INSTITUTIONAL REPORT

for internal communication

UNIVERSITY OF CAPE TOWN

CARBON FOOTPRINT REPORT 2017

ACKNOWLEDGEMENTS

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The Properties and Services Department and the Environmental Management Working Group.

All the data holders from across the university from the Properties and Services Department, Student Housing, and Procurement Services.

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External review: Anthony Dane, director at Change Pathways.

Previous reports can be downloaded at http://www.uct.ac.za/main/explore-uct/sustainability.

A. INTRODUCTION

This is the seventh carbon footprint report of the University of Cape Town, for the year 2017. The first report, for the year 2007, was completed in 2009; however, the boundaries of that report were limited to Main Campus. The first report with the current boundaries and using the current methodology, the Greenhouse Gas Protocol, was for 2012. The report covers the entire university across all campuses of 708 267 square metres (m^2) and a total population of 35 343 students and staff.

This reporting process has produced two outputs:

1. This detailed report for internal purposes that aims to report on the findings, identify the best opportunities for emission reductions, and also to capture institutional knowledge;
2. An executive summary for external reporting purposes, to be available on UCT's website.

Beyond reporting on the findings of the 2017 footprint, key objectives of this report are to serve as a record of the process, provide background to the results and identify the challenges experienced in compiling the UCT Carbon Report over the years, towards future improvement.

This report was written at a time when there was an absence of leadership within UCT around campus sustainability, due to vacant staff posts and transitions in governance. During 2018, a new post of Director of Sustainability in the Office of the Vice-Chancellor was created, and it is therefore expected that future reports will be guided by the new incumbent with greater support from the executive.

Previous reports since 2012 have reported on all scopes – Scope 1, 2 and 3 emissions, as per the GHG Protocol[1]. A major challenge was encountered in gathering the data for the Scope 3 Indirect Emissions for this report. It should be noted that reporting of Scope 1 and Scope 2 emissions is compulsory under the GHG Protocol, with all other indirect emissions reported on a voluntary basis. This informed the decision to omit Scope 3 emissions from these results. Matters relating to data gathering for Scope 3 activities have been reported, and recommendations made to ensure that these emissions can be reported more effectively in future. Scope 3 emissions had risen to comprise 26% of total emissions by 2016 and are thus considered material for UCT to report on and to target for emission reduction strategies. In particular, Scope 3 Business Travel, comprising air travel, hired cars and staff mileage reimbursements, is a significant cost to the university and presents opportunities for mitigation.

Why is reporting carbon emissions important for UCT?

The arena of climate change is recognised by the university as one of its key research strengths, and UCT has enjoyed recognition for world-leading research in this arena. UCT is proud of holding one of the largest concentrations of climate expertise in Africa[2].

UCT signed its first international environmental declaration, the Talloires Declaration, as far back as 1990. This commitment was strengthened in 2012 by joining the International Sustainable Campus Network (ISCN) and signing the ISCN-GULF (Global University Leader Forum) Sustainable Campus Charter, an international university-based environmental policy that integrates sustainability in education, research,

[1] https://ghgprotocol.org/standards

[2] "The ACDI that [Professor Mark] New directs reflects the largest concentration of expertise in climate and development in Africa." Source: UCT African Climate and Development Initiative (ACDI) website

outreach, strategic planning and operations. The results of the UCT Carbon Footprint Reports form a key component of the reporting in terms of the ISCN-GULF Charter.

Achieving Sustainable Development Goals (SDG), as set out by the United Nations, has become an increasing focus within UCT research in recent years. UCT academics and researchers were among the world-leading academics involved in lobbying for and drafting of the Sustainable Development Goals adopted in 2015 by the United Nations. The importance of climate change is reflected in Sustainable Development Goal 13: "Take urgent action to combat climate change and its impacts".

Internal environmental policies that commit to reporting and mitigating carbon emissions include:

- UCT Green Campus Policy Framework, 2008, adopted by the university Council in 2009.
- The Green Campus Action Plan 2009 drafted under the direction of the Properties and Services Department (P&S) and the Environmental Management Working Group (EMWG).

At the country level, South Africa has made international commitments to progress its contribution to the global effort to mitigate climate change. Under the United Nations Convention on Climate Change, South Africa's nationally determined contribution (NDC) will result in an emissions trajectory that peaks between 2020 and 2025, plateaus for approximately a decade, and declines in absolute terms thereafter. The NDC refers to various policy instruments, including "… company level carbon budgets, as well as regulatory standards and controls for specifically identified greenhouse gas pollutants and emitters".

Given these policies and commitments, UCT should play a leadership role in terms of setting and achieving ambitious greenhouse gas and energy targets.

Key drivers for reporting and mitigating greenhouse gas emissions for the university are:

- Innovation and leadership: Leveraging this reporting process for educational benefit; exploring emissions offsets[3]; mitigation measures; and coordination and alignment of the reporting processes.
- Resource/operational cost savings for electricity, water, fuel use on land, and air travel, especially given projected rising electricity and water tariffs.
- Water consumption reduction in the context of drought: Reducing water consumption is critical in response to the severe drought in Cape Town and would reduce operational costs and emissions.
- Meeting increasing stakeholder expectations over the use of fossil fuels and water conservation, as well as greenhouse gas emissions.

[3] Provision is made in the legislation for carbon offsets in the Draft Carbon Tax Bill expected to be implemented South Africa in June 2019. A carbon offset is one of the mechanisms an organisation can use to reduce its carbon footprint and reduce its emissions profile. Carbon offset schemes encourage organisations to invest in environmental projects around the world in order to balance out their own emissions.

Methodology	- Greenhouse Gas Protocol – corporate accounting and reporting standard. - Emission factors are from the UK Department for Environment, Food and Rural Affairs (Defra)[4], except for electricity supply where the Eskom factor was used as described below. - Results are reported in metric tonnes of carbon dioxide equivalent – tCO_2e. - The quality of data for Scope 1 is based on measurements and therefore of high quality. Scope 2 data has improved to medium-high quality since data is being gathered from digital meters for the major portion of electricity supplied.
Inclusions	- The entire university across all campuses and properties. - Staff: 6 640 full-time equivalent (FTE). - Students: 28 703. - Electricity grid emission factor: 0.97 $kgCO_2e/kWh$.
Exclusions	- Data required for emissions calculation is not currently available for the majority of Scope 3 categories, except water supply and waste, therefore results for Scope 3 are not reported here. - The Greenhouse Gas Protocol requires carbon footprint calculations to include all direct emissions under Scope 1 and indirect emissions from purchased electricity under Scope 2 as compulsory reporting. Other activities under indirect emissions, Scope 3, are voluntarily reported.

Emission Factors

Emission factors convert operational activity data (e.g. kilometres driven, kilowatt hours of purchased electricity) into a value indicating the greenhouse gas emissions generated by that activity, reported as carbon dioxide equivalent (CO_2e).

Electricity grid emission factor

The Grid Emission Factor is the total amount of greenhouse gases emitted per unit of electricity generated for and distributed by an electricity grid. South Africa has a carbon intensive grid due to the majority of power generation being coal-fired. The Eskom Grid Emission Factor is decreasing over time as efforts are made to reduce the environmental impact of producing electricity. A further decline is expected as renewable energy generation increases in South Africa through the national Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

Electricity use is a major component of the UCT carbon footprint, typically around 75% of total emissions. Any change to the emission factors therefore has a significant effect on overall results. For the 2014 report, an emission factor determined by an industry partnership, aiming to provide a more accurate grid emission factor than the one reported by Eskom, was used to estimate 2014 emissions

[4] Emission factors obtained from https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2016

(0.94 $kgCO_2e/kWh$; MAC Consulting 2013). Subsequently this process has not been repeated and therefore in subsequent years the footprint has relied on grid emission factors reported by Eskom. For the 2015 and 2016 reports, an Eskom emission factor of 1.03 $kgCO_2e/kWh$ was used.

For this report, a decision was taken to use the emissions factors from the annual Eskom Integrated Reports (IR) as per Table 1 below, and to restate electricity emissions for 2015 and 2016 using these factors. The Eskom Integrated Reports are published in March of each year and cover nine months of the preceding year, therefore the Eskom factor published in 2016 is used for the UCT 2015 report, and so on.

Table 1: Electricity emission factor used in this report

Eskom Integrated Report Year	Emission factor in tonnes CO2e per MWh	UCT Carbon Report year
2016	1.01	2015
2017	0.99	2016
2018	0.97	2017

B. RESULTS SUMMARY

The total emissions for Scope 1 and Scope 2 for 2017 are 69 535 tCO_2e, compared with 70 693 tCO_2e in 2016 (Table 3). This is a -1.6% decrease compared to 2016, a positive result given that the population increased by 1.1% in this period and the floor area increased by 0.3%. Results indicate that energy use and associated emissions have been relatively stable over time.

