel consumption data provided covers all operating vehicles. Data was provided as the quantity of diesel used during the reporting period. All diesel use reported is known to be used by UCT shuttle vehicles. Emission factors applied to estimate the associated greenhouse gas emissions are sourced from the latest Methodological Guidelines for Quantification of GHG Emissions, October 2022 (DFFE, South Africa) Tier 2 Country-Specific with Global Warming Potentials from the IPCC AR5, for mobile combustion per fuel type.

Renewable Electricity

This is the second year that UCT is reporting the use of renewable electricity within the institution's greenhouse gas inventory. The on-site generation of electricity must be reported in Scope 1. At UCT this relates to on-site solar installations at three locations. There are no associated direct emissions. However, the "avoided Scope 2 emissions" are reported outside of Scopes for reference, as the energy is utilised by UCT facilities which would otherwise have required grid electricity.

SCOPE 2

Purchased Electricity

This scope covers all electricity consumption under UCT's operational control.

Data was provided by Terrafirma for most campuses, while separate data was provided for ICTS and GSB. A SAP and a P&S report were provided for all other Erfs such as residences and all other UCT admin buildings. SAP data includes many reversals, which are listed in the comments section of UCT's SAP data report. Taking these into account would require an extensive manual process of updating several figures per erf. Due to the time required, the existing figures are applied. Therefore, results are slightly over estimated.

GSB

"UCT has 100% operational control of it's Graduate School of Business and Conference Centre, located at the V&A Waterfront. The facility is metered as part of the Protea Breakwater Lodge Hotel. In order to apportion electricity consumption between the hotel and the university, the following methodology was applied: Consolidated electricity consumption is provided for the three facilities, along with total expenditure. Although the actual consumption is not metered separately per facility, the billing is separated and this was used to determine a best estimate of the % split in consumption between the facilities. Some of the guests at the Breakwater Lodge are UCT students and academics. As such, UCT is considered to have operational control of any associated electricity consumption at that facility. The hotel has provided an updated estimated % breakdown of hotel visitors for 2023. UCT has accounted for their control of electricity use at the hotel based on the combined % of UCT student and academic visitors. The breakdown is as follows:

- UCT Students & Academics: 25.76%
- Other Hotel Guests: 74%

Selected facilities are excluded from the total floor area metric as UCT is considered to have little operational control over activity (and therefore, associated emissions) at these locations: Red Cross Hospital, Groote Schuur, Field Stations, Sports Science Institute, Valkenberg Manor House & Wild Fig, Montebello. As such, electricity consumption for these facilities is not included in the assessment.

To date, UCT's assessments have applied Eskom's financial year factor to the prior calendar year's data, which is the most appropriate option because Eskom's financial year runs from 1 April to 31 March annually. For example: Eskom's AR 2021 factor (based on their financial year 1 April 2020 - 31 March 2021) is applied to UCT's 2020 data. The majority of the months in that Eskom financial year fall in 2020 and are, therefore, most applicable to UCT's 2020 data. See tab "Figures" for a list of Eskom emission factors and the UCT reporting year's they have been applied to.

Eskom Factor 1 and Factor 2: All UCT assessments prior to 2020 have been based on the Eskom emission Factor 1 "total energy sold". GCX recommended switching to Eskom's Factor 2: "total energy generated". This is because Factor 2 is calculated using national energy results that exclude Eskom's own consumption, thus avoiding double counting in the calculation of the emission factor. Factor 2 has been applied to all subsequent assessments (FY2020 onwards).

Scope 2 emissions associated with electricity consumption during UCT's 2023 financial year were measured by applying the emission factor from the South African Department of Forestry, Fisheries and Environment (DFFE) Grid Emission Factors Report, 2023. Although it is based on data from 2021 it is considered to be a more appropriate measurement of the country's grid emission factor.

Scope 2 emissions were calculated and reported using both the location-based and market-based methods. This is in accordance with GHG Protocol Corporate Standard's "Scope 2 Guidance" (January 2015). No contractual instruments were purchased during the reporting periods, and since South Africa currently has no official residual mix factor, both the location-based and market-based totals are the same.

