



# **Carbon Footprint Assessment Report**

## **Year of assessment: 2020 & 2021**

**Report Issued: October 2022**

## Project Team

|  |                                  |
|--|----------------------------------|
| <b>UCT (Project Owner)</b>             |                                  |
| Manfred Braune                         | (Project Director)               |
| Tamzyn Arendse                         | (Project Administrative Support) |
| <b>GCX (Project Consultant)</b>        |                                  |
| Caroline Kirov                         | (Project Consultant)             |
| Ohad Shachar                           | (Project Consultant Director)    |
| <b>Carbon Calculated (Peer Review)</b> |                                  |
| Nici Palmer                            | (Lead peer reviewer)             |
| Robyn Ferrar                           | (Support peer reviewer)          |

## TABLE OF CONTENTS

|           |   |           |
|-----------|---|-----------|
| <b>1</b>  | <b>Executive Summary</b> .....                        | <b>5</b>  |
| 1.1       | Results .....   | 5         |
| 1.2       | Targets .....   | 7         |
| 1.3       | Recommendations .....                                 | 7         |
| <b>2</b>  | <b>Introduction</b> .....                             | <b>8</b>  |
| <b>3</b>  | <b>Boundaries</b> .....                               | <b>8</b>  |
| 3.1       | Temporal Boundary .....                               | 8         |
| 3.2       | Organisational Boundary .....                         | 8         |
| 3.3       | Operational Boundary .....                            | 9         |
| <b>4</b>  | <b>Results Summary</b> .....                          | <b>11</b> |
| 4.1       | Absolute Emissions .....                              | 11        |
| 4.2       | Intensity Metrics .....                               | 12        |
| <b>5</b>  | <b>Scope 1</b> .....                                  | <b>13</b> |
| 5.1       | Shuttle Emissions .....                               | 14        |
| 5.2       | Vehicle Fleet Emissions .....                         | 14        |
| 5.3       | Refrigerant Gas Emissions .....                       | 14        |
| 5.4       | Stationary Combustion Emissions .....                 | 15        |
| <b>6</b>  | <b>Scope 2</b> .....                                  | <b>16</b> |
| <b>7</b>  | <b>Scope 3</b> .....                                  | <b>17</b> |
| 7.1       | Construction Emissions .....                          | 18        |
| 7.2       | Fuel and Energy-Related Emissions .....               | 18        |
| 7.3       | Purchased Goods and Services Emissions .....          | 18        |
| 7.4       | Commuting Emissions .....                             | 19        |
| 7.5       | Business Travel Emissions .....                       | 19        |
| 7.6       | Waste Generation Emissions .....                      | 19        |
| <b>8</b>  | <b>Targets</b> .....                                  | <b>20</b> |
| <b>9</b>  | <b>Recommendations</b> .....                          | <b>21</b> |
| 9.1       | Carbon Management .....                               | 21        |
| 9.2       | Data Management .....                                 | 22        |
| <b>10</b> | <b>Appendix A - Methodology</b> .....                 | <b>23</b> |
| <b>11</b> | <b>Appendix B - Assumptions and Limitations</b> ..... | <b>29</b> |

## Glossary of Terms

|                     |   |
|---------------------|---|
| Capex               | Capital Expenditure                                     |
| CO <sub>2</sub> e   | Carbon Dioxide Equivalent                               |
| Covid-19            | Coronavirus Disease 2019                                |
| DEFRA               | Department of Environment, Food and Rural Affairs       |
| GHG                 | Greenhouse Gas  |
| GSB                 | Graduate School of Business                             |
| HVAC                | Heating, Ventilation And Cooling                        |
| IPCC                | Intergovernmental Panel on Climate Change               |
| LPG                 | Liquid Petroleum Gas                                    |
| kgCO <sub>2</sub> e | Kilograms of Carbon Dioxide Equivalent                  |
| kWh                 | Kilowatt Hours  |
| NGER                | National Greenhouse Gas Emissions Reporting             |
| SAGERS              | South African Greenhouse Gas Emissions Reporting System |
| tCO <sub>2</sub> e  | Tonnes of Carbon Dioxide Equivalent                     |
| UCT                 | University of Cape Town                                 |

# 1 Executive Summary

This report provides the 2020 and 2021 financial year carbon footprint reports of the University of Cape Town (UCT). The scope covers all the university's campuses and the emissions-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, the most widely recognised global methodology for greenhouse gas accounting and reporting.

## 1.1 Results

This assessment covers an unprecedented time in UCT's history due to the impact of the Covid-19 pandemic on activity levels on its campuses, and this is evident throughout the results discussed in this report. Total Scope 1, 2 and 3 emissions dropped 30% between 2019 and 2020, followed by a 25% increase due to partially stabilised activities in 2021. However, the university's emissions profile in terms of Scope 1, 2 and 3 remains similar to previous years with Scope 2 contributing the majority of the overall footprint – about two thirds of total emissions in each reported year.

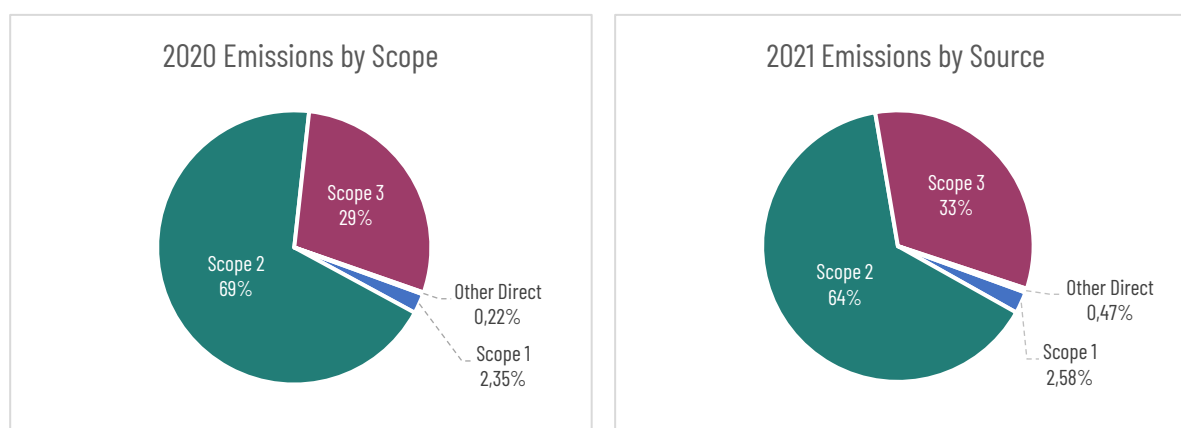


Figure 1: UCT 2020 and 2021 Carbon Footprint Emissions by Scope

### Scope 1

UCT's combined direct emissions include all activities under UCT's operational control: UCT Shuttle and Vehicle Fleet travel, the combustion of diesel and LPG on-site and refrigerant gas top-ups. Total direct emissions decreased 54% between 2019 and 2020 with almost all source activities slowing during lockdown, except for emissions arising from diesel used in generators, which increased 254% in 2020 due to increased hours of load shedding, rising a further 26% the following year alongside a total Scope 1 emissions increase of 37% in 2021.

### Scope 2

Emissions arising from electricity consumption followed a similar trend, dropping 28% in 2020 and rising again by 17% in 2021. This emissions source contributed 64% of UCT's total carbon footprint in 2021. Of those emissions, electricity used at Main Campus contributed 54%, followed by Medical Campus and Satellite Residences. 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.

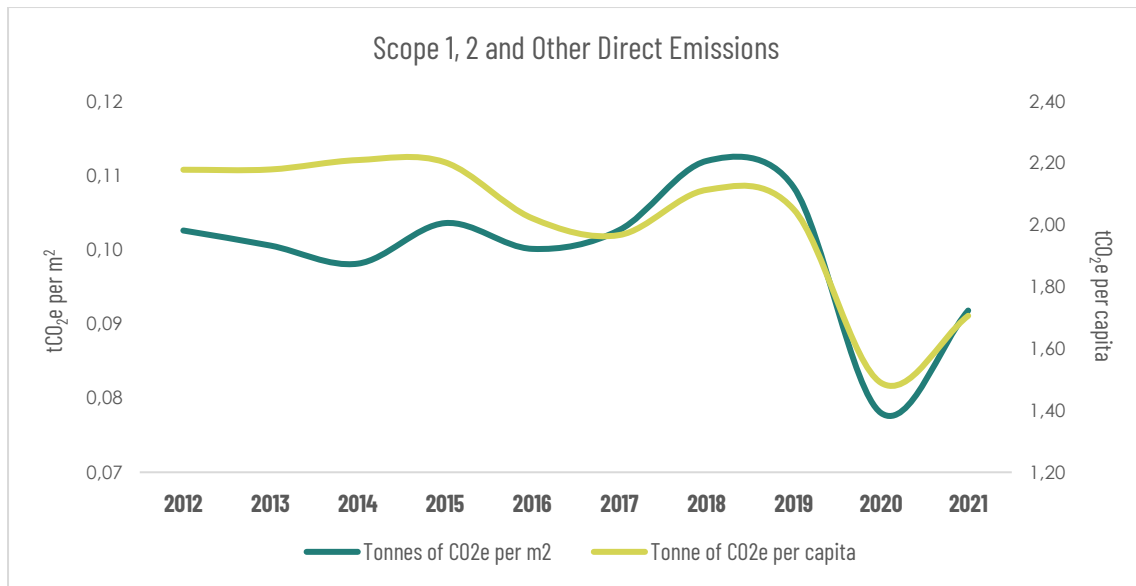


Figure 2: Annual Fluctuations in Scope 1, 2 and Other Direct Emissions

### Scope 3

Indirect emission sources arising from activities upstream and downstream from an organisation are reported within the 15 categories of Scope 3. This is the first assessment in which UCT has reported emissions associated with construction. This category covers the upstream, embedded greenhouse gas emissions in the materials used to construct UCT's capital goods. Now that this indirect emissions source is included in UCT's inventory, it is the highest contributor to Scope 3 emissions at 11,758 tCO<sub>2</sub>e and 39% of Scope 3 emissions during 2021. Although this has raised the overall carbon footprint, it also provides a new opportunity for implementing and tracking emission reductions. All other Scope 3 sources continue to be reported, and even though construction emissions are added in 2020, total Scope 3 emissions dropped 32% relative to 2019, followed by a 43% increase in 2021. A significant contributor to the initial decrease was the reduction in emissions arising from air travel, dropping 94% from 13,424 tCO<sub>2</sub>e in 2019 to just 763 tCO<sub>2</sub>e in 2020 due to Covid-19 restrictions and lockdown.