Emissions from all Scope 1 activities increased significantly by 14.6% (or 319 tCO_2e) compared to 2016, from 2 188 tCO_2e to 2 507 tCO_2e (Table 3). This increase is due to an increase in refrigerants (10%); an increase in vehicle fleet emissions (46.6%) due to improved data; and an increase in Jammie Shuttle emissions (14.2%), likely due to growth in demand for the service. The use of liquid petroleum gas (LPG) decreased, with emissions declining by -46.7% or 89 tCO_2e.

Scope 2 indirect emissions from the purchased electricity decreased by -2.2%. This is due to a decrease in emissions for the Graduate School of Business (GSB) by -76.3% or 1055 tCO_2e[5]; off-campus residences by -7% or 748 tCO_2e; and for Medical Campus by -1.5% or 178 tCO_2e. The data quality for electricity supply is improving annually due to the extensive installation of digital meters for Main Campus and the Medical and Hiddingh campuses. In addition, monitoring and reporting is being undertaken by specialist consultants.

While Scope 3 emissions results are not reported here, some discussion is provided on the challenges found with respect to data gathering of these emissions. Water supply results are reported due to the critical drought conditions in the reporting period. The most positive result under Scope 3 is for water supply, where a decrease in consumption of 24% occurred due to water saving interventions driven by a severe drought.

[5] Actual decrease of -24.9%, with the remaining decrease due to a revised allocation of electricity supply between the GSB and the Breakwater Lodge, sharing facilities on the same campus.

In terms of the intensity of emissions[6], emissions per square metre decreased by -1.9% to 0.098 tonnes CO_2e per square metre per annum, while the total building area increased by 0.3%, a positive result. The per capita emissions decreased by -2.7% from 2.02 tCO_2e to 1.97 tCO_2e with a 1.1% increase in population (Table 2).

Table 2: Intensity Metrics 2017–2012

INTENSITY METRICS (Scope 1 & 2 only)	2017	2016	2015	2014	2013	2012	% change
Gross Area	708 267	706 125	706 125	705 653	672 858	649 404	0.3
Tonnes CO2e/sqm/annum	**0.098**	**0.100**	**0.104**	**0.098**	**0.101**	**0.103**	**-1.9**
Population – Staff & Student FTE	35 343	34 965	33 204	31 329	31 041	30 579	1.1
CO2e/person/annum	**1.97**	**2.02**	**2.21**	**2.21**	**2.18**	**2.18**	**-2.7**

The intensity metrics can useful for benchmarking an organisation's performance against similar institutions and was included in some earlier UCT carbon footprint reports. After some research and discussion[7], the consensus among members of the International Alliance of Research Universities (IARU) Sustainable Campus Initiative was that benchmarking is of limited value, due to the number of local variables (energy supply emissions factors, own energy production, climate zone, housing at campus or not, share of laboratory facilities). In fact, comparative GHG benchmarking for universities was described as "exceptionally difficult" and has not been undertaken for this report. The availability of appropriate sustainability scorecards should be revisited in future. It is considered more relevant for now that UCT measures its performance against its own results year-on-year and develops targets towards realistic but steady reduction in emissions.

UCT is now in a position to shift towards a focus on mitigation measures that would result in operational cost savings and a reduction in the carbon footprint [given at least five years of comparable results contained in these reports].

With the exception of the electricity data, the reporting process reflects no improvement upon previous years. Further efforts are required with respect to data gathering and accuracy, and to streamline the annual reporting process.

The implementation of the Draft Carbon Tax Bill is expected in June 2019. Provision is made in the legislation for carbon offsets. There is an opportunity for UCT to explore the benefits of carbon offset projects in terms of research and education and enhancement of reputation as a leading and innovative institution.

[6] Intensity metrics only include Scope 1 and 2 emissions in terms of the GHG Protocol methodology.

[7] Opinion was obtained from:

- Melissa Goodall, associate director of the Yale Office of Sustainability, chair of the Sustainable Campus Initiative of the International Alliance of Research Universities (IARU); co-chair of the Advisory Council of the International Sustainable Campus Network (ISCN).
- Tomas Refslund Poulsen, head of Energy & Sustainability, University of Copenhagen.
- Lindsay Crum, metrics and program manager, Yale Office of Sustainability.

Table 3: Comparative GHG emissions (tonnes CO_2e)

CATEGORY	2017	2016	2015	2014	2013	Diff 2016 to 2017	% Change 2016–2017
Scope 1 Direct Emissions	**2 507**	**2 188**	**1 658**	**1 792**	**1 823**	319	**14.6**
Jammie Shuttle	902	789,50	861	1 006	1 068	112	14.2
UCT vehicle Fleet	697	475	503	556	465	221	46.6
LPG	102	191	160	230	289	-89	-46.7
Diesel for generators	-	-	134	-	-	-	-
Refrigerants [1]	807	733	-	-		74	10.1
Scope 2 Indirect Emissions purchased electricity	**67 028**	**68 505**	**71 569**	**67 447**	**65 835**	-1 477	**-2.2**
Electricity: Main Campus	44 001	*43 774	*46 933	44 219	42 583	227	0.5
Electricity: Medical Campus	11 477	*11 654	*12 027	11 239	10 648	-178	-1.5
Electricity: Off-campus residences [2]	9 885	*10 633	*10 850	10 149	10 729	-748	-7.0
Electricity: GSB	327	*1 382	*1 387	1 393	1 417	-1 055	-76.3
Electricity: Hiddingh [3]	504	*527	-	111	116	-24	-4.5
Electricity: ICTS on Main	834	*534	*372	335	342	301	56.3
TOTAL EMISSIONS	**69 535**	**70 693**	**73 227**	**69 239**	**67 658**		

* Indicates a restated result that may differ from the original report for that year. This may be due to improvements in data collection or changing emission factors. A decision to restate a result is always considered against the principle of comparability of the GHG Protocol.

Notes:

1. New category added for 2016 report as data became available.
2. Floor area for Rochester Residence (accommodating over 300 students and staff) remains an estimate; to be updated by P&S.
3. Hiddingh electricity for 2015 included in Main Campus data.