SCOPE 3

"Category 1: Purchased Goods and Services: Paper

This category includes the embedded emissions within purchased paper during the financial year. UCT's paper use includes custodial paper as well as office paper use. For all paper types, the full 12 months-worth of data was provided and no extrapolations were required."

Although data was provided in the form of a SAP report where the general ledger listed various purchases related to paper and stationary, it only provided expenditure data and no information related to paper quantities or weights. Therefore, additional data was requested as follows:

Numbers of paper reams or towels or bales related to each paper category: Reams of paper used at ICTS, custodial paper bales and towels from Campus Cleaning Services, and reams of paper procured from suppliers. All reported units were converted to kilograms of paper. See "assumptions" tab for conversions. The most recent available Sappi Typek emission factor for 80gsm paper was applied to estimate emissions embedded within office paper used.

To estimate embedded emissions within custodial paper used, an emission factor has been applied from UK Government Conversion Factors for greenhouse gas (GHG) reporting V1.1, 2023, AR5 for paper material use.

Category 1: Purchased Goods and Services: Water

A SAP report was provided covering all UCT water consumption, excluding the GSB, in kilolitres consumed. No filtering or unit conversions or assumptions were required. A separate report was provided for the GSB. Although this is a Scope 3 source, to account for partial control of water consumption at BWL, consumption was apportioned based on the floor area of each facility (BWL, CC and GSB) in line with the method applied in previous assessments. C7-2 is a code reserved from digital water meter readings, the installation of which is yet to be completed.

Category 1: Purchased Goods and Services: Food Provisions

The data submitted for the number of meals provided at Residences is consolidated, rather than detailing the number of breakfasts, lunches and dinners as in 2023 and prior. To estimate the quantity of each meal

type, the consolidated total meal number was apportioned to number of breakfasts, lunches and dinners based on the % split present in 2021 and 2022, assuming similar activity in 2023.

Food Supply emissions are calculated based on emission factors from a UCT student alumni dissertation: Gravenor, M. (2013), Food Sustainability at UCT: An exploratory investigation into the University of Cape Town's food system and its relation to the institutional carbon footprint, Minor dissertation towards a Master of Science specialising in Climate Change and Sustainable Development, University of Cape Town. First Tier Residences are contracted by UCT Properties and Services, who provided meal provision data. The residences also supply students with meal vouchers which they redeem on campus from the campus food vendors. Therefore, although voucher figures are provided by Food & Connect (Residences food), emissions are reported alongside those from food supply via campus vendors. They are removed from the residence food supply emissions, to avoid double counting.

Campus Food Vendors data is provided by the primary vendor, Food & Connect. Since information related to the balance of the vendors was not available, the totals for the period were estimated using sample from the popular outlets.

Category 2: Capital Goods: Construction

In the absence of primary material quantities data, UCT was able to submit secondary expenditure figures for construction-related activities during 2023. Rands spent were converted to Euros based on the exchange rate at the time of the assessment (see the tab "EF"). An emission factor from EXIOBASE (Climatiq) Construction Work: South Africa, 2019, AR5 was applied to estimate the associated embedded emissions within the capital goods constructed during the reporting year.

Category 3: Fuel- and Energy-Generating Activities

This category covers Fuel- and Energy-Related Activities that are not included in Scope 1 or 2. It includes Well-to-Tank emissions associated with the fuel used in generators, LPG used in equipment and fuels used in UCT's vehicle and shuttle fleets. It also includes emissions associated with transmission and distribution losses within the electricity grid, Well-to-Tank emissions associated with the generation of electricity and the generation of electricity lost during transmission and distribution. Emissions associated with Transmission and Distribution losses are calculated using a factor of 0.089 kgCO2e per kWh, sourced from the South African Department of Forestry, Fisheries and Environment (DFFE) Grid Emission Factors Report, 2023. Although it is based on data from 2021 it is considered to be a more appropriate measurement of the country's grid emission factor and transmission and distribution losses emission factor.