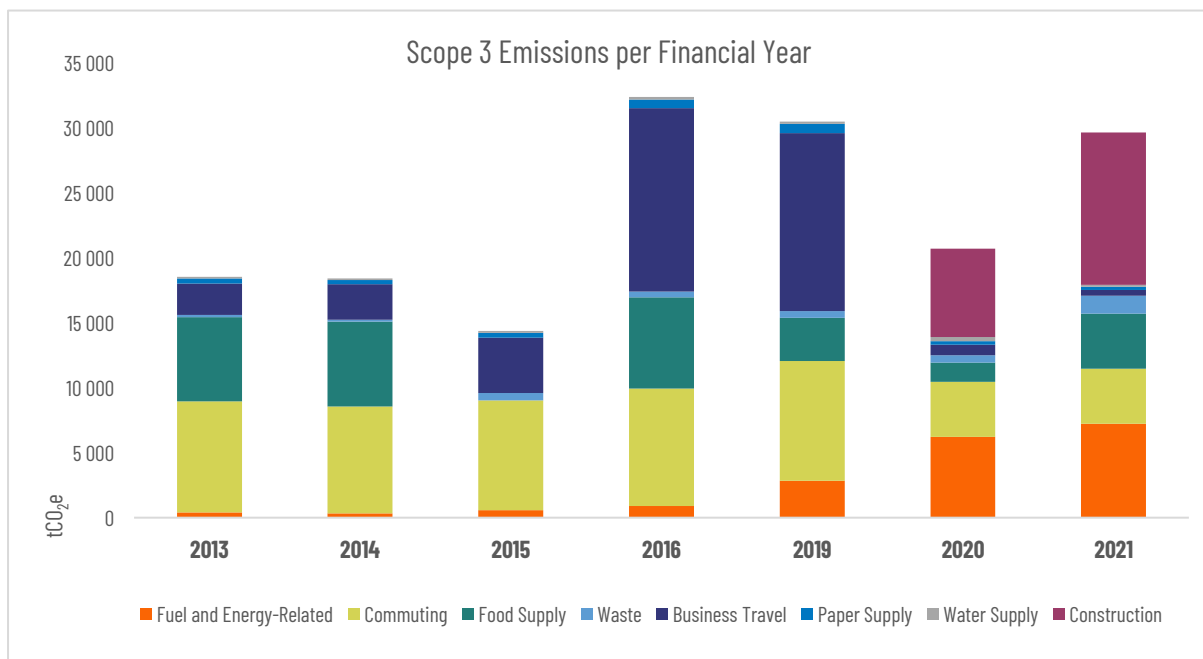


Figure 3: Annual Scope 3 Emissions per Financial Year, by Source Activity

## 1.2 Targets

UCT has set the following target: Net Zero emissions by 2050 (Scope 1 and 2) with an aim to decrease emissions by 2 – 5% per annum from 2020. Because UCT has reported these emissions relatively consistently since 2012, the following table indicates a current reduction of 9% in Scope 1, 2 and Other Direct emissions since that year:

| Emissions                | Tonnes of CO <sub>2</sub> e |        |        | % Change     |
|--------------------------|-----------------------------|--------|--------|--------------|
|                          | 2012                        | 2020   | 2021   | 2012 vs 2021 |
| Scope 1, 2, Other Direct | 66 622                      | 51 767 | 60 929 | <b>-9%</b>   |

Table 1: Percentage Change in Scope 1, 2 & Other Direct Emissions

## 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.

### Data Management

There are good opportunities for UCT to improve data quality and, therefore, the accuracy of emissions results. The next step in improving data quality will be to aim for the collection of consumption or distance data rather than expenditure data. Some emission sources are already reported based on consumption such as diesel use and electricity. However, some are still based on expenditure such as business travel and construction, which requires estimates to convert the data into consumption figures, to enable the calculation of greenhouse gas emissions. UCT can establish internal systems to begin logging consumption or distances travelled, which will enable more accurate calculations going forward.

### 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. With the rollout of various solar PV installations on UCT campuses, future inventories will 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 start to displace Scope 2 emissions over time.

## 2 Introduction

GCX was appointed by the UCT to undertake the institution's 2020 and 2021 financial year greenhouse gas assessments. These two assessments follow annual consecutive assessments that have been conducted since 2012.

Using an Excel-based log, GCX indicated what data was required for the calculation of UCT's 2020 and 2021 carbon footprints. The required data was collected by the UCT team from the relevant institutional departments and sent to GCX ad hoc, between March and September 2022. 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 calculations and methodology were independently reviewed by Carbon Calculated. 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 has been provided in the additional report spreadsheet "*GCX\_UCT\_CFA\_2020 & 2021\_Calculations.xlsx*".

## 3 Boundaries

### 3.1 Temporal Boundary

This assessment covers UCT's two most recent financial years:

- 1 January to 31 December 2020
- 1 January to 31 December 2021

### 3.2 Organisational Boundary

#### Facilities

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 Facilities Boundary



## Staff and student populations

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:

| Populations  | 2020          | 2021          |
|--------------|---------------|---------------|
| Students     | 28 447        | 29 444        |
| Staff        | 6 308         | 6 265         |
| <b>Total</b> | <b>34 755</b> | <b>35 709</b> |

Table 3: Populations of Students and Staff per Reporting Period

### 3.3 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.

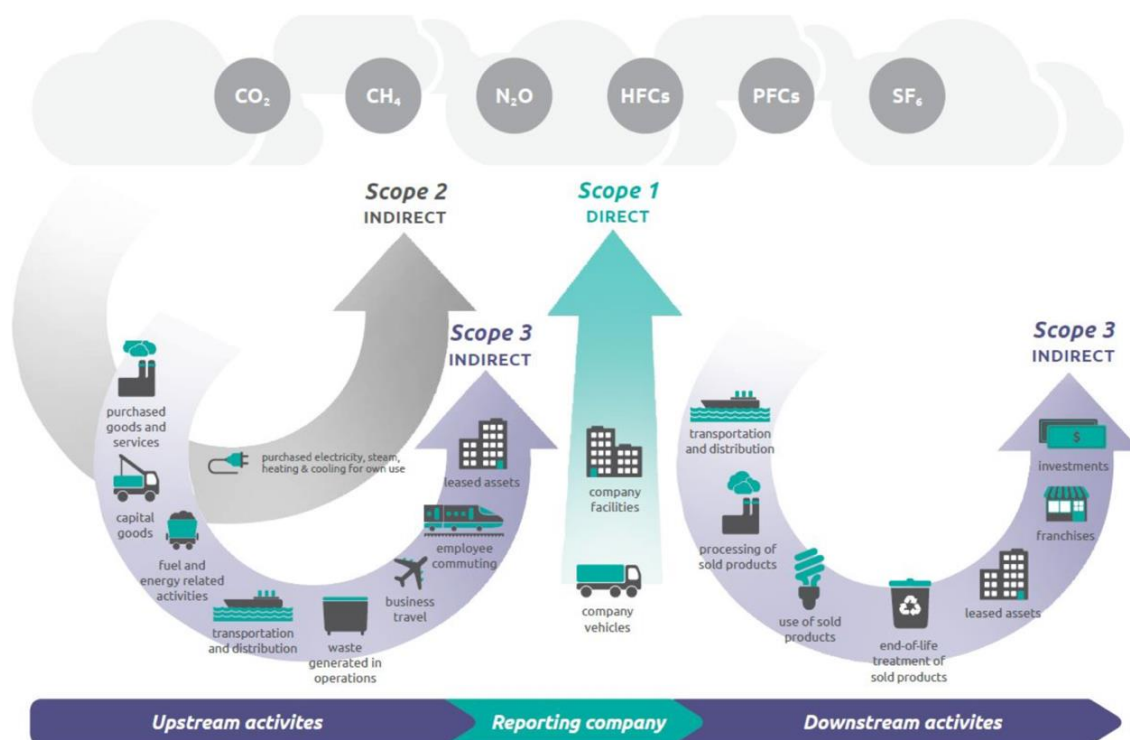


Figure 4: Operational Boundaries by Scope, Activity and Greenhouse Gas

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                     |   |  |                      |
|-----------------------------|---|--|----------------------|
| Location                    | Source Category   | Explanation  | 2020 & 2021 Boundary |
| Direct / 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                     |   |  |                      |
| Location                    | Source Category   | Explanation  |                      |
| Indirect energy consumption | Purchase of Energy  | Heat, steam, electricity: generated off-site   | ✓                    |
| Out of Scopes               |   |  |                      |
| Location                    | Source Category   | Explanation  |                      |
| On-site                     | Fugitive emissions  | Intentional or unintentional release of GHGs not included under the Kyoto Protocol   | ✓                    |
|                             | Biofuels  | CO <sub>2</sub> only: CH <sub>4</sub> and N <sub>2</sub> O are reported in Scope 1   | NA                   |
| Scope 3                     |   |  |                      |
| Location                    | Source Category   | Explanation  |                      |
| Upstream                    | Purchased Goods and Services                                | Embedded emissions in raw materials, paper, water, etc. (cradle to gate)   | ✓                    |
|                             | Capital Goods   | Embedded emissions in purchased capital goods and equipment  | ✓                    |
|                             | 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.  | 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  | X                    |
| Downstream                  | Downstream Transport and distribution                       | 3 <sup>rd</sup> party transportation of products sold by the reporting company, between the company and the end consumer.                      | NA                   |
|                             | Processing of sold products                                 | Processing of intermediate product sold by the company   | NA                   |
|                             | Use of sold products  | End use of products that directly consume electricity, emit GHGs or form GHGs during use   | NA                   |
|                             | End of life treatment of sold products                      | Waste disposal and treatment of EoL products   | NA                   |
|                             | 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 2020 and 2021 Carbon Footprint Operational Boundary

## 4 Results Summary

### 4.1 Absolute Emissions

UCT's 2020 and 2021 financial year results are tabulated below.