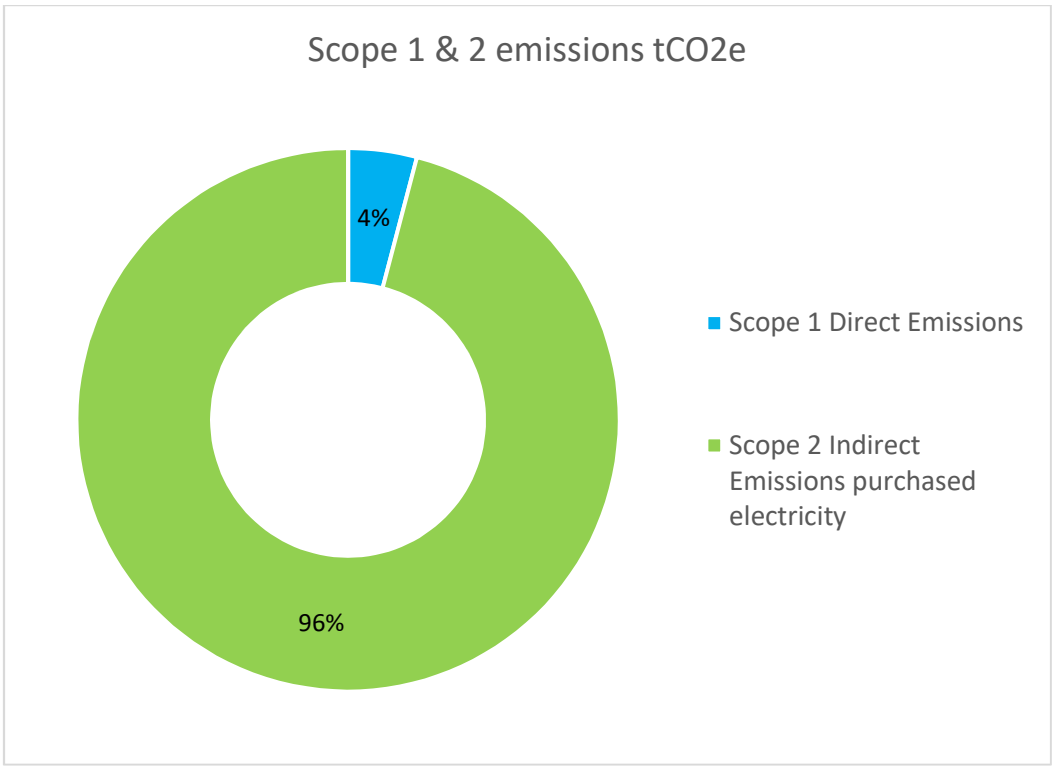

Figure 1: Scope 1 & 2 Emissions

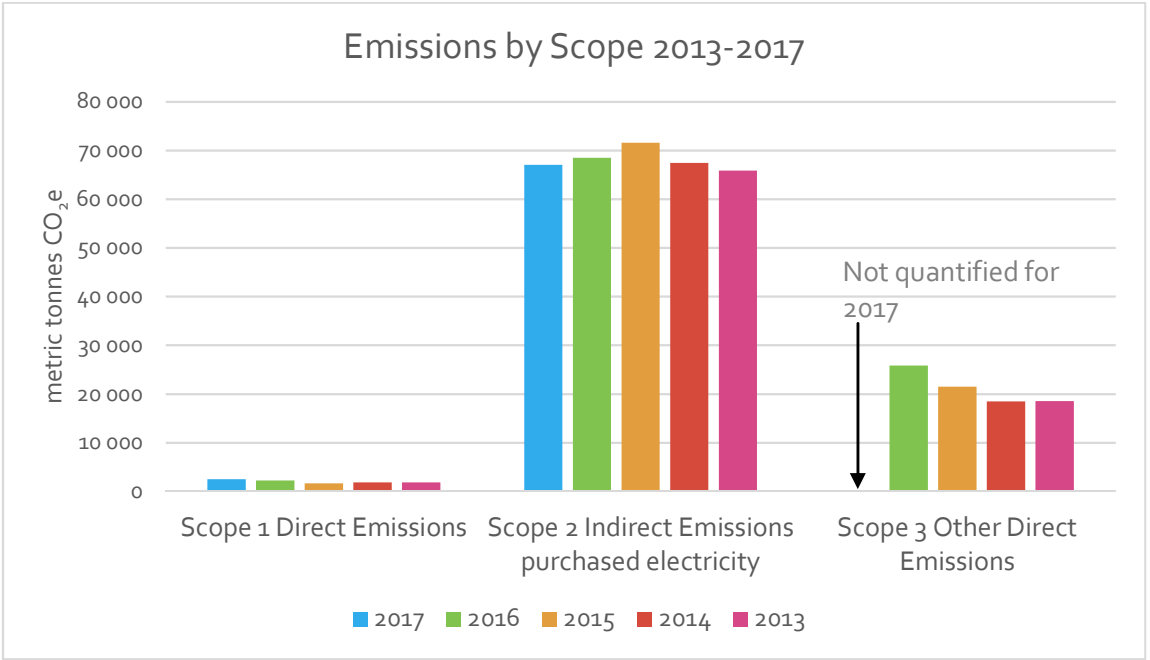

Figure 2: Emissions by Scope 2013–2017

C. EMISSIONS BY SCOPE

SCOPE 1 – DIRECT EMISSIONS

Table 4: Scope 1 Direct Emissions 2017

Description	Units	Consumption	tonnes CO2e
Total emissions from transport service (Jammie)			**902**
	Litres of diesel (100% mineral)	337 422	902
Total fugitive emissions from refrigerants			**807**
	Kg of R22	193	349
	Kg of R410A	60	126
	Kg of R134a	39	56
	Kg of 407C	24	43
	Kg of R507A	58	233
Total emissions from vehicle fleet			**697**
	Litres of petrol	165 240	380
	Litres of diesel	118 472	317
Total emissions from LPG gas			**102**
Medical	Kg of LPG	26 727	79
Main Campus	Kg of LPG	1 170	3
Residences	KG of LPG	6 690	20
TOTAL SCOPE 1 DIRECT EMISSIONS			**2 507**

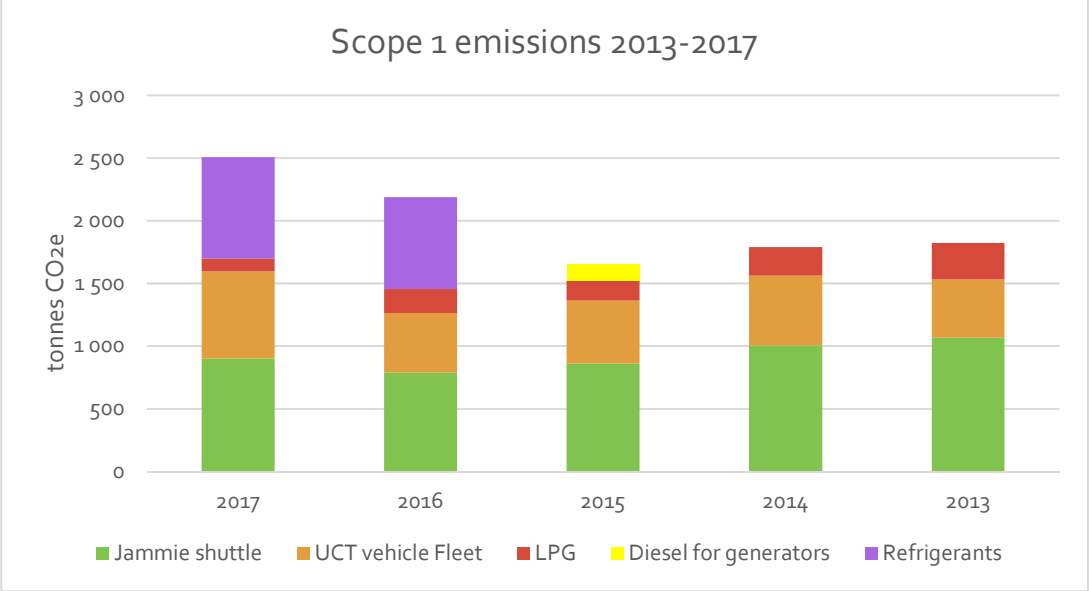

Figure 3: Scope 1 emissions by year 2013–2017

Trends in Scope 1 emissions from 2013–2017 are shown in Figure 3 above, with the increase in emissions associated with refrigerants in 2017 compared to 2016 clear (reporting of refrigerants began in 2016). A decline in the use of LPG gas is evident; as is the use of diesel for back-up generators during extensive nationwide planned power outages in 2015. UCT may wish to consider an alternative technology such a solar photovoltaic (PV) system (with battery storage) for the power outages that are likely to continue in future.

Jammie Shuttle

Positive progress occurred in 2017, when UCT renewed the Jammie Shuttle bus fleet with higher specification buses with European emission standards Euro 3 to Euro 5. These buses are designed to produce lower emissions of carbon monoxide (CO), nitrous oxide (NOx) and particulate matter (PM), addressing pollution that affects human health. A fleet of 18 Scania buses (Euro 5) began operation in January 2017, while the nine Volare midi-buses (Euro 3) arrived in March 2017.

Data collection and quality

Data for the fuel used by Jammie Shuttles was submitted by the Transport Office, with a monthly breakdown of litres used[8]. The shuttles filled up with fuel at petrol stations until a bulk tank was installed on campus in April 2017.

In terms of passenger number trends, it became apparent that previous figures provided were estimations, (population x academic days), and not an actual headcount; therefore, this indicator is not reported on here. An automated tracking of passengers using the shuttle would contribute to transport planning and to reporting on Scope 3 Commuting emissions[9].

Results and Findings

The Jammie Shuttle emissions increased by 14.2%, reportedly due to the reduced interruptions to operations caused by student protests[10], as had occurred in 2015 and 2016. Comparison with 2014 is therefore more relevant, and a positive decrease of 12% since 2014 is found. The total population in 2017 was 12% higher than in 2014; route and timetable rationalisation efforts have occurred since 2014, aimed at reducing operating costs. The arrival of the new fleet of buses in 2017 is likely to have improved efficiency of diesel consumption. Accurate annual passenger figures are not available to aid this analysis. The graph in Figure 4 reflects fuel use across the years 2012–2017.

[8] The same data is present in the SAP system report for Vehicle Fleet; avoid double counting. Although the leasing of new buses makes them part of UCT's vehicle fleet, it was considered useful to keep Jammie Shuttle data as a separate category.

[9] Pers. Comm. Clive Lippert, Manager: UCT Transport Services

[10] Clive Lippert, Manager Transport Services.

