AUDIT REPORT ON PROGRESS OF

THE UCT GREEN CAMPUS ACTION PLAN

For the Period 2009-2010

Compiled for the UCT Properties and Services Department

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INTRODUCTION

This Technical Report should be read in conjunction with the Summary Table Report which provides an overview of progress achieved during the period 2009-2010. The Summary Table uses colour coding to indicate degree of progress, ranging from Good Progress (green shading), to Fair Progress (orange), to No Progress (red shading).

This report records the progress made in relation to the implementation of the University of Cape Town (UCT) Green Campus Action Plan (GCAP), during the two-year period 2009-2010. The geographical study area is Main Campus, comprising the Upper, Middle and Lower Campuses. The report describes the activities required to implement the Plan; key information collected, the obstacles and barriers encountered, and the next steps to be taken. The report records the status of the Plan at UCT, as at the end of 2010.

In general, the Actions requiring capital expenditure in the GCAP have not progressed well, as a financing model or mechanism for campus greening at UCT has not yet been developed. A number of the Actions relate to reduction of resource use – namely water and electricity. If resource savings are to be sought, the campus would require the widespread replacement of fittings such as lighting, taps, urinals and air-conditioning plant. These are not budgeted for in the annual maintenance budget, and capital will need to be obtained for these major retrofits. Development of a funding model for campus greening is therefore necessary before these Actions can achieve significant progress. The focus of implementation over the two year period has thus been on those Actions that require behavioural change, or are low-cost, rather than requiring capital expenditure.

The aim of this report is to review the Plan, and then adjust priority Actions and reset targets or goals for the next two year period.

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ACRONYMS

ARPO	Assistant Radiation Protection Officer
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
BEN	Bicycle Empowerment Network
BMS	Building Management System
CCOH	Canadian Centre for Occupational Health and Safety
CDM	Clean Development Mechanism
CEF	Central Energy Fund
CFL	Compact fluorescent lamp
CPUT	Cape Peninsula University of Technology
CRT	Cathode Ray Tube
DBSA	Development Bank of South Africa
DoE	Department of Energy
ECS	Energy Conservation Scheme
EGS	Environmental and Geographical Sciences
EMP	Environmental Management Plan
EMWG	Environmental Management Working Group
EMWG	Environmental Management Working Group
EPEAT	Electronic Product Environmental Assessment Tool
ERC	Energy Research Centre
eWASA	e-Waste Association of South Africa
FSC	Forestry Stewardship Council
GBCSA	Green Building Council of South Africa
GCAP	Green Campus Action Plan
GCI	Green Campus Initiative
GMO	Genetically Modified Organisms
GSB	Graduate School of Business
GSM	Gross Square Metres
GWP	Global Warming Potential
HBA	Hazardous Biological Agents
HCS	Hazardous Chemical Substances
HP	Hewlett-Packard
HVAC	Heating Ventilation and Air-Conditioning
ICTS	Information and Communication Technology Services
IPM	Integrated Pest Management
kL	Kilolitre
LCD	Liquid Crystal Display
LPG	Liquid Petroleum Gas
MBA	Masters in Business Administration
MSDS	Material Safety Data Sheets
NERSA	National Energy Regulator of South Africa

NMT	Non-Motorised Transport
ODP	Ozone Depletion Potential
P&S	Properties and Services
PASE	Partnership for a Sustainable Environment
PCP	Power Conservation Programme
PET	Polyethylene terephthalate
PIC	Project Implementation Committee
PVC	Polyvinyl chloride
RPO	Radiation Protection Officer
SANBI	South African National Biodiversity Institute
SAPCA	South African Pest Control Association
SUDS	Sustainable Urban Drainage Systems
SUN	Stellenbosch University
SWH	Solar Water Heaters
TMNP	Table Mountain National Park
UB&DC	University Building and Development Committee
UCT	University of Cape Town
UK	United Kingdom
USA	United States of America
UWC	University of the Western Cape
VOC	Volatile Organic Compound

1 ENERGY

In line with global and national trends, energy consumption is considered to be the most pressing issue for facilities management due to energy security, rising costs of electricity, and climate change concerns and commitments. UCT's energy supply is comprised almost totally of electricity supplied by the national grid from largely coal-fired power in combination with a small percentage of nuclear power. The annual expenditure of electricity in 2008 was R18 million which has risen to around R36 million by 2010 due to price increases. Further increases are expected to occur in the next few years. This makes energy efficiency and conservation one of the top priorities amongst all Actions listed in this Plan.

1.1 Install electricity meters to each building to identify consumption at building level

Before efficiency measures and conservation targets could be introduced on Main Campus, adequate information regarding the substantive uses needs to be gathered and analysed. Presently, the main campus is metered globally, with a small number of meters at building level. The aim was to eventually install meters to every building and then to each academic department over time.