| Scope                                    | Source                                       | Tonnes of CO <sub>2</sub> e |               | % of Total  |             |
|--|--|-----------------------------|---------------|-------------|-------------|
|  |  | 2020                        | 2021          | 2020        | 2021        |
| Scope 1                                  | UCT-owned vehicles: UCT Shuttle              | 348                         | 547           | 0.5%        | 0.6%        |
|  | UCT-owned vehicles: Vehicle fleet            | 486                         | 612           | 0.7%        | 0.7%        |
|  | Fugitive Emissions (Kyoto Gases)             | 622                         | 919           | 0.9%        | 1.0%        |
|  | Stationary Combustion: LPG                   | 71                          | 40            | 0.1%        | 0.0%        |
|  | Stationary Combustion: Diesel for Generators | 177                         | 223           | 0.2%        | 0.2%        |
| <b>Sub-Total Scope 1</b>                 |  | <b>1 705</b>                | <b>2 340</b>  | <b>2%</b>   | <b>3%</b>   |
| Scope 2                                  | Electricity: Main Campus                     | 27 750                      | 31 674        | 38%         | 35%         |
|  | Electricity: Medical Campus                  | 10 734                      | 11 695        | 15%         | 13%         |
|  | Electricity: Off Campus residences           | 8 980                       | 12 437        | 12%         | 14%         |
|  | Electricity: GSB                             | 980                         | 623           | 1%          | 1%          |
|  | Electricity: Hiddingh                        | 381                         | 473           | 0.5%        | 0.5%        |
|  | Electricity: ICTS on Main                    | 1 076                       | 1 265         | 1%          | 1%          |
| <b>Sub-Total Scope 2: location-based</b> |  | <b>49 902</b>               | <b>58 166</b> | <b>69%</b>  | <b>64%</b>  |
| <b>Sub-Total Scope 2: market-based*</b>  |  | <b>49 902</b>               | <b>58 166</b> | <b>69%</b>  | <b>64%</b>  |
| <b>Sub-Total Scope 1 &amp; 2</b>         |  | <b>51 607</b>               | <b>60 506</b> | <b>71%</b>  | <b>67%</b>  |
| Scope 3                                  | Fuel and Energy-Related                      | 6 232                       | 7 249         | 9%          | 8%          |
|  | Business Travel - Land                       | 48                          | 42            | 0.07%       | 0.05%       |
|  | Business Travel - Air                        | 763                         | 395           | 1.1%        | 0.4%        |
|  | Commuting                                    | 4 245                       | 4 219         | 6%          | 5%          |
|  | Purchased Goods & Services: Food             | 1 467                       | 4 253         | 2%          | 5%          |
|  | Purchased Goods & Services: Paper            | 271                         | 249           | 0.37%       | 0.28%       |
|  | Purchased Goods & Services: Water            | 321                         | 147           | 0.44%       | 0.16%       |
|  | Waste Generated in Operations                | 584                         | 1 384         | 0.8%        | 1.5%        |
|  | Capital Goods: Construction                  | 6 798                       | 11 758        | 9%          | 13%         |
| <b>Sub-Total Scope 3</b>                 |  | <b>20 729</b>               | <b>29 696</b> | <b>29%</b>  | <b>33%</b>  |
| Other Direct                             | Fugitive Emissions (non-Kyoto gases)         | 160                         | 424           | 0.22%       | 0.5%        |
| <b>Total Emissions</b>                   |  | <b>72 496</b>               | <b>90 625</b> | <b>100%</b> | <b>100%</b> |

Table 5: UCT 2020 and 2021 Carbon Footprint Results Summary

Avoided emissions from renewable energy consumption: During the 2020 and 2021 financial years, one small solar installation was present at UCT's Graça Machel residence. Energy consumption data related to this installation is not currently available and the associated "avoided" emissions related to renewable energy use are excluded.

Refrigerant gases: all prior assessments reported emissions associated with each refrigerant gas in Scope 1. The results for 2020 and 2021 are reported with emissions associated with non-Kyoto gases reported as "Other Direct" emissions to align with reporting guidelines in the GHG Protocol. \*No market-based instruments (contractual instruments or arrangements where electricity is purchased from a selected source with specific attributes, such as renewable energy) were purchased by UCT during these reporting periods. Although dual Scope 2 reporting is required in accordance with the GHG Protocol for Corporate Accounting and Reporting, South Africa does not have a residual mix factor for market-based electricity consumption. Calculations revert to the grid emission factor.

The latest financial year's emissions are displayed by Scope in the adjacent pie chart, showing the significant impact of Scope 2 on the institution's carbon footprint. Although the pandemic impacted emission results, it did so relatively uniformly across all Scopes. Therefore, this chart provides a useful illustration of UCT's emissions breakdown that does not need to be considered within the context of the pandemic.

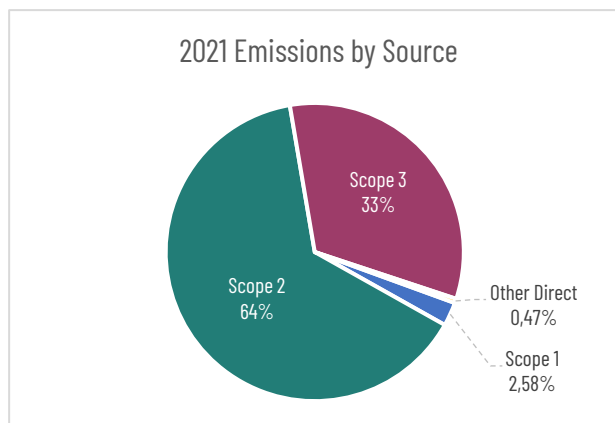


Figure 5: UCT's 2021 Total Carbon Footprint Emissions per Scope

## 4.2 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 2012 assessment in the table below, which shows an 11% decrease in emissions per square metre, and a 22% reduction in emissions per capita (2012 vs 2021).

| Intensity Metrics                           | Financial Year |         |         | % Change     |
|---|----------------|---------|---------|--------------|
|   | 2012           | 2020    | 2021    | 2012 vs 2021 |
| Gross Area (m <sup>2</sup> )                | 649 494        | 663 713 | 663 713 | 2.2%         |
| tCO <sub>2</sub> e / m <sup>2</sup> / annum | 0.103          | 0.078   | 0.092   | <b>-11%</b>  |
| Population                                  | 30 579         | 34 755  | 35 709  | 17%          |
| tCO <sub>2</sub> e / capita / annum         | 2.18           | 1.49    | 1.71    | <b>-22%</b>  |

Table 6: UCT 2012, 2020 and 2021 Intensity Metrics Comparison

The figure below illustrates how these results must be considered within the context of the significant impact that Covid-19 has had on UCT's activity levels in 2020 and 2021. Emissions results throughout this assessment reveal a sharp drop between 2019 and 2020, followed by a slight increase in 2021 as restrictions were lifted. Future assessments should reveal a more stabilised emissions trajectory going forward.

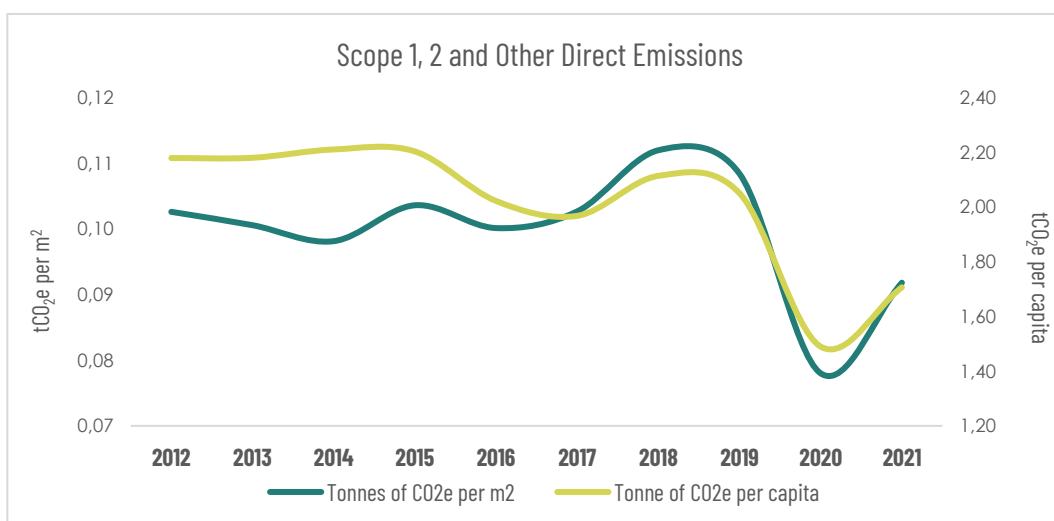


Figure 6: Annual Fluctuation in GHG Emissions Intensity Metrics

## 5 Scope 1

The figure below provides a breakdown of UCT's Scope 1 emissions by emissions source. There are two important features to this figure. First, the clear impact of Covid-19 restrictions and lockdowns on UCT's direct emissions in 2020 and 2021 and, second, the potential of fugitive refrigerant gases to impact UCT's direct emissions in a highly variable manner. Although most sources of emissions declined in 2020 and 2021, relative to previous years, one has increased: emissions from the stationary combustion of diesel in generators. This is directly related to increased hours of load shedding in recent years. However, this emissions source only accounts for 10% of total Scope 1 emissions so overall, the trajectory of Scope 1 results reflects the general drop caused by lower campus occupancy during the pandemic. The sections below expand on the results of each Scope 1 emission source for the 2020 and 2021 financial years.