Category 5: Waste generated in operations

A detailed waste report was provided along with PDF certificates from Cape e-Waste Recyclers to confirm the quantities of recycled eWaste. To estimate emissions associated with general waste to landfill, an emission factor is applied from Friedrich & Troy 2012 ""GHG emission factors developed for the collection, transport and landfilling of municipal waste in South African municipalities"". Waste Management, Vol. 33: Issue 4, which is updated annually to account for updates to South Africa's grid emission factor. Emission factors for recycled waste are from UK Government GHG Conversion Factors for Company Reporting 2023, AR5.

Category 6: Business travel

Air travel data submitted for 2023 is of higher quality than that used in previous years. Air travel information was submitted for five travel agencies: Travel Manor, Travel with Flair Cape Town, Flywell Travel Agencies Cape, Travel Connections and one data sheet from an unknown agency "Travel Agency A". Flights booked via these agencies represent 62% of the total invoiced quantity for UCT's air travel during 2023. Therefore, the data that was made available, which was converted to passenger kilometres per flight haul and class, has been extrapolated to represent 100% of the total invoiced quantity. Data provided for "Travel Agency A" could not be analysed based on travel distances. As such, although no methodology was specified by the travel agency, the agency-calculated greenhouse gas emissions were

applied directly as the best estimate of the associated flight emissions. Based on individual route checks, emissions have been underestimated by the agency. Since passenger kilometres per flight haul and class could not be summarised, these emissions were excluded from those that were extrapolated.

In the absence of a UK Government emission factor for short haul premium economy flights, the emission factor for short haul business class flights has been applied to all premium economy flights as a conservative estimate.

Air travel emission factors include the effects of radiative forcing.

To estimate Well-to-Tank emissions arising from air travel booked via "Travel Agency A", they were assumed to be approximately 12% of the calculated emissions. This is based on the average proportional difference between Well-to-Tank and Flight emission factors from UK Government Conversion Factors for greenhouse gas (GHG) reporting V1.1, 2023, AR5, which is 12%.

Car hire data was also provided in SAP reports: separate general ledgers were provided for UCT car hire and for UCT staff reimbursements and allowances. These reports included additional expenditure which needed to be filtered out to arrive at actual Rands spent on car hire.

Car rental Rands / Km were previously derived from actual distance travelled data from Bidvest. Bidvest data was not provided for this assessment. Therefore, the cost per kilometre travelled is based on South Africa's 2023 Automobile Association rate.

Staff reimbursements: one general ledger was provided covering staff travel reimbursements, as well as travel allowances. Data was only available as travel expenditure, no distances or vehicle types were available. Data was filtered for food allowances, and by cost per km to isolate reimbursements expenditure. Allowances are filtered as all entries that contain "travel" and exclude travel at the reimbursements cost per km to prevent double counting.

Category 7: Employee Commute

In the interest of comparability, the methodology applied in 2019, 2020, 2021 and 2022 is maintained in this assessment. Data is based on the UCT Information Systems survey undertaken in 2014. The survey reflects commuting activity of students and staff at upper campus. Figures are extrapolated to reflect the full UCT commuting population for each year. The modal % split is maintained, however UCT request an adjustment in 2022 to reflect the general shift from staff and student commuting via train to commuting via taxi. These %'s were adjusted in UCT's previous assessment to represent the increase in travel by taxi and the decrease in travel by train, without affecting the proportions of the other travel modes per year. Total persons commuting is based on staff and student population figures for 2023. Commuting in UCT shuttles is excluded as the associated emissions are reported in Scope 1 as UCT-owned and controlled vehicle. It is assumed that the average minibus taxi has a capacity of 8 people. As such, the emission factor for minibus taxi travel is derived from that for a large petrol vehicle, divided by 8. Emissions do not include home working emissions.

Student and staff populations commuting to campus were reduced for UCT's 2020 and 2021 assessments, based on detailed attendance schedules, to account for the impact of Covid on commuting. These adjustments were removed for UCT's 2022 and 2023 assessments because commuting has mostly normalised for this reporting period.

The category also includes the Well-to-Tank emissions associated with the fuel used for employee commuting for each mode of travel. No data is available related to home working and this is noted as an exclusion.