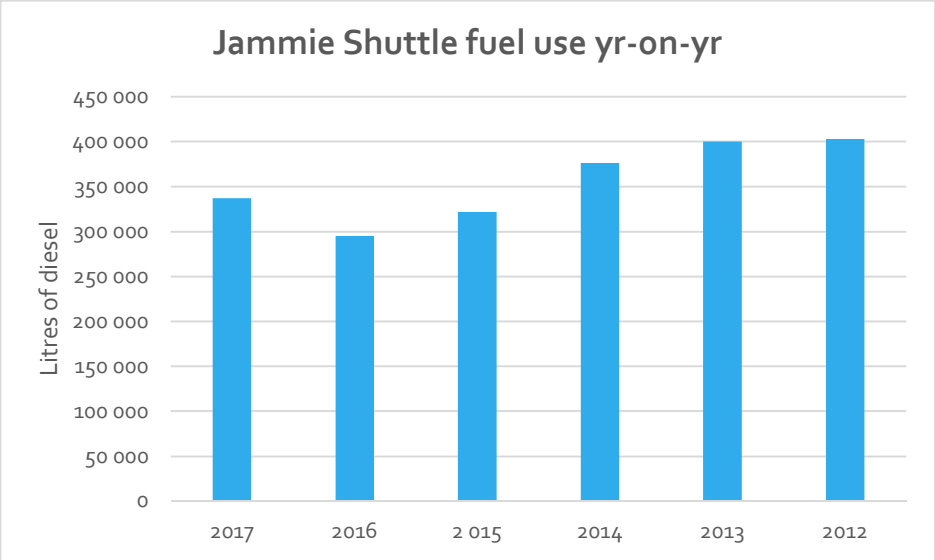

Figure 4: Jammie Shuttle fuel use 2012–2017

Refrigerant gases – (fugitive emissions from gas in air-conditioning and refrigeration equipment)

Data collection and quality

Refrigerants were included for the first time in the 2016 report, towards compliance with the requirement for completeness in Scope 1 emissions reporting. Records of the amount (kilograms) and type of gas refills to equipment (air-conditioning chillers and refrigerators for laboratories and catering) were obtained from the service providers and are considered to be of high quality.[11] The range of refrigerant types used at UCT are included in Figure 5 below. Data was provided for gas to two new major equipment installations (MCB and Zoology buildings); however, an approach has been taken to exclude new gas quantities in the footprint as any fugitive emissions from equipment will be reported in future reports.

More accurate calculation methodologies to ascertain gases being emitted would require a register of all equipment with their gas capacity.

Results and Findings

Emissions from gas refills increased by 10.1% compared to 2016, from 733 tCO_2e to 807 tCO_2e.

For the new equipment installations at MCB and Zoology buildings, a total of 444 kg of gas (type R134a) was supplied, equivalent to a potential 635 tCO_2e if emitted into the atmosphere. The next step is to shift towards refrigerants with lower global warming potential (GWP) in line with best practice and legislation. Planning towards replacement of equipment using hydrochlorofluorocarbons (HCFCs) that must to be phased out in terms of the Kyoto Protocol and the South African regulations[12] is required.

[11] Reclaimed gas is not counted in this carbon footprint. Recovery and recycling of HCFCs and other ozone-depleting substances is mandatory in terms of the National Environmental Management: Air Quality Act, 2004 and the 2014 regulations regarding the phasing-out and management of ozone-depleting substances.

[12] DEAT 2014, South Africa Hydrochlorofluorocarbons Phase-out Management Plan (SA HPMP).

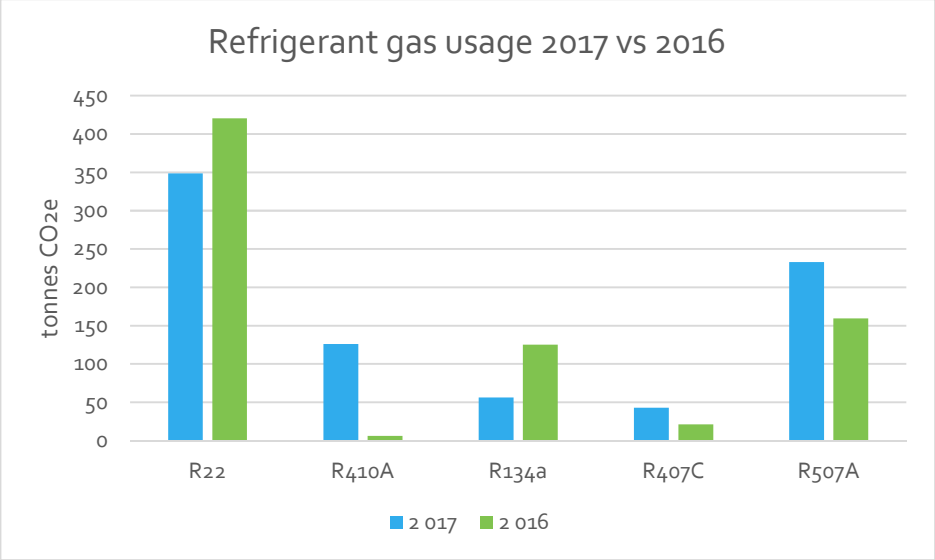

Figure 5: Refrigerant usage 2017 vs 2016

Vehicle Fleet

Data collection and quality

A data set was provided from the SAP system by the Procurement department, including a more complete record of fuel purchases made via service providers and by UCT departments. While this is positive in terms of completeness, this dataset does not include two key metrics – litres of fuel and type of fuel (petrol or diesel). Past figures provided by Procurement were from the third-party service provider, Absa Vehicle Management, and were taken to be complete; however, analysis of the SAP dataset for this report, using Rand value, reflects that the Absa data is only one-third of this activity and therefore, there has been under-reporting in the past. Fuel is also purchased via other service providers such as Bidvest[13] and by UCT departments.

Results and Findings

Emissions from the vehicle fleet increased by 46.6% compared to 2016. This increase is due to more complete data as well as increased fuel consumption. The increase in consumption is evident when comparing the Absa fuel figures for 2016 and 2017, where the increase in fuel purchased was 21% higher than in 2016 (Figure 6). Unfortunately, analysis of this trend by comparing the size of the vehicle fleet year-on-year is not practical at this point due to the fleet list data quality. Efforts should be made to improve this data in future reporting.

[13] UCT has 22 vehicles leased on a long-term basis from Bidvest that use Standard Bank cards for refueling.

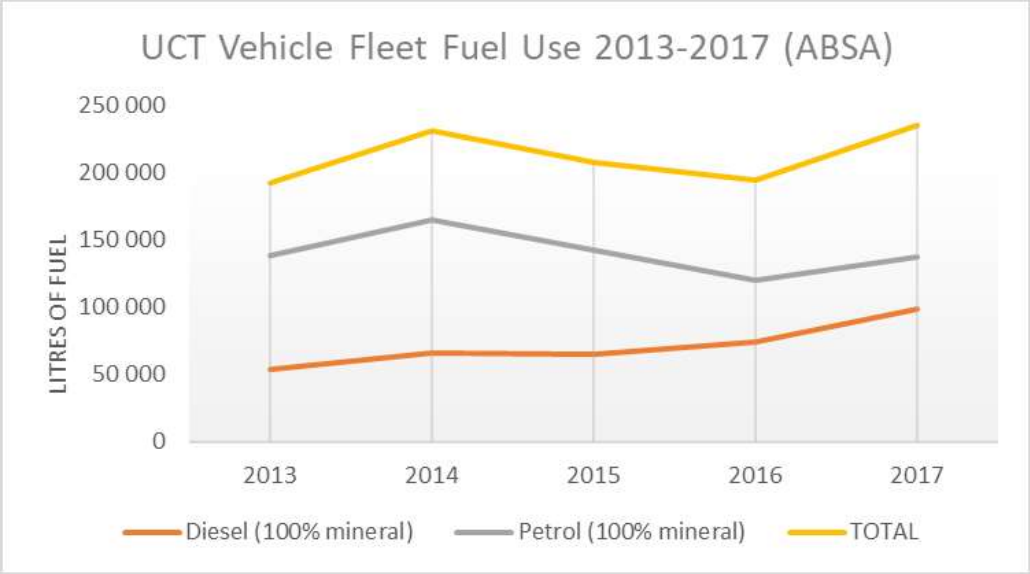

Figure 6: UCT Vehicle Fleet fuel use (includes Absa card data only)

The Health Sciences faculty emerged as a major fuel consumer, where vehicles travel to provide services in community clinics across the city.

Liquified Petroleum Gas

Emissions from the use of liquified petroleum gas (LPG) decreased by 46.7% or 89 tCO_2e, in line with a continuous trend since 2013, due to the use of heat pumps for water heating instead of LPG-fueled heaters. Of the total LPG purchased, around 19% was for the residences, 77% for the Faculty of Health Sciences.

Stationary combustion – Diesel

There were no nationwide planned power outages occurring in 2017, so a figure in the category of diesel fuel for generators, included in the 2015 report, has not been included. With load shedding expected in the future, alternatives to diesel generators, such as solar PV with storage present an opportunity for mitigation and should be investigated.