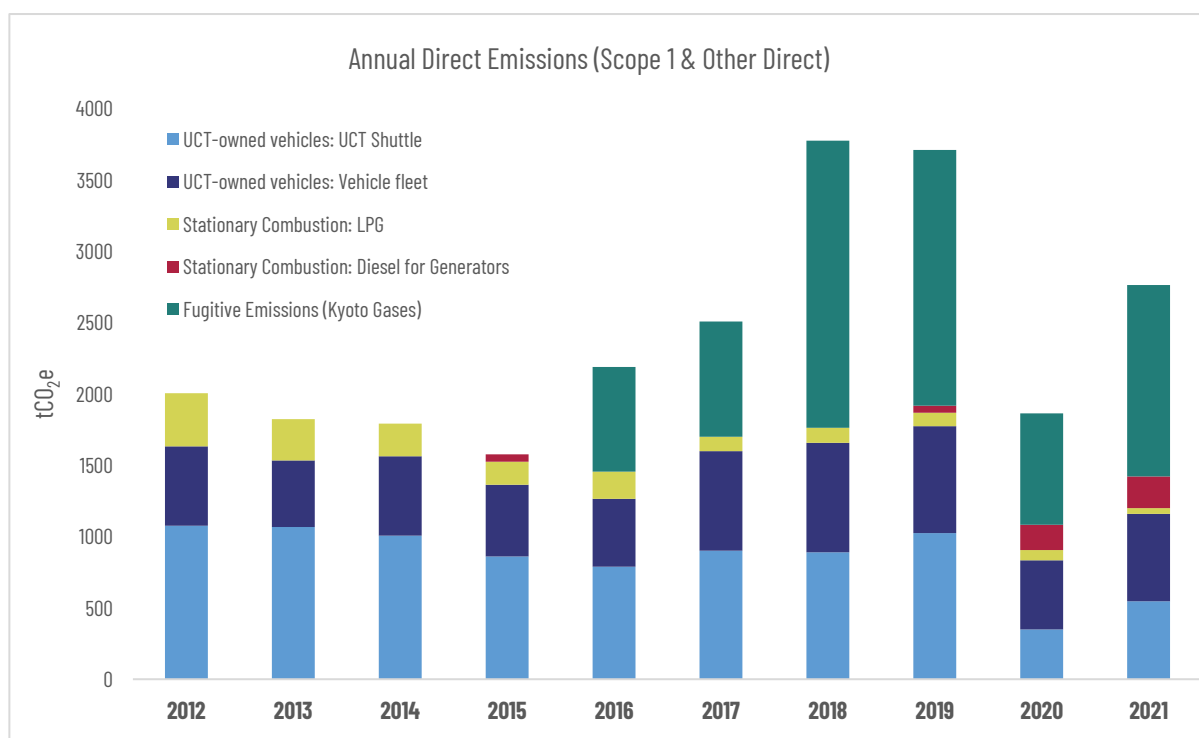


Figure 7: Annual Fluctuations in Scope 1 GHG Emissions per Source Activity

| Scope 1                                      | Tonnes of CO <sub>2</sub> equivalent |              |              |              |              |              |              |              |              |              |
|--|--------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
|  | 2012                                 | 2013         | 2014         | 2015         | 2016         | 2017         | 2018         | 2019         | 2020         | 2021         |
| UCT-owned vehicles: UCT Shuttle              | 1 076                                | 1 068        | 1 006        | 861          | 790          | 902          | 889          | 1 025        | 348          | 547          |
| UCT-owned vehicles: Vehicle fleet            | 557                                  | 465          | 556          | 503          | 475          | 697          | 769          | 748          | 486          | 612          |
| Fugitive Emissions (Kyoto & non-Kyoto Gases) | 0                                    | 0            | 0            | 0            | 733          | 807          | 2 012        | 1 793        | 782          | 1 342        |
| Stationary Combustion: LPG                   | 372                                  | 289          | 230          | 160          | 191          | 102          | 105          | 95           | 71           | 40           |
| Stationary Combustion: Diesel                | 0                                    | 0            | 0            | 53           | 0            | 0            | 0            | 50           | 177          | 223          |
| <b>Total</b>                                 | <b>2 005</b>                         | <b>1 823</b> | <b>1 792</b> | <b>1 577</b> | <b>2 188</b> | <b>2 507</b> | <b>3 774</b> | <b>3 711</b> | <b>1 864</b> | <b>2 763</b> |

Table 7: Annual Scope 1 GHG Emissions per Source Activity

### 5.1 Shuttle Emissions

UCT Shuttle emissions arise from the combustion of fuel in UCT’s shuttle fleet vehicles, all of which run on diesel. The shuttle fleet includes 31 vehicles: 28 buses and 3 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. Although one vehicle was added to the fleet in 2020, emissions decreased 66% between 2019 and 2020 due to the impact of Covid-19 restrictions on shuttle use activity. Emissions then rose by 57% between 2020 and 2021 as activity began to increase again, totalling 547 tCO<sub>2</sub>e in 2021.

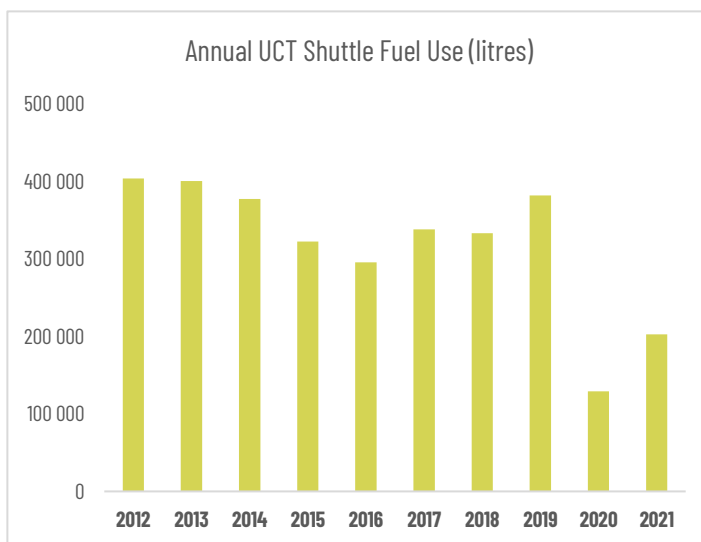


Figure 8: Annual Shuttle Fuel Use Comparison

### 5.2 Vehicle Fleet Emissions

UCT’s vehicle fleet emissions decreased 35% between 2019 and 2020, followed by a 26% increase in 2021 as Covid-19 restrictions started to ease. Emissions totalled 612 tCO<sub>2</sub>e in 2021, arising from the combustion of 149,849 litres of petrol and 98,326 litres of diesel during the financial year. UCT’s 2018 and 2019 fuel use was starting to reveal an upward trend, which was likely to have continued through 2020 and 2021 were it not for reduced travel due to restrictions during those years. The sudden drop in fuel use in 2020 is illustrated in the adjacent chart.

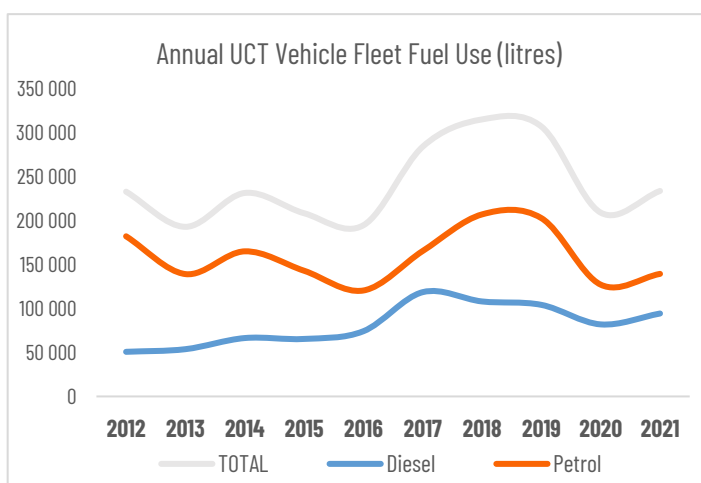


Figure 9: Annual Vehicle Fleet Fuel Use Comparison

### 5.3 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. With lower occupancy levels at UCT’s facilities in 2020, the requirement for refrigerant gas refills decreased significantly. The associated GHG emissions decreased 56% relative to 2019, after which they increased by 72%. Although HCFCs are ozone depleting substances which should be avoided for use in air-conditioning systems, the HCFC-R22 still contributed the majority of UCT’s fugitive emissions in 2021.