ORGANISATIONAL BOUNDARY

UCT confirmed that all properties with 0m^2 reported on the D1 properties list are not under UCT's operational control. Where electricity data has been provided for a campus or an erf number, it has been

confirmed that the consumption is under UCT's operational control. Where m2 are provided for an erf that is not under UCT's operational control, it has been removed from the total m2.

APPENDIX B – ASSUMPTIONS & LIMITATIONS

It is often necessary to make assumptions and extrapolations based on the available data. Please take note of some of the key assumptions, extrapolations and limitations listed below:

It was assumed that all data submitted to GCX by UCT was accurate, precise and complete unless stated otherwise.

Scope 2

Where electricity consumption data is provided by SAP or P and S, for an Erf at Upper Campus, Middle Campus, Lower Campus, Medical Campus or Hiddingh, it is assumed that the electricity consumption at the erf is accounted for by UCT's metering through TFS and the data provided for those precincts.

Where partial data was available for a property and the remaining months were unavailable, they were estimated based on the average of existing months of data.

Where data was unavailable for a property that is owned by UCT, where electricity use is not listed as a service type on UCT's Master Erven, or properties that are listed as "leased", it is assumed that electricity consumption is not under UCT's operational control (for example, the property is leased out) and, as such, the associated emissions are excluded from Scope 2.

The sheets "Master Erven" and "D1 Property Areas" list UCT owned facilities and associated erf numbers. Campus-level data is provided by Terrafirms Solutions, along with a list of "Campus Buildings" covered by the data. However, the list of TFS campus buildings primarily lists generators, and does not provide erf numbers. Therefore, it is assumed that the TFS data covers Upper, Middle, Lower, Hiddigh and Medical Campuses, including all erfs listed under those campus names on the Master Erven sheet. Is it also assumed that the TFS data for Medical Campus includes the erf numbers listed on the Master Erven sheet for "Health Science", "Groote Schuur" and "Red Cross". On the sheet "D1 Property Areas" some erf numbers are not shown. Ideally electricity data could be provided in kWh consumed per erf number, alongside a comprehensive list of UCT-controlled erfs. In the absence of full visibility into this information, the data provided is assumed to cover all UCT-controlled erfs for the reporting period.

Where 2023 data was unavailable for a Residence or Other Admin Building that is still listed on the UCT Master Erven or property areas list, consumption is estimated based on the most recent available data as a best estimate.

Scope 3

It is assumed that the flight activity provided in travel consultant reports is a good representative sample of all UCT flight activity.

It was assumed that the emissions associated with a short haul first class flight are similar to those associated with a short haul business class flight. The latter is applied to short haul first class flights in the absence of a haul-specific emission factor.

Staff reimbursements: it is assumed that all general ledger records where "net price" (cost per km) is logged at R3.82 and R4.18, and no other records on the ledger reflect staff reimbursements.
Travel allowances: it is assumed that all entries on the general ledger, aside from staff reimbursements, that are not labelled "travel" do not reflect travel allowances.

Commute: travel by car is assumed to be conducted on average by medium petrol cars. It is assumed that the average minibus taxi has an 8 person capacity.

Emissions related to paper used for exam books and papers have been based on estimated data to date, using assumptions regarding average usage per student.

It is assumed that an average toilet roll weighs 150 grams. The average weight of hand towels utilised at UCT is based on that used in 2019: 0.2 kg each.

Hired cars: vehicle types are not known. In order to apply an emission factor it is assumed that they are mostly medium-sized petrol vehicles.

Staff reimbursements and travel allowances: vehicle types are not known. In order to apply an emission factor they are assumed to be mostly medium sized with unknown fuel type.

Property areas: where total square metres were provided, "external gross area" is applied to calculations in line with previous methods. Where gaps in area data were manually completed in previous assessments, the same was done for this assessment, assuming no changes to the relevant property areas. UCT confirm that there were no significant changes to the organisational boundary. An updated properties list was submitted, which includes changes in size to existing facilities.

This report was compiled by GCX
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