SCOPE 2 – INDIRECT EMISSIONS FROM PURCHASED ELECTRICITY

Data collection and quality

The extensive roll-out of digital electricity meters at building level across the Main and Medical campuses was implemented from 2014, with the first 12-month data set from these meters available for the 2016 report. Consistency in the electricity emissions results is emerging due to more accurate data from this metering system. Municipal billing data, captured manually within the P&S finance department, is still used for off-campus residences and the Graduate School of Business (GSB).

The dataset provided for the GSB is for the entire Breakwater Lodge complex, including the hotel facilities not attributable to UCT. An allocation approach based on floor area is used to determine the GSB's share. Of total electricity consumed, 46% has been allocated to the GSB in past reports. Improved data for 2017 has resulted in a material re-allocation, from 46% to only 14.5% of total electricity consumed, and therefore significantly lower emissions.

When reviewing the Scope 2 electricity results (Figure 7), it is important to note that emissions have been calculated using the updated factors published by Eskom annually, as described above, with 2015 and 2016 restated due to the change in emission factors (Table 1).

Scope 2 Results and Findings

Results for emissions from the purchase of electricity are:

- Overall Scope 2 emissions decreased by -2.2% over 2016, from 68 505 to 67 028 tCO_2e (Table 3; Figure 7).
- Emissions for Main Campus increased by 0.5% or 227 tCO_2e.
- Medical Campus emissions decreased by -1.5% or 178 tCO_2e. No reasons for this decrease were found (e.g. energy efficiency measures).
- Off-campus residences decreased by -7%. This represents the second most significant change in UCT's emissions year-on-year. Reasons for this are unknown but reduced (hot) water usage due to the drought may be an explanation.
- A positive result was found for the GSB with a -23.4% decrease, before adjusting the percentage allocation as described above. This is reportedly due to the installation of lighting sensors and other energy efficiency measures[14]. Using the new allocation of 14.5%, a greater decrease in emissions of -76% is found. This is the most significant contributor to the change in UCT's overall emissions.
- A marked increase in consumption was found at the ICTS facility (Information and Communication Technology Services) of 56.3% or 301 tCO_2e. An increase of a similar magnitude occurred in 2016. At the end of 2016 ˜50 additional servers were introduced into the ICTS data centre and additional storage units were installed in 2017, forming a new cloud platform for research[15]. Additional air-conditioning demands for cooling this equipment contribute further to consumption. A further major increase in IT infrastructure is predicted for 2018, with the research arenas of radio astronomy and genomic collaborative regional computer resource being

[14] Arnold Rabie, GSB Maintenance.

[15] Andre Le Roux, Director: Enterprise Infrastructure Services, Information and Communication Technology Services (ICTS)

a key driver of demand. This trend of increased energy consumption by servers is expected to continue, and therefore investments with respect to renewable energy generation for the data centre are indicated, with the added benefit of energy security.

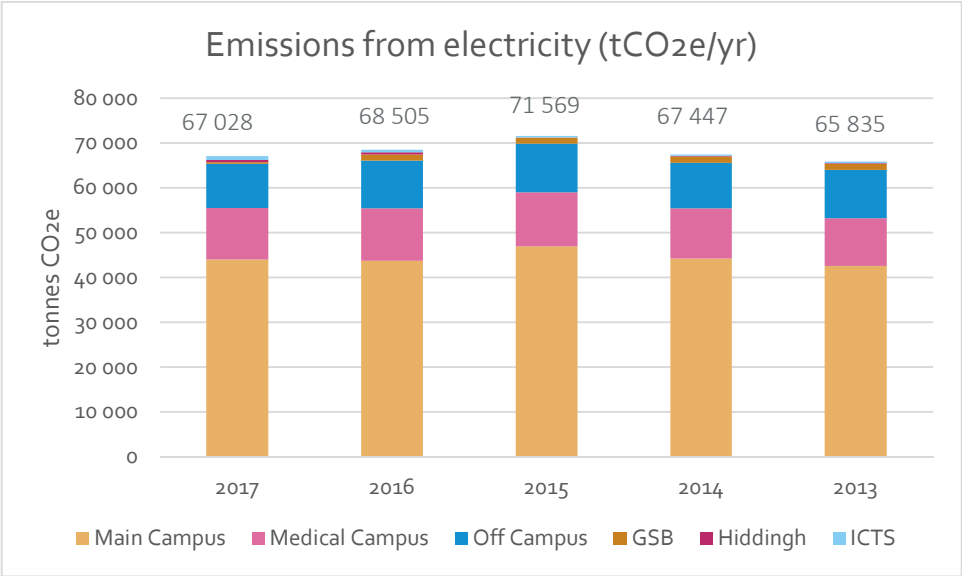

Figure 7: Scope 2 electricity emissions by year

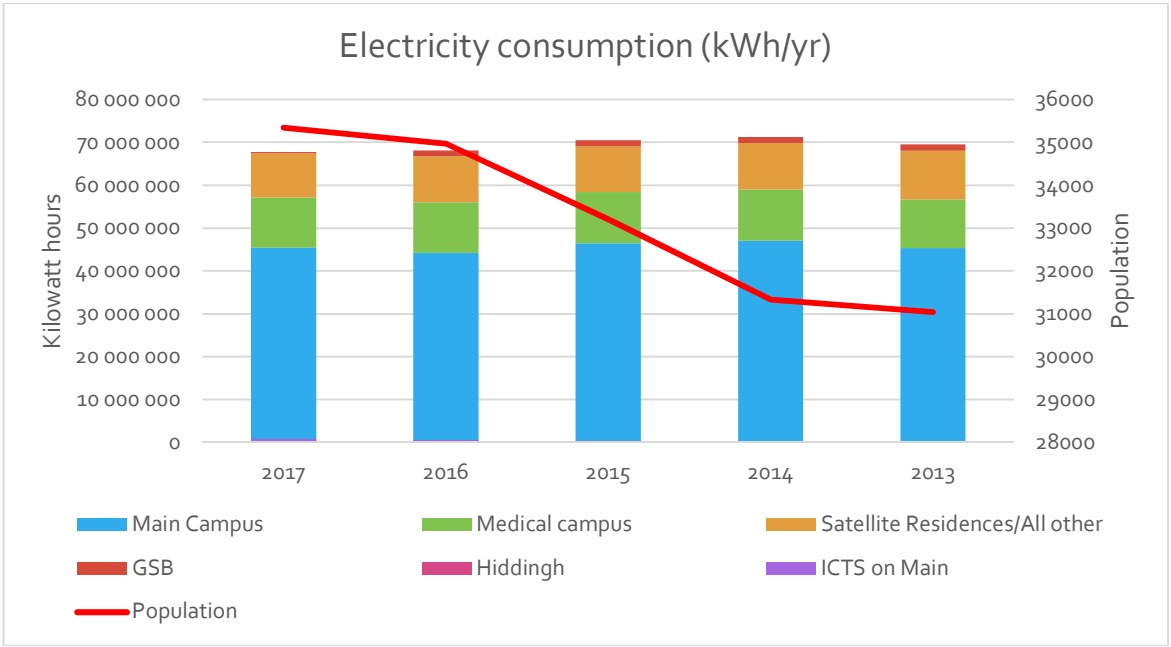

Figure 8: Electricity consumption in kilowatt hours

Overall, electricity consumption has been decreasing slightly against a significant increase in campus population, as shown in Figure 8, with a concomitant increase in floor area (see Table 2).

SCOPE 3 – ALL OTHER INDIRECT EMISSIONS

Scope 3 is an optional reporting category dealing with all other indirect emissions that occur from sources not owned or controlled by the entity (GHG Protocol, 2013). The GHG Protocol guidelines acknowledge that data availability and reliability may influence which Scope 3 activities are included in the inventory, and that data accuracy may be lower. The objective of the Scope 3 inventory may be more about understanding the relative magnitude of Scope 3 activities. Thus, emission estimates are acceptable as long as there is transparency with regard to the estimation approach.

As stated in the Introduction above, Scope 3 emissions results have not been reported for 2017 due to inadequate data received. This section of the report focuses on data collection and data quality and capturing institutional knowledge about the reporting process. The relative contribution to Scope 3 of the activities selected for reporting from 2012–2016 is shown in the Figure 9 below.