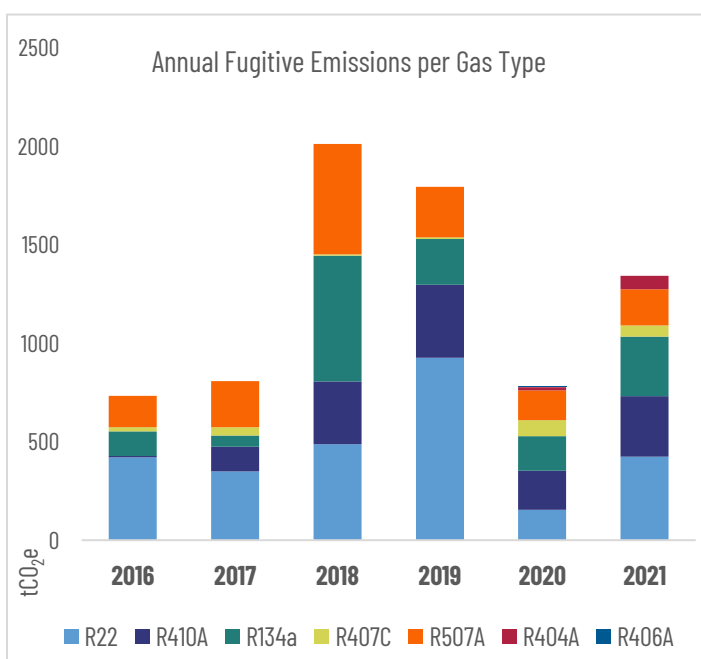


Figure 10: Annual Fugitive Emissions per Gas Type

## 5.4 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.

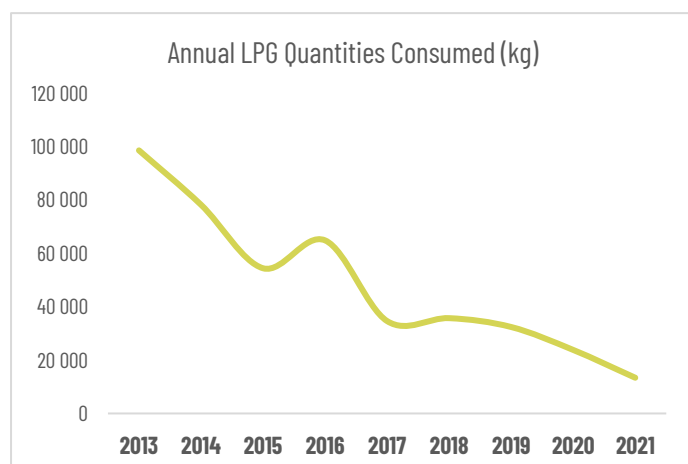


Figure 11: Annual LPG Consumption Comparison

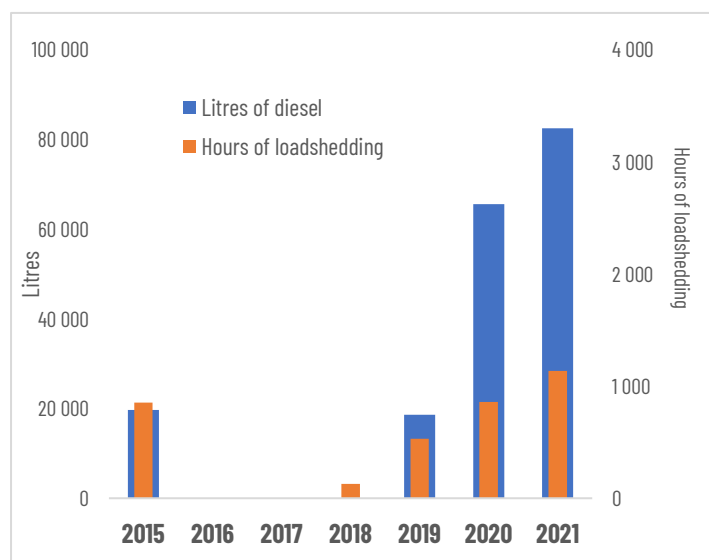


Figure 12: Annual Diesel Consumption Comparison

### LPG emissions

With UCT's shift from LPG water heaters to heat pumps, combined with the impact of Covid-19, emissions associated with the combustion of LPG have steadily decreased since 2018. Total LPG use emissions decreased by 25% between 2019 and 2020, and decrease by a further 44% in 2021. Of the total 13,369 kilograms of LPG used by UCT in 2021, 97% was used at the Medical Campus, while the balance was purchased for facilities located at Ring Road.

### Generator Diesel Emissions

Where most emission sources in these carbon footprints display a sizeable decline in 2020 due to the impact of the Covid-19 pandemic, emissions arising from the combustion of diesel in UCT-controlled generators increased 254% between 2019 and 2020, and increased by further 26% between 2020 and 2021. The suggested increase in diesel use between 2019 and 2020 is exaggerated due to an improvement in data quality and completeness supplied for this assessment; 2019 diesel use was under reported. This explains the lack of correlation between hours of load shedding per year and litres of diesel consumed by generators at UCT.

UCT submits an annual report to the Department of Forestry, Fisheries and Environment in accordance with South Africa's National Greenhouse Gas Emissions Reporting Regulations (NGER). The combined installed energy generation capacity of all UCT-owned and controlled back-up generators exceeds the reporting threshold of 10MW(the) and, as such, the institution has taken the initiative to submit a fuel consumption and emissions report related to diesel consumption across all installed generators. The methodology for calculating emissions arising from diesel combustion in generators aligns with the methodology required for South African NGER reporting.

## 6 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 Eskom. The following results are derived from an emission factor of 1.06 kgCO<sub>2</sub>e per kWh (Eskom Annual Report 2021). This is slightly higher than the emission factor of 1.04 applied to UCT's previous assessment results. The figure below illustrates Scope 2 emissions per UCT campus / facility during each financial year to date.

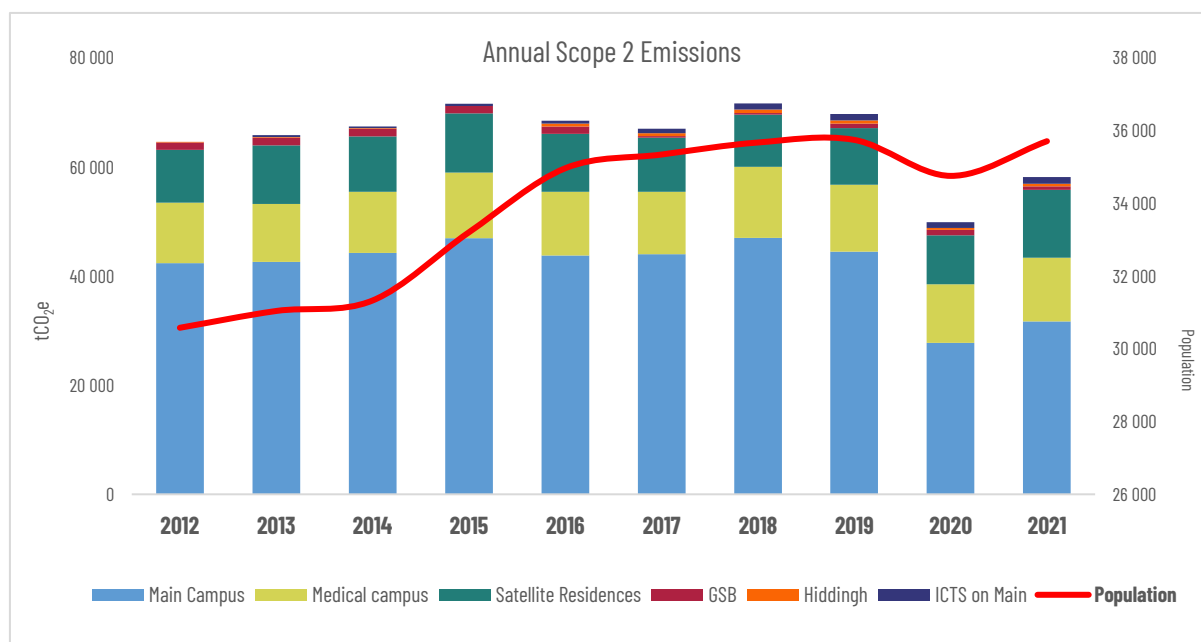


Figure 13: Annual Scope 2 Emission Fluctuations

UCT's annual Scope 2 results largely reflect the impact of Covid-19 on campus occupancy rates: while Main and Hiddingh Campus occupancy dropped notably during Covid-19 restrictions, Medical Campus remained relatively busy and off campus residences continued to consume energy as usual. Main Campus energy use dropped 39% between 2019 and 2020, followed by an increase of 14% in 2021. Across all facilities, a total of 54 million kilowatt hours of electricity were consumed during the 2021 financial year. Emissions arising from electricity consumption contributed 64% of UCT's total carbon footprint in 2021. Of this portion, electricity used at Main Campus contributes 54%, followed by Medical Campus and Satellite Residences. 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.

| Facility                      | Tonnes of CO <sub>2</sub> equivalent |               |               |               |               |               |               |               |               |               |
|-------------------------------|--------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|                               | 2012                                 | 2013          | 2014          | 2015          | 2016          | 2017          | 2018          | 2019          | 2020          | 2021          |
| Main Campus                   | 42 394                               | 42 583        | 44 226        | 46 933        | 43 774        | 44 001        | 47 024        | 44 512        | 27 750        | 31 674        |
| Medical campus                | 11 044                               | 10 648        | 11 241        | 12 027        | 11 654        | 11 477        | 12 993        | 12 238        | 10 734        | 11 695        |
| Satellite Residences          | 9 702                                | 10 729        | 10 141        | 10 850        | 10 633        | 9 885         | 9 585         | 10 375        | 8 980         | 12 437        |
| GSB                           | 1 363                                | 1 417         | 1 393         | 1 387         | 1 382         | 327           | 301           | 839           | 980           | 623           |
| Hiddingh                      | 116                                  | 116           | 112           | 0             | 527           | 504           | 622           | 602           | 381           | 473           |
| ICTS on Main                  | 0                                    | 342           | 335           | 372           | 534           | 834           | 1 096         | 1 141         | 1 076         | 1 265         |
| <b>Total tCO<sub>2</sub>e</b> | <b>64 617</b>                        | <b>65 835</b> | <b>67 447</b> | <b>71 569</b> | <b>68 505</b> | <b>67 028</b> | <b>71 621</b> | <b>69 706</b> | <b>49 902</b> | <b>58 166</b> |

Table 8: Annual Scope 2 Emissions per Facility



## Electricity Use vs UCT Population

Population numbers referred to in this report reflect the number of enrolments at UCT. This assessment sees interesting trends in population relative to energy use (right). Due to Covid-19 restrictions the number of enrolled students does not reflect the number of students present at the university's campuses. Therefore, although electricity consumption dropped significantly in 2020 due to the impact of Covid-19, student and staff populations, although they dropped slightly, remained relatively steady in comparison.

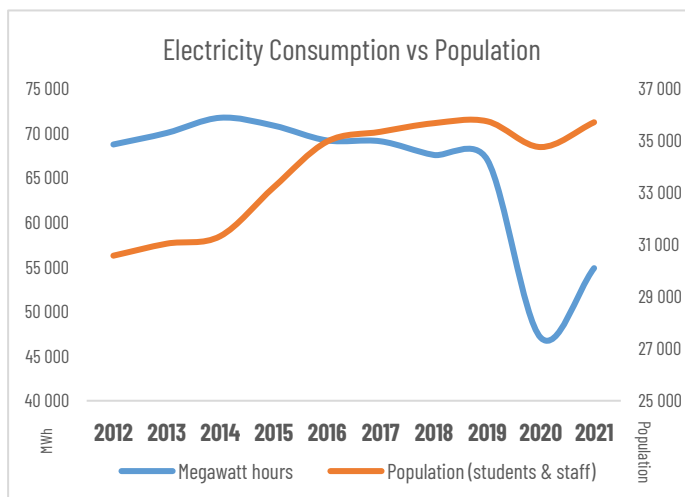


Figure 14: Annual Fluctuations in Electricity Consumption vs Population

## 7 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 2020 and 2021 are tabled and discussed below.

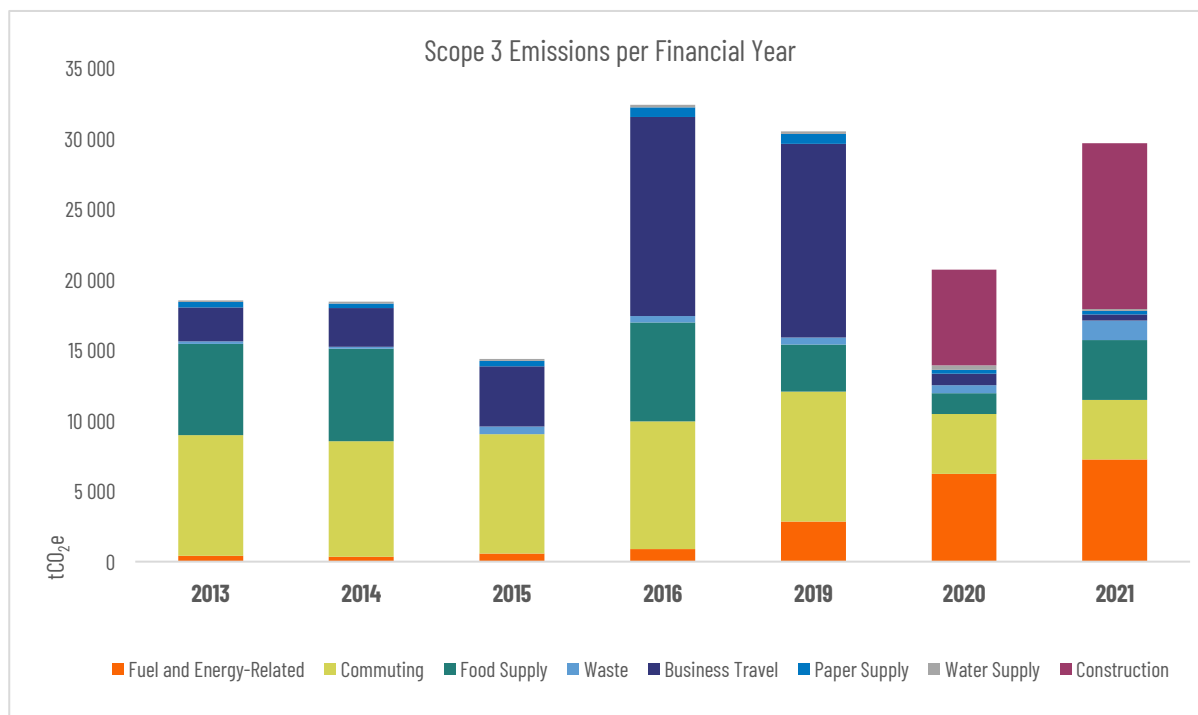


Figure 15: Annual Scope 3 Emissions Fluctuations, per Source Activity

Note: Scope 3 was not reported in 2012 or 2018, while minimal sources were reported in 2017.

| Scope 3                 | Tonnes of CO <sub>2</sub> equivalent |               |               |               |               |            |          |               |               |               |
|-------------------------|--------------------------------------|---------------|---------------|---------------|---------------|------------|----------|---------------|---------------|---------------|
|                         | 2012                                 | 2013          | 2014          | 2015          | 2016          | 2017       | 2018     | 2019          | 2020          | 2021          |
| Construction            | 0                                    | 0             | 0             | 0             | 0             | 0          | 0        | 0             | 6 798         | 11 758        |
| Fuel and Energy-Related | 0                                    | 409           | 341           | 581           | 890           | 0          | 0        | 2 842         | 6 232         | 7 249         |
| Commuting               | 0                                    | 8 566         | 8 217         | 8 465         | 9 071         | 0          | 0        | 9 221         | 4 245         | 4 219         |
| Food Supply             | 0                                    | 6 485         | 6 549         | 0             | 7 022         | 0          | 0        | 3 349         | 1 467         | 4 253         |
| Waste                   | 0                                    | 175           | 143           | 558           | 452           | 506        | 0        | 506           | 584           | 1 384         |
| Business Travel         | 0                                    | 2 406         | 2 752         | 4 258         | 14 131        | 0          | 0        | 13 728        | 811           | 437           |
| Paper Supply            | 0                                    | 386           | 305           | 382           | 667           | 0          | 0        | 708           | 271           | 249           |
| Water Supply            | 0                                    | 121           | 139           | 138           | 194           | 174        | 0        | 179           | 321           | 147           |
| <b>Total</b>            | <b>0</b>                             | <b>18 547</b> | <b>18 446</b> | <b>14 382</b> | <b>32 427</b> | <b>680</b> | <b>0</b> | <b>30 533</b> | <b>20 729</b> | <b>29 696</b> |

Table 9: Annual Scope 3 Emission Results per Source Activity

## 7.1 Construction Emissions

This is the first assessment in which UCT has reported emissions associated with construction. This category covers the upstream, embedded greenhouse gas emissions in the materials used to construct UCT's capital goods. For UCT during 2020 and 2021, this included the construction of buildings, electrical and plumbing infrastructure, demolition and earthworks, as well as voice and data infrastructure. Now that this indirect emissions source is included in UCT's inventory, it is the highest contributor to Scope 3 emissions at 11,758 tCO<sub>2</sub>e and 39% during 2021. Although this has raised the overall carbon footprint, it also provides a new opportunity for implementing and tracking emission reductions.

## 7.2 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" emissions for fuels consumed, as well as "Transmission and Distribution Loss" emissions related to electricity consumed. The 2020 total for this category is more than double the 2019 total. However, this does not reflect an increase in activity but rather the application of a more appropriate, South Africa-specific emission factor, which is higher than its UK counterpart, previously applied.

## 7.3 Purchased Goods and Services Emissions

### Food Supply

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. Upstream embedded emissions in food supplied to UCT decreased 56% between 2019 and 2020, followed by a 190% increase in 2021. After inspection it is believed that 2019 figures were under reported and the more recent data from 2021 is the most accurate reflection of food supply activity to date. As such, more accurate (higher) 2019 figures and emissions would have revealed a sharper drop between 2019 and 2020, where 2021 figures would more closely align with those from 2019.

### Water Supply

Water data was supplied via SAP, in addition to consumption data from UCT's Graduate School of Business, which is consistent with the breakdown provided in 2019. A comprehensive water metering system is still being installed and the system data should be available for use in UCT's next assessment. Although water consumption declined by 38% between 2019 and 2020 due to reduced activity on campuses, emissions increased by 80%. This is due to the application of a more appropriate, higher South African emission factor for water supply. Overall consumption continued to decline into 2021. Future assessment results will enable a more meaningful annual emissions comparison with the consistent application of the new emission factor.

### Paper Supply

UCT purchases office paper and custodial paper, as well as paper and books used for exams. Greenhouse gas emissions are embedded in these papers during the production and transportation of the material. Paper use emissions dropped 62% in 2020 and dropped a further 8% in 2021. Consistent with previous years, the majority of paper (88% in 2020 and 75% in 2021) is for office use and this is where UCT can focus on reducing paper use and the associated emissions.

## 7.4 Commuting Emissions

Commuting Emissions are based on a survey taken in 2014. However, the data is updated based on the following factors: Populations of students and staff, monthly campus occupancy variations due to Covid-19 split between medical and main campus, a decline in train travel and a consequent increase in taxi travel. As expected, due to many students remaining at home during 2020 and much of 2021, these emissions decreased 54% between 2019 and 2020, followed by a further 1% decrease in 2021.

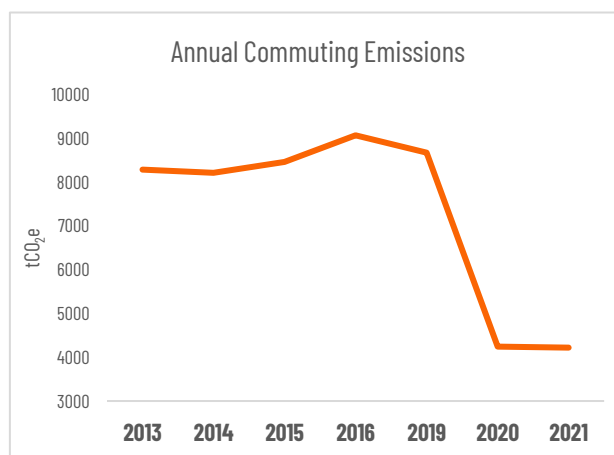


Figure 16: Annual Commuting Emissions Fluctuations

## 7.5 Business Travel Emissions

The international impact that Covid-19 had on travel is evident in the results of UCT's Scope 3 business travel emissions, particularly related to air travel which has decreased 94% between 2019 and 2020, decreasing further by 48% the following year in 2021.

Likewise, road travel emissions have decreased by 84% year-on-year between 2019 and 2020, followed by a further 13% reduction between 2020 and 2021. This includes hired cars, staff reimbursements and travel allowances.

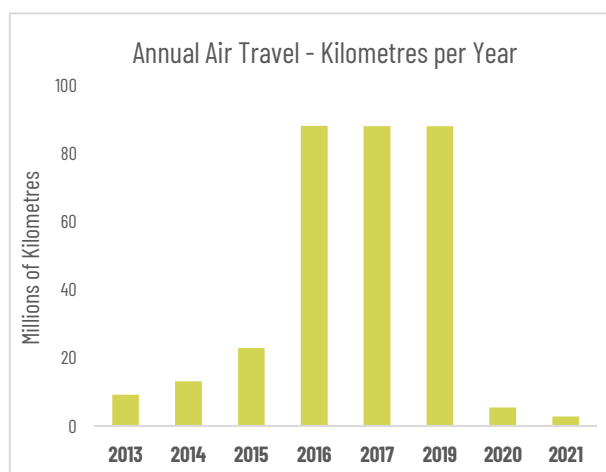


Figure 17: Annual Air Travel Emissions Fluctuations

## 7.6 Waste Generation Emissions

Indirect emissions from waste generation occur due to disposal, treatment method and transport of waste types. In 2021, 78% of UCT's waste generated was sent to landfill. Currently the university has several recycling initiatives in place which reduce overall emissions from this source. Total waste emissions decreased 61% between 2019 and 2020 due to reduced activity during that year, then levelled out again with a 132% increase into 2021.

## 8 Targets

Since the boundary of Scope 3 emissions fluctuates year-on-year, as does the availability and accuracy of the associated data, it is best to review annual emission comparisons by looking at Scope 1, Scope 2 and Other Direct emissions only.

The results show an overall **9% decrease** in these emissions relative to UCT's first assessment in 2012, which equates to approximately **1% emissions reduction per annum**.

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. UCT's 2050 Net Zero target will require 2-5% emissions reduction per annum off a 2020 baseline. Due to the unique impact of Covid-19 on the 2020 inventory, UCT should consider 2021 a more appropriate baseline emissions inventory.