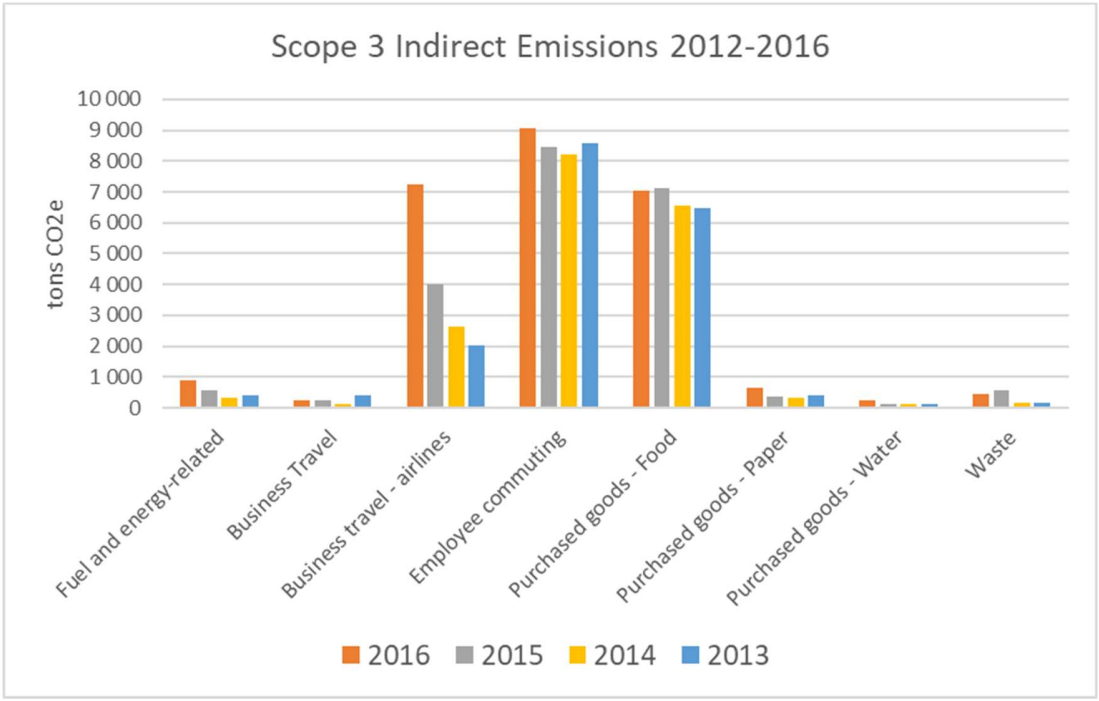

Figure 9: Scope 3 Emissions by year

UCT started to explore Scope 3 emissions in their value chain in 2012. This was assisted by student teams who undertook research and collected and analysed data. For 2016, all Scope 3 emissions amounted to 26% of total emissions.

An ongoing lack of data has limited the potential to:

a) better inform material categories and prioritise Scope 3 categories for measurement, reporting and management; and
b) reporting as part of the 2017 carbon footprint.

While not all universities report Scope 3 emissions, it is important for UCT to drive a process, including facilitated dialogues, to explore the relevance and associated merits of measuring and managing emissions in its value chain.

BUSINESS TRAVEL

This category includes emissions from the transportation of employees for business-related activities in vehicles owned or operated by third parties, such as aircraft, trains, buses and passenger cars.

Business Travel: Air Travel

Data collection and quality

Data collection for this activity has been challenging for several years. Recommendations made to improve reporting have not been actioned to date, including reconfiguring the air travel information captured in the SAP system to provided kilometres travelled, and alignment of department level data capturing to a uniform standard.

A new, more complete data set was provided for the 2016 and 2017 reports, drawn from the UCT SAP system. It included all travel agencies, and all direct online ticket purchases by UCT staff. However, this large data set does not contain the required metric, *kilometres travelled*. Therefore for 2016 the number of air tickets purchased was estimated using a range of assumptions with guidance from the external reviewer.

To improve on the data quality of this report, an effort was made to obtain data from nine external travel agencies, requesting each agency to provide a record of tickets purchased by UCT, with the departure city and destination, required to calculate distance[16] travelled. Data was not received from the travel agencies therefore no result has been reported. This lack of data was a major contributor to the decision to omit Scope 3 results for this report. For 2016, air travel contributed 7.3% to total emissions.

Results in recent years (Figure 10) have showed marked increases in air travel: 2014 (44%); 2015 (52%) and 2016 (81%). Reasons for these significant increases in air travel could not be determined (but may at least in part reflect more complete gathering of data) and require further research, using higher quality data and relevant metrics. A degree of growth in travel for research collaboration may be unavoidable; therefore, an offset approach to mitigation would be appropriate.

[16] The total distance of a flight is relevant as a different emission factor is applied to the calculation for short-haul, medium-haul or long-haul flights.

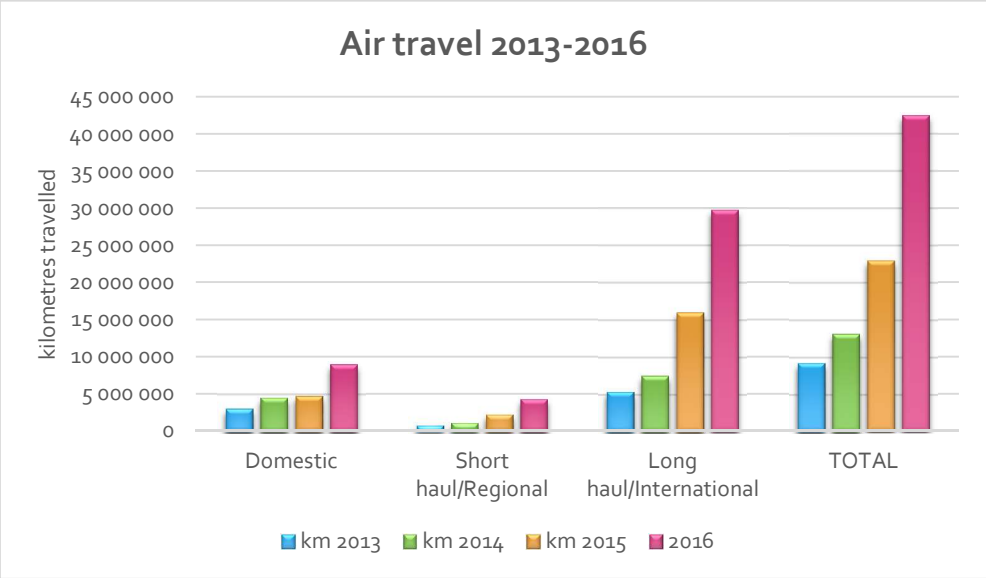

Figure 10: Air Travel 2013–2016 (results for 2017 not quantified)

Business Travel: Hired Cars

Data collection and quality

Data for the hired cars was obtained from two different sources: Bidvest and the UCT SAP system data report provided by the Procurement department. Once again, the SAP report did not contain the required metric, *kilometres travelled*. It was possible to compare the Rand value of these two reports, which showed a material difference, with the Bidvest monetary value being only one-third of the SAP report value. This indicated that a significant proportion of the data could be missing. It should be noted that the SAP reports tend to be 'contaminated' with non-applicable items, due to inconsistent data entry by multiple purchasers across the university. Improvement to the clarity of the information system is required.

Business Travel: Staff Mileage

Data collection and quality

Staff mileage fuel reimbursement data was provided in the form of a SAP system report compiled by Procurement. Staff are reimbursed at an annual rate for kilometres travelled, including wear and tear. The metric required for the calculation is *kilometres travelled*. The column of the spreadsheet 'Invoice Quantity' should reflect kilometres travelled or claimed by the staff member; however, a large proportion of the entries are '1' or '2', obviously not mileage. In addition, many entries relate to petty cash travel allowances of a fixed Rand amount, assumed to be fuel spend; however, this data is unclear and negatively impacts the integrity of the data. For future calculations, an improvement in the quality of the data is needed. A column headed 'kilometres' would avoid confusion.

For 2016, Business Travel (Hired Cars and Staff Mileage) contributed 0.23% to total emissions.

COMMUTING

Transportation of employees between their homes and their worksites during the reporting year (in vehicles not owned or operated by the reporting company).

Data collection and quality

No data was available for commuting by students and staff. Previous reports used the results of surveys undertaken by Information Systems students in 2015 and this group were not involved in the carbon footprinting exercise for the 2016 and 2017 reports. Student surveys of commuter modes have not been produced since the 2014 report. Further, UCT has not conducted any official commuting surveys since this reporting commenced.

Emissions from commuting comprised 9.14% of total emissions in 2016, making this the largest of the Scope 3 categories.

PURCHASED GOODS

This category includes all upstream (ie cradle-to-gate) emissions from the production of products purchased or acquired by the reporting company. Products include both goods (tangible products) and services (intangible products).