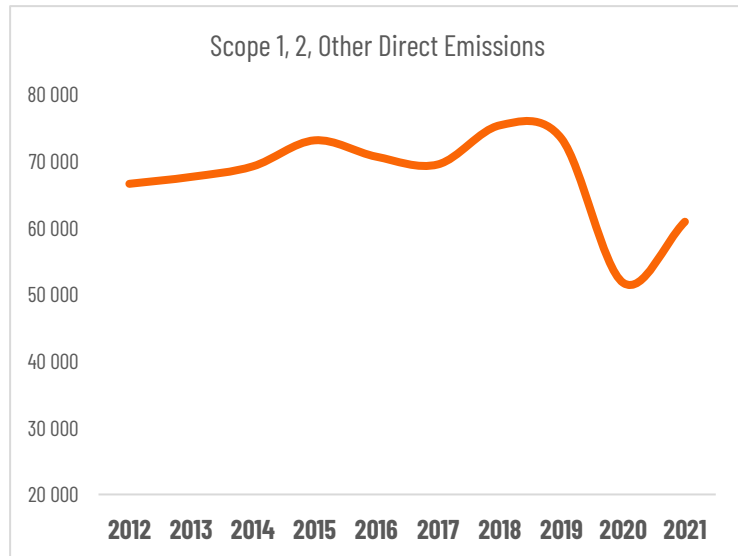


Figure 18: Annual Fluctuation in Scope 1, 2 and Other Direct Emissions

| Emissions                | Tonnes of CO <sub>2</sub> e |        |        | % Change     |
|--------------------------|-----------------------------|--------|--------|--------------|
|                          | 2012                        | 2020   | 2021   | 2012 vs 2021 |
| Scope 1, 2, Other Direct | 66 622                      | 51 767 | 60 929 | <b>-9%</b>   |

Table 10: Percentage Change in Scope 1, 2 & Other Direct Emissions

### UCT has set the following targets:

- Net Zero emissions by 2050 (Scope 1 and 2)
- 2 - 5% reductions in emissions per annum from 2020

### Renewable Electricity at UCT

During the 2020 and 2021 financial years, one small solar installation was present at UCT's Graça Machel residence. Energy consumption data related to this installation is not currently available and the associated "avoided" emissions related to renewable energy use are excluded. This will be included retrospectively in future assessments. Scope 2 provides the greatest opportunity for emission reductions at UCT and the most effective approach for the institution to maintain its reduction target. Solar PV installations are underway and the impact will reflect in UCT's subsequent carbon footprint results.

## 9 Recommendations

### 9.1 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 58,166 tCO<sub>2</sub>e which contributed 64% of UCT's most recent greenhouse gas inventory. Of this, 54% are accounted for by electricity consumption on Main Campus. **Electricity consumption at Main Campus 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 relatively robust. With the rollout of various solar PV installations on UCT campuses, future inventories will 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 start to displace Scope 2 emissions over time.

#### Scope 1 and 3

Although Scope 1 and 3 contribute 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 should investigate the feasibility of converting UCT's shuttle and vehicle fleets to electric vehicles. This initiative can run alongside the installation of solar electricity production, such that electric vehicles can be charged on-site via solar PV. UCT can also focus on route and driving efficiency to reduce overall fuel consumption.
- **Fugitive refrigerant gases:**  
UCT should 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 of paper - 88% in 2020 and 75% in 2021 - is 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.
- **Waste generation:**  
78% of UCT's waste is sent to landfill. Although waste emissions only contribute 1.5% 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.

## 9.2 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.

- **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 (m<sup>2</sup>). 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 a 5-year data management plan by UCT.
- **Diesel used in generators:** Unlike the data provided for UCT's 2019 assessment, diesel consumption data provided for 2020 and 2021 was not disaggregated between buses and Quants. Emissions associated with one Quantum vehicle was previously reported in the UCT fleet emissions category. It was not possible to report the same way for 2020 and 2021 since data was consolidated by fuel type. Therefore, emissions arising from this vehicle's activity may be double counted. Ideally fuel consumption per vehicle should be collected, to clearly separate shuttle and fleet emissions.
- **Business Travel:** Data was provided in the form of SAP general ledgers, which log information including expenditure. However, no travel distances or routes are logged, and this information is required for greenhouse gas emission calculations. UCT should implement a system for logging all flight routes and flight class for air travel, as well as distances or fuel quantities related to travel by road.
- **Construction:** The data provided for this first assessment of UCT's construction footprint was neatly aggregated as total capital expenditure (capex) on construction-related projects and infrastructure. However, accounting for construction emissions based on expenditure provides a very broad estimate of the actual impact. Since this source contributes a material portion of UCT's greenhouse gas emissions and 40% of Scope 3 emissions, 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 eventually be submitted by all vendors to cover the sale volumes from each.
- **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.
- **Waste:** GCX noticed errors on the data sheet submitted from the service provider. UCT should double check totals when deriving data from these sheets.

## 10 Appendix A - Methodology

Results were measured in according to the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard (WRI & WBCSD, 2004), applying the operational control consolidation approach. 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, limited Scope 3 emissions were also included. All emissions were expressed as CO<sub>2</sub> equivalents (CO<sub>2</sub>e), and account for carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O).

All emission factors used were from UK Government GHG Conversion Factors for Company Reporting 2020 and 2021, using IPCC AR4 (2007) GWPs, unless stated otherwise. Fuel emission factors (diesel, petrol and LPG) are directly from IPCC 2007 factors for each fuel, to align with the South African National Greenhouse Gas Emissions Reporting (NGER) Regulations reporting methodology requirements. These fuels present emissions sources that have the potential to be captured under these regulations. Since UCT already submit annual NGER reports to the Department of Forestry, Fisheries and Environment via the government's SAGERS reported system, these factors are applied to align the methodologies for the sake of consistency.

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 Appendix B "Assumptions and Limitations".

### Scope 1

#### Diesel used in generators

- 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 purchases, which were converted to estimated litres of diesel combusted, through the application of an assumed fuel price for each transaction. Line items that clearly showed service charges (not litres of diesel purchased) were removed from the total. After invoices were supplied to verify consumption figures, it was found that most fuel prices applied were not accurate. GCX adjusted them to recalculate diesel consumption values, which are also provided on the supplied invoices. Invoices were provided for all 2020 transaction records and for less than half of 2021 transaction records. After adjustments, the total diesel consumption reduced by 15% for 2020 and by 3.5% in 2021. This differs from the 2019 methodology where only the information provided on invoices was utilised and it was noted that not all invoices were available, so total diesel use was under reported. LPG data was supplied by P&S as expenditure information, which included service charges. Since this is not a true reflection of LPG use, PDF invoices were provided, which GCX used to verify the actual quantities of LPG purchased. The PDFs refer to two locations for 2020 and 2021: UCT Ring Road Rondebosch and Medical Campus. UCT confirm that although there were more location categories in the 2019 assessment, the information provided is comprehensive for the current reporting years.

#### 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 scope. Several different refrigerant gas types were refilled during each reporting period. The relevant emission factor is applied to each, to calculate the equivalent CO<sub>2</sub> equivalent emissions. Refills are conducted by various service providers across UCT facilities.

## Vehicle Fleet

- Vehicle fleet data was provided by Absa, Eqstra and from UCT via the internal SAP system. Previously, data was also provided by Bidvest to facilitate the calculation of a UCT-specific Rands per litre for petrol and fuel consumption. However, since all Bidvest fuel purchases are also logged on the SAP system, UCT chose to utilise the SAP data rather than sourcing the Bidvest report. As such, fleet emission calculations are based on lower quality data this year, because Bidvest activity is included based on expenditure data and the Rands per litre applied to convert all expenditure data from SAP to fuel quantities is based on national average fuel prices for 2020 and 2021.
- Quantums - travel emissions are now reported in the Shuttle emissions category rather than Fleet (as in 2019) because fuel consumption data is provided consolidated per fuel type. Since Quantums and buses both use diesel, Quantum activity can't be separated from the UCT Shuttle buses. Eqstra report: several line items reported fuel use, but the fuel type was not noted. In these instances, it is assumed to be petrol. Eqstra report summary does not provide dates to differentiate between 2020 and 2021. Therefore, the litres are split in half between the 2 reporting periods as a best estimate. Most likely, 2020 was lower and 2021 was higher. Although Bidvest information is included in the SAP report, that data was previously excluded from the SAP totals and reported separately, because the travel in these owned vehicles monitored by Bidvest was logged in litres of fuel, which yields more accurate emission calculations. Since actual consumption data is not provided in the SAP report, total spend is used to estimate fuel quantities, applying 45 / 55% split between diesel and petrol assuming a similar split to the ABSA vehicles activity. Cost per km is based on average price of petrol and diesel in each reporting year.

## 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 includes 33 vehicles. The fuel consumption data provided (A3) covers all 33 vehicles. Unlike the data provided for UCT's 2019 assessment, diesel consumption data provided for 2020 and 2021 was not disaggregated between buses and quantums. In 2019 only buses were reported in the Shuttle emissions category. Quantums and other non-bus vehicles were reported in Fleet category under "Bidvest". CA 299 702 (Quantum 301): fuel consumption related to this vehicle was reported in the "Fleet" emissions for the 2019 reporting year. Since the 2020 and 2021 data is consolidated for all buses and quantums, this vehicle's consumption cannot be separated out from the rest of the shuttle fleet. Therefore, the emissions are reported under UCT Shuttle category. CA 329 930 (Nissan NP200) and CA 311 628 (VW Polo) were previously reported with UCT-owned vehicle fleet emissions, rather than shuttle emissions. Since this data is reported separately, due to the different fuel type (petrol) we are able to continue to report the associated emissions with UCT-owned vehicle fleet emissions category. Balance of vehicles: to avoid double counting, all records on SAP report labelled "Jammie Shuttle" have been removed and are excluded from the emissions reported in Fleet category. Therefore, it is assumed none of these vehicles' fuel consumption emissions are double counted. One Quantum vehicle: CA 299 702 was reported to be part of the Bidvest-managed fleet in 2019. This vehicle consumes diesel and the associated fuel use was reported consolidated with all other diesel vehicles. Therefore, it is possible the activity is reported in both categories and double counted. Vehicle CAA 193 710 is new since the 2019 assessment.

## Scope 2

- Electricity grid emission factor for South Africa of 1.06 kg CO<sub>2</sub>/kWh was applied to the 2020 and 2021 reporting years, (Eskom Annual Report, 2021). Ideally the grid emission factor for 2022 would be applied to UCT's 2021 data, however, Eskom is yet to release their annual report for the current financial year. 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 to date have been based on the Eskom emission Factor 1 "total energy sold". GCX recommends 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 these 2020 and 2021 assessment results. Eskom's AR 2021 Factor 1 is 1.08 tons of CO<sub>2</sub> per MWh and Factor 2 is 1.06 tons of CO<sub>2</sub> per MWh. If UCT prefers a consistent comparison of Scope 2 emission results based on the same choice of factor for all assessments, Eskom's Factor 2 can be applied retrospectively to each past reporting year to update historic totals.
- 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. 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.