Food Supply

The climate impacts of the food supply and agricultural systems are increasingly recognised, as are the potential impacts of global warming on food security (FAO, 2016). These impacts are caused by livestock production and soil and nutrient management, resulting in direct and indirect emissions of the three major greenhouse gases: carbon dioxide, methane and nitrous oxide. Food supply emissions contributed 7.07% to total emissions in 2016, the third largest Scope 3 category.

Data collection and quality

The Food Supply category has two components: first-tier residences and campus food vendors (±30) contracted by Properties and Services. The data from the first-tier residences is readily available from the catering service provider, presented as a count of all meals provided for breakfast, lunch and dinner as well as meal vouchers that students redeem on campus. This data is of high quality and results reflect a consistency over time.

Data from campus food vendors is of much lower quality. It has been provided in the past (2012–2014) by one of the major vendors owning several outlets and extrapolated to account for all vendors. Food vendor contracts with UCT do not require the provision of any data on the quantity of meals sold, making measurement difficult. A transition from independent food vendors to a single UCT food company is being considered, which is an opportunity to obtain more accurate data on food supplied and to shift towards lower-intensity emissions food offerings.

Emission factors for meal types have been estimated using averaging methods based on the dissertation by Gravenor (2013), which in turn drew upon Audsley et al (2009). Future calculations should use more recent and refined emission factors, where available.

Paper Purchased

Data collection and quality

Paper products reported include office and printing paper, exam papers and books, and custodial paper (toilet paper, hand towels). Two sources of data for office paper use, comprising around 80% of emissions in this category, have been used in previous reports. These are the ICTS-managed computer labs and the Campus Copy Centres managed by a service provider, Nashua. When submitting data for this report, ICTS expressed doubts about the reliability of their data, and efforts are required to resolve this for future calculations. Records of custodial paper are readily available from purchasing documentation and appear reliable. A local emission factor determined by paper producer Mondi is available for this category.

Water Supply

Given the critical nature of water consumption during the drought in Cape Town, results for water supply are reported below. It is important to note that UCT is one of the top water users in the city[17]. The cost of water rose substantially from late 2016 as a result of restrictions under drought conditions, impacting on operational costs at UCT.

Data collection and quality

Data for water consumption is captured from municipal bills by the P&S finance department and Student Housing. Data quality tends to be unreliable as the municipal billing data contains numerous billing reversals and estimates rather than actual meter readings, affecting data quality. Future data quality is expected to improve due to the installation of digital water meters during 2017 and 2018.

Findings

Results reflect a positive decline in consumption of 24% compared to 2016. There was a university-wide initiative in 2017 to conserve water in response to severe drought conditions and the introduction of water restrictions by the municipality. UCT was requested by the municipality to reduce water consumption by 45% over 2015 and set a more ambitious target of 50%[18]. This water conservation initiative comprised several components:

- A **Water Task Team** was established under the office of a Deputy Vice-Chancellor, including academics, researchers, managers, technical staff and students.
- A key strategy was the nomination of '**water champions**', a team of 42 volunteers across all campuses tasked with awareness-raising in their departments.
- Support for this objective came in the form of a **substantial grant** of R2 million from UCT Council, which was used for an awareness campaign, borehole testing and dam rehabilitation.
- The **UCT Water Desk** was established with a dedicated staff member to help drive the information and communications campaign.
- The more accurate measurement of water consumption was addressed through the installation of **digital meters** at building level and a water-monitoring platform was installed.

[17] UCT Water Task Team Report v2, September 2018.
[18] UCT Water Task Team Report v2, September 2018.

The campaign achieved a measure of success. From August 2017, the overall consumption of water started to decline[19]. Decreased water consumption has been particularly successful within residences, where since 2016 there has been a systematic effort to conserve water, including replacing baths with showers in residences and flatlets and the use of buckets of grey water for toilet flushing.

SOLID WASTE

Disposal and treatment of waste generated in the reporting company's operations in the reporting year (in facilities not owned or controlled by the reporting company).

Data collection and quality

Since solid waste recycling began around 2008 at UCT, materials being recovered from the waste stream have continually been expanded to a wider range of waste categories. Types of waste included in the reporting are mixed recyclables (paper, cardboard, cans and bottles), hazardous waste, electronic waste and IT equipment, fluorescent light tubes, polystyrene, Tetrapak and printer cartridges.

Although data has been provided by the waste service provider since the first UCT Carbon Footprint report in 2012, it became apparent around 2015 that this data was highly unreliable. A new service provider commenced waste collection and recycling in 2015, introducing a different measurement methodology, making comparison across years difficult. The new service provider's waste reports reflected a significantly lower recycling rate.

Data collection for hazardous waste at UCT is well managed due to the need for compliance with legislation, and a dedicated Environmental Risk Officer within P&S is responsible for reporting. This officer also gathers data for electronic waste and printer cartridges.

Since 2015, food waste from first-tier residences has been separated at source and sent to a maggot farming facility, to be used as animal feed. This waste is measured by the waste service provider and is considered to be of reasonable quality.

Findings

A data set was provided for 2017 by the service provider. Tons of waste sent to landfill increased from 1 059 tons to 1 189 tons or 12% over 2016. Recycled waste decreased from 117 tons to 69 tons or 41%, but this excludes paper waste recovered and sold for recycling by cleaning staff acting on their own initiative. The measurable percentage of total waste from campus bins that was recycled (excluding food and all other waste types) was only 6%. The impact of low recycling quantities has a significant effect on the monthly waste contract cost, where credit is received for recyclables.

Ongoing efforts to improve recycling rates by the student-led Green Campus Initiative, and Properties and Services, over the past decade, have not achieved success. (These efforts have included provision of bins, signage and training of cleaning staff, waste audits and awareness campaigns.) Renewed efforts to promote recycling on campus are clearly required and are an ongoing agenda of the Waste Task Team and the Environmental Management Working Group.

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[19] Kevin Winter, presentation to the UCT Convocation AGM, Dec 2017.

D. THE REPORTING PROCESS

The data gathering process for this report was similar to previous years, with the same challenges experienced in terms of momentum, effectiveness and data quality. The process was most effective in 2014 when the executive director of P&S took responsibility for gathering all the data and engaged directly with the data holders, demonstrating the effectiveness of strong leadership in this process.

Past initiatives to encourage buy in, such as meeting with managers of data holders at the start of the process, to resolve data gathering issues from the previous year, have not generated an improvement. The responsibility for providing accurate and timeous data should become part of the key performance indicators of the data holders.

Detailed data requests are issued via P&S to each data holder across the university. However, there is typically a lack of responsiveness to both initial data requests and queries regarding data anomalies. Even though data examples and templates are provided to data holders, the relevant metrics are not always contained in the data sets received. Appendix 1 contains a list of all data sets required for footprinting, the source of the data and the required metric.

High-level recommendations to improve data for future reporting are:

General

- The UCT carbon reporting process requires endorsement at **executive level** to communicate the commitment of the university to data holders and other stakeholders.
- Coordination and **alignment of reporting processes** across the university is required, undertaken by a staff member with an appropriate level of authority.

Specific

- Records of fuel purchases for the **vehicle fleet** should include the type and quantity of fuel purchased, either diesel or petrol.
- The installation of digital metering for **electricity** consumption should be expanded to larger off-campus residences.
- An exercise in evaluating Scope 3 categories to determine which of these are material to reporting is recommended.
- Service providers in the value chain should be required to report the appropriate meta-data for Scope 3 emissions.
- Data for **hired cars** and **staff mileage** reimbursements should include the kilometres travelled. The SAP system could be modified to include a column for this information. Departmental purchasing staff across the university require training on data entry.
- For **air travel** data, the SAP system needs to be modified to include a column for 'Departure City' and 'Destination City' from which the kilometres travelled can be calculated. The preferred travel agencies should be required to provide annual reports that are aligned with UCT's emissions reporting data requirements.
- Official annual commuting surveys to be conducted to track **commuting** transport modes, provide evidence to support behaviour change to lower carbon modes of transport, and contribute to transport planning.

For this report and the previous report, the Information Systems students did not participate in the calculation of the carbon emissions as part of their curriculum. Unless the course Convenor can be confident that all the data will be submitted within in the first few weeks of the semester in February/March each year, using this exercise as the basis of the semester course is not feasible.

UCT should aim to continue to involve the Information Systems and other students in the carbon footprint measurement process. This can deliver a range of enhanced and experiential learning outcomes, while not eroding the core objective of measuring and managing the university's energy and carbon footprint, as a basis for playing a leadership role in mitigating climate change.

E. RECOMMENDATIONS FOR MITIGATION OF EMISSIONS

With more than five years of emissions data available, it is time to focus on mitigating emissions that have the benefit of reducing operational costs and would have a reasonable payback period or good return on investment. Key among these is energy efficiency (particularly lighting, ventilation and air conditioning) and renewable energy in the form of solar PV (rooftop and floor mounted), which may by now have dropped so far in price as to offer a good investment return. It is also important to explore incentives and 'soft' funding that could improve the business case. Operational savings should be considered in capital allocation budgets.