#### GSB

- "UCT has 100% operational control of its 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, the expenditure is separated and this was used to determine a best estimate of the % split in consumption between them. 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 estimated % breakdown of hotel visitors for each reporting period. 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: 17.5% (2020), 7.3% (2021), Other Hotel Guests: 82.5% (2020), 92.7% (2021)"
- 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, Grootte Schuur, Field Stations, Sports Science Institute, Valkenberg Manor House & Wild Fig, Montebello. As such, electricity consumption for these facilities was not provided and is not included in the assessment.
- 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.

#### Erf numbers

- 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. To avoid double counting, the associated emissions are reported for those campuses only. In previous assessments, Baxter Theatre was considered not to be under UCT's operational control in terms of electricity consumption. The

area of the Baxter was excluded from the assessment boundary. After discussions in 2022 it has been concluded that the theatre should be considered to be under UCT's operational control. The square metres of the facility are now included in the boundary, and the electricity consumption is assumed to be included in the data provided for lower campus, as this is assigned to erf 103239 which is under Lower Campus on the Master Erven (see "Assumptions").

### Scope 3

- Emissions associated with Transmission and Distribution losses are calculated using a factor derived from Eskom's AR21 based on the overall energy losses on Eskom's networks, which came to 11.78% during their financial year.

### Business Travel

- Flight information was supplied in a SAP report where the general ledger provided expenditure data rather than actual distances travelled or flight routes. The report includes many non-flight expenses linked to local and foreign air travel, and related payments such as accommodation, taxes, services fees, etc, which were filtered out based on various assumptions.
- Flight routes or distances were not provided. Therefore it is not possible to correctly apply DEFRA methodology for flights distance categories.
- UCT had an economy-only flights policy during 2020 and 2021. There may have been an occasional business class flight which would have required approval, but it can be assumed that more than 99% of flights were economy class.
- The general ledger for foreign flights contained some local flights. However, data was processed and reported in the categories provided.
- As per 2019 methodology, flight average Rands per km was derived from a small sample of actual flights taken by UCT. These metrics were derived for local air travel, foreign air travel, travel in 2020 and travel in 2021.
- 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. For this assessment, Bidvest entries were not filtered out because a separate Bidvest report was not provided.
- 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 applied to the 2019 calculations has been applied, assuming similar costs in 2020 and 2021.
- 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.

### Commuting

- In the interest of comparability, although emissions are significantly affected by the impact of Covid-19, the methodology applied in 2019 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 to reflect the general shift from staff and student commuting via train to commuting via taxi. These %'s were adjusted to increase travel by taxi and decrease 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 2020 and 2021, with both years adjusted to account for the impact of Covid-19 on staff and student presence on campus. Occupancy has been provided for the Health Faculty and for Rest of UCT because these 2 areas differed significantly. Staff and students had more of a presence at

Health Faculty due to treatment of Covid-19 patients and conducting Covid-19 research. Total populations are adjusted based on these detailed reports. Commuting in UCT shuttle is excluded as the associated emissions are reported in Scope 1 as UCT-owned and controlled vehicles

- To estimate emissions from travel by taxi, the emission factor was applied for large petrol vehicle, which has been divided by the average number of passengers per taxi trip (assume to be 10 on average), to determine emissions per passenger kilometre.

#### Food Supply

- 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.

#### Residence Meals

- First Tier Residences are contracted by UCT Student Housing Department, 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. Information on Halaal meals was not provided because the data provider no longer provides those meals at residences.

#### Campus Food Vendors

- Campus Food Vendors data is provided by the primary vendor, Food & Connect. No data is provided for the balance of the vendors. 2019 Campus Food Vendors data from Food & Connect was broken into Hot meals, Sandwiches, Wraps, Hot Chips, Burgers, Double hot dog, Mac & Cheese and Butter Chicken. F&C explained a general move away from meal of the day / plated meals. Data is now provided as "Bakery Items" and "Food Items". The stats are low due to Covid-19 19 and the low student and staff participation rate in 2020/1 due to the restrictions and limited access to campus during this period. Factors source: 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.

#### Extrapolations for Food Vendors

- For the 2019 assessment it was assumed that Food & Connect provided approximately one third of all meals on campus. In 2020 after the state of emergency was declared, all stores closed for the remainder of the year. It is assumed that the data provided represents close to 100% of activity. In 2021, 50% of vendors were trading (from April 2021) which means there were only 3 or 4 vendors trading. For the purpose of accounting for food supply emissions, GCX assumed Food & Connect was, on average, one of 3 main vendors operating on campus for the majority of 2021. As such, emissions are extrapolated to represent all 3 vendors' activity in 2021.

#### Paper

- Initial data provided was in the form of a SAP report where the general ledger listed various purchases related to paper and stationary, providing only 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 both

Waltons and Konika Minolta. All reported units were converted to kilograms of paper. See "assumptions" tab for conversions.

- Since most paper used is Mondi paper type, the emission factor applied to calculate emissions associated with paper use is from Mondi Rotatrim August 2019.

#### 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. UCT confirm that data provided in C7-1 and C7-3 covers all UCT water consumption for 2020 and 2021. C7-2 is a code reserved from digital water meter readings, the installation of which is yet to be completed.

#### Waste

- Emission factors for recycled waste are from UK Government GHG Conversion Factors for Company Reporting 2020 and 2021 v1.00. The emission factor for general waste to landfill is from Freiderich & Trois, 2011. C8-2: Hazardous Chemical Waste was provided in litres and converted to kilograms by GCX based on an average density for "commercial waste" of 0.089 tonnes per m<sup>3</sup>. C8-1: As per 2019 assessment, recycled waste is total recycled kg minus food waste (as the waste report includes food waste in the total recycled waste). The Waste Control report totalled the incorrect cells to provide the total recyclable waste. GCX recalculated it as the sum of 2021 recyclable waste. C8-3: Printer cartridges are included in the kilograms of e-Waste reported for C8-2. C8-4 and C8-5: Data provider ICTS confirms that no eWaste was collected in 2020, though there is waste reported from P&S. For 2021 there is waste removal reported by ICTS and P&S.

#### Construction

- Construction data is based on UCT's expenditure on construction during each reporting period in ZAR. To convert ZAR to USD an exchange rate is applied based on the average ZAR / USD exchange rate in 2020 and 2021 respectively. An extensive report was submitted by UCT that included construction and non-construction expenditure: capital projects, repairs and maintenance, consulting fees, advertising, moving, security services, notations, landscaping, purchasing of new properties, etc. To separate the amounts spent on construction projects, it was confirmed with UCT that all projects labelled "Capital Projects - Building", "Capital Projects - Electrical", and "Capital Projects - Plumbing", "Capital Projects - Demolition & Earthworks" and "Capital Projects - Voice and Data Infrastructure" relate to construction projects. Various voice and data infrastructure projects are undertaken. Those included here are projects managed under UCT Properties & Services department as this is where construction data is sourced. However, it currently excludes voice and data infrastructure projects managed by other departments.
- The GHG Protocol Scope 3 Evaluator Tool for capital goods: "construction" was applied to calculate the GHG emissions arising from this construction activity. The emission factor was back calculated and listed on the "EF" tab.

#### Boundary

- UCT confirm that all properties with 0m<sup>2</sup> 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 m<sup>2</sup> are provided for an erf that is not under UCT's operational control, it has been removed from the total m<sup>2</sup>.

## 11 Appendix B – Assumptions and Limitations

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

- Electricity Consumption:**

Most electricity data is provided per erf. In order to ensure that electricity data was provided for all erfs under UCT's operational control, a single clear and comprehensive list of erf numbers under the institution's operational control is required. Although a few lists were provided, some erf numbers were not listed. Where electricity is provided at campus level, it is not clear exactly which erfs are covered by the data and, therefore, whether or not all erfs are covered in the overall data set. 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, Hiddingh and Medical Campuses, including all erfs listed under those campus names on the Master Erven and Property Areas spreadsheets. This implies that the data provided for lower campus includes consumption at the Baxter Theatre (as erf 103239 is listed on the Master Erven under Lower Campus). 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 would 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 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.
- Where 2020 or 2021 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 2019 data as a best estimate.
- Erf 46015 (7 Stanley) data was provided from Community Development as kWh consumed per month. All data was available except for January 2021, which was estimated by GCX based on the average consumption across all other months in that year.
- Flights: since the SAP report provided included many non-flight expenses, actual flight records were isolated by filtering out certain key words, mostly aligned with the 2019 method applied. Records including the following words were filtered out: "baggage", "accom", "uber", "transfer", "change", "fee", "hire", "insurance", "shuttle", "tax", "serv".
- Staff reimbursements: as per 2019 methodology, it is assumed that all general ledger records where "net price" (cost per km) is logged at R3.61, 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. Kilometres travelled are based on an assumed average vehicle efficiency of 6l per 100 km in line with previous assessments. The kilometres are derived from total spend on allowances, which exclude accommodation to more accurately estimate fuel quantities used for travel.
- Commute: For the purpose of this assessment it is assumed that the health faculty population accounts on average for approximately 15% of UCT students and staff.

- Commute: For the purpose of this assessment it is assumed that staff typically travelled to campus 250 days of the year while students travelled to campus 152 days of the year.
- To account for the impact of Covid-19, the number of students and staff travelling on those days has been adjusted for certain monthly periods where proportions of populations present on campus were logged. The portions were logged separately for the Health Faculty and the rest of campus.
- 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. The assumptions have been adjusted based on an estimated 20% reduction in exams on campus in 2020 (relative to 2019) and 25% reduction in 2021 (relative to 2019).
- 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.
- Food: In 2019 a vouchers figure was provided by Residence and by Food&Connect. Only 1 was used for calculations to avoid double counting. The one used was the figure from Food & Connect, which was lower than the Residence figure, assuming some vouchers were not redeemed and the lower figure is a more accurate reflection of consumption.
- 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. Other gaps in area data remain zero square metres.
- Construction data is based on UCT's expenditure on construction during each reporting period in ZAR. To convert ZAR to USD an exchange rate is applied based on the average ZAR / USD exchange rate in 2020 and 2021 respectively.