SCOPE 1: DIRECT EMISSIONS

Refrigerant gases

- Shift to the procurement of **refrigerants** with lower global warming potential to stay ahead of legislative requirements for phasing out certain gases.

Vehicle fleet

- Futureproof the vehicle fleet by changing to **electric vehicles** as soon as is feasible.
- Investigate feasibility of installing solar-powered charging stations for electric vehicles (for UCT vehicle fleet, staff and student vehicles). This is a key area with scope for mitigating emissions. Such an initiative presents an opportunity for bold, visible demonstration of leadership and commitment to sustainable transportation and has educational value.

Jammie Shuttle

- Work towards improved data and analytics of patterns of use and mileage.
- Plan a procurement process that shifts towards electric buses at the end of the seven-year current bus lease.

SCOPE 2: PURCHASED ELECTRICITY

Electricity consumption

In the context of the risks of rising tariffs and security of supply remaining high:

- Review investments to date in energy efficient equipment (air-conditioning chillers, elevators, lighting and lighting sensors) and set new targets and priorities. Then invest in a programme of electricity efficiency measures to save operational costs and emissions.

- Conduct feasibility studies to demonstrate economic viability of renewable energy generation on site and to access funding. This mitigation measure has multiple benefits – reducing emissions, contributing to energy security and having significant educational and reputational value.

- Increase the number of buildings on which electricity consumption data is reported on the UCT website. Identify substantive uses and develop management strategies (including installation of more efficient equipment and behaviour change strategies).

- Invest in an effective communication campaign to the UCT community about electricity consumption trends, as was launched for water conservation, via digital dashboards and other media.

SCOPE 3: ALL OTHER INDIRECT EMISSIONS

The relative priority of Scope 3 recommendations is lower than for Scopes 1 and 2. Key areas to consider include: business travel (particularly air travel) given the significant role of this category in contributing to costs but also emissions, as well as being an area where mitigation options exist (e.g. Skype) or where options to offset should be investigated; and understanding the impact the university has in equipping students (in the case of teaching) and decision-makers (in the case of research) to reduce GHG emissions.

Business Travel: Land-based

- Develop accurate reporting methods for hired cars and staff mileage trends and communicate to staff to encourage cost and emissions reductions.

Business Travel: Air Travel

- Prioritise the improvement of the information system to ensure the gathering of accurate data. This measure needs to be accompanied by training of purchasing staff to align data entry methods.
- Conduct research and analysis to gain insight into the ongoing trend of increasing air travel at UCT.
- Actively promote a shift towards alternatives to air travel, highlighting this activity as a key individual choice that can contribute to climate change mitigation and high costs.
- Engage with stakeholders around an appropriate offset approach for these (and other) emissions. Investigate options using the expertise of UCT's academics.
- Explore the potential benefits to UCT of a revenue stream from the sale of carbon credits. With the pending implementation of the Draft Carbon Tax Bill, there is a move towards carbon taxes that will see the development of a carbon market.

Commuting

- Conduct official annual commuting surveys, using the results to launch an awareness campaign to promote behaviour change to lower carbon modes of transport.

Food supply

- Launch and support a Sustainable Food Initiative to provide education about the link between food supply systems and global warming.
- Transition towards menus in the first-tier residences and campus outlets with lower emissions, for example, reducing meat and dairy consumption and opting for plant-rich meals.

Water supply

- Roll out a water supply smart-metering system. Expand upon the successful water campaign in terms of measurement, monitoring and communication towards behaviour change.
- Target buildings with substantive uses of potable water and celebrate successful conservation efforts.
- Develop alternative water resources such as groundwater and rainwater harvesting.

Solid Waste

- Learning from the UCT Water Campaign, renew efforts to manage and promote recycling, with the appropriate allocation of resources towards infrastructure, custodial staff training and communications.
- Highlight the impact of the low recycling performance on the cost of the monthly waste contract, where credit is received for recyclables.

F. CONCLUSION

In spite of the challenges in collecting data for this report, there is a fair degree of confidence that the results for Scope 1 and Scope 2 emissions can inform high-level policy decisions at UCT. Key focus areas for UCT are:

1. Renewed commitment to leadership in climate change mitigation of campus operations;
2. Transition towards stronger governance for sustainability;
3. Improvement of emissions data systems and analysis;
4. Transition towards developing and implementing mitigation actions based on the results of the carbon footprint reports; and
5. Set targets for emission reductions over the long-term.

To contribute towards global goals to keep global warming below the 2˚C threshold as per the Paris Agreement, UCT should take the step of setting long-term reduction targets. While target setting should be aligned with South Africa's nationally determined contribution (NDC) under the Paris Agreement, UCT should play a leadership role in terms of setting and achieving ambitious greenhouse gas and energy targets. UCT is urged to commence the research and the stakeholder engagement process required towards setting realistic targets over the next year.

SUMMARY OF KEY RECOMMENDATIONS

1. Invest in a programme of **electricity efficiency** measures to save operational costs and emissions.

2. Invest in on-site **renewable energy** generation to reduce emissions and save operational costs.

3. Champion further additions of **renewable energy** to the national grid.

4. Introduce electric vehicles, where possible powered by solar energy, into the vehicle fleet as a demonstration of leadership in sustainable transportation.

5. Reconfigure the **air travel information system** towards obtaining accurate data and understanding trends of rapidly increasing travel.

6. Roll out the **water-use monitoring** system and identify substantive uses towards conservation targets.

7. Allocate adequate resources to the **solid waste management** and recycling programme to achieve recycling rates in line with best practice.

8. Invest in knowledge generation to better understand food consumed at UCT, from farm to fork.

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Emission factors: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2016

Greenhouse Gas Protocol: http://www.ghgprotocol.org/

International Sustainable Campus Network (ISCN): http://www.international-sustainable-campus-network.org/

UCT News water: https://www.news.uct.ac.za/article/-2017-06-01-uct-responds-to-water-crisis
https://www.news.uct.ac.za/article/-2017-02-02-tackling-water-shortages-on-campus
https://www.news.uct.ac.za/article/-2017-07-13-can-uct-become-a-water-sensitive-campusa

Scorecards and Reporting Platforms

Association for the Advancement of Sustainability in Higher Education (AASHE) https://stars.aashe.org/

Second Nature - American College & University Presidents' Climate Commitment (ACUPCC): https://secondnature.org/

The Climate Registry: http://www.theclimateregistry.org/

INF3011 Student Project Reports: available at: Vula Student Reports 2015

APPENDIX 1: LIST OF DATA REQUIRED, SOURCES AND METRICS

CATEGORY/SECTOR	DESIGNATION	METRIC
Electricity: GSB	GSB Finance Dept	Kilowatt hours
Water: GSB	GSB Finance Dept	Kilolitres
E-Waste (ICTS)	ICTS	Kilograms
Video Conferencing	ICTS	Hours
Paper Products – print paper ICTS	ICTS	Sheets
Commuting	n/a	Kilometres travelled per mode
Paper Products (Campus copy centres)	Nashua	Sheets
Transport: Jammie Shuttle	P&S Transport Manager	Litres fuel/passengers
Water: Main Campus; Medical	P&S Finance	Kilolitres
Water: Hiddingh Campus	P&S Finance	Kilolitres
Solid Waste	P&S: Custodial and Estates	Tons Wet/Dry
Electricity: Main & Medical campuses	P&S: Maintenance & Operation	Kilowatt hours
LPG	P&S: Vendor Management	Kilograms
Hazardous Waste: Medical/Chemical	P&S: Environmental Risk Officer	Litres/kilograms
E-Waste	P&S: Environmental Risk Officer	Kilograms
Printer cartridges (Green Office)	P&S: Environmental Risk Officer	Kilograms
Electricity: Hiddingh Campus	P&S: Finance	kWh
Paper Products – custodial	P&S: Finance	Rolls
Building List & Areas	P&S: Physical Planning Unit	Metres squared
Transport: Hired cars	Procurement	Kilometres
Transport: UCT Vehicle Fleet	Procurement	Litres fuel; diesel/petrol
Transport: Staff reimbursements	Procurement	Kilometres
Air travel	Procurement	Kilometres
Population data	Registrar's office	Students & staff (FTE)
Electricity: Off-campus Residences	Student Housing	Kilowatt hours
Water: Off-campus Residences	Student Housing	Kilolitres
Food supply: Residences	Student Housing	Number of meals served
Food supply: Vendors	No information source	Number of meals served