Activities

July 2009: Andre Theys, Manager Engineering Services, P&S, investigated a range of metering technologies from different suppliers, assessing their performance and suitability. High capital cost of equipment was a barrier at this stage. These meters would have been linked to the Building Management System (BMS).

August 2009: The Energy Research Centre (ERC), UCT was involved in testing metering technologies at Kramer Building during 2009, and the results were assessed by November 2009.

March 2010: A new web-based technology became available. This technology is based on the delivery of real-time energy consumption information via wireless meters installed in each building. The benefits include a low monthly cost for a web-based subscription service for data reporting. Andre Theys commenced with testing the service and meters.

Key Information

- Number of buildings on Main Campus = 77 (refer to Appendix 1: *Schedule of Buildings on Main Campus*).
- Buildings on Upper Campus do not typically have their own main electrical distribution boards, but are linked together to transformers in substations, making independent metering unviable. Meters would have to be installed at transformer level, rather than at building level.
- Annual consumption 2008 — 45,000,000 kWh (Main Campus)
- Annual electricity expenditure (2008) — R18 million
- Budget estimate 2009 — R25 million
- Budget estimate 2010 — R36 million

Progress

March 2010: The 'energy dashboard' web-based subscription service was purchased by UCT for two years. Assessment and demonstration of the technology within P&S were undertaken.

Mid- 2010: A decision was taken to install approximately 30 'smart' meters on Upper Campus, with completion anticipated before the end of 2010. This internet delivered technology makes the consumption of electricity visible to chosen staff in real-time, providing for better management decisions, as well as serving as the basis for further energy-saving interventions. It also supports behavioural change, especially when made widely available, for example on electronic noticeboards. The dashboard can provide fully configurable, customisable reporting that reflects trends in consumption.

Medical Campus meters were installed at transformer level. Menzies building meters were installed during 2010. Andre Theys completed a proposal for metering of the two main data centres, namely Upper Campus, Bremner Building, the Information and Communication Technology Services (ICTS) Building, and '7 on Main'. Confirmation from the Director of ICTS was required prior to installation.

During 2010, six meters were installed at the Medical School as a pilot project. The meters are placed on each transformer, and in the case of Medical school, there is fortunately one transformer per building. A challenge of the installation process was the requirement to shut down power to the buildings to during the installation.

During 2011 the installation of 33 meters is planned, subject to arranging a suitable schedule for 'down time'. On Upper Campus there are 33 transformers serving over 100 buildings meaning a number of buildings would be affected by each installation.

Next Steps

- Install 33 meters on Upper Campus.
- Use data received from metering to analyse consumption patterns and identify reduction strategies.

1.2 Establishing baseline of electricity consumption

The intention was to establish a global baseline of electricity consumption for Main Campus, against which reduction targets could be set and trends monitored. The benchmark to be used as a basis for comparison is that used by the national energy efficiency standard, SANS 204:2008 *Energy Efficiency in Buildings*, also used in the new Green Star SA Rating system. SANS 204:2008 measures maximum annual consumption per building classification, measured as 'Maximum Energy Consumption' in kWh/m² per annum for each climatic zone in South Africa. For example, offices in Cape Town should aim to limit energy consumption to a maximum of 185 kWh/m² per annum. However, some problems were identified in relating UCT's consumption to the SANS 204 benchmark, since target values vary depending on the Classification of Occupancy of buildings, for example 'Offices', 'Dormitories' or 'Places of Instruction'. The buildings on Main Campus consist of a wide range of uses, thus the otherwise simple calculation using Total Electricity Consumption divided by Total Building Area would not be comparable to the SANS 204 benchmarks. This problem would be

resolved to some extent by the installation of meters at each building. However, until such time, the calculation would serve the purpose of establishing the global baseline against which trends can be identified.

The legislation governing energy consumption in South Africa was tabled for comment by the National Energy Regulator of South Africa (NERSA) in July 2008 as a medium-term solution to the energy capacity shortage. The 'Energy Conservation Scheme' (ECS) is a component of the South African Power Conservation Programme (PCP), and is not yet mandatory for all consumers. It is intended as a strategy for managing growth in consumption and new connections and the rules of the Scheme set out a mechanism for deviating from the set or approved tariffs payable by a customer. The ECS would require all participating consumers to achieve energy savings targets, with associated incentives and penalties which would become effective when the Scheme becomes mandatory, i.e. once all legislative and regulatory enablers are in place. The Scheme establishes a National Savings Target[1] of 10%, however there are differentiated targets for each sector measured in relation to an 'Annual Baseline Consumption'. The Annual Baseline Consumption is the energy consumed during the 'Baseline Period' (October 2006 to September 2007 inclusive), with no automatic adjustment for growth since September 2007. The Scheme would charge customers excess energy charges in the event that the customer consumes more electricity in a 'Billing Period' than his final monthly Energy Allocation[2]. Energy saving would therefore be incentivised by a customer being able to trade the electricity saved in a Billing Period.

Activities

June 2009: Electricity consumption data was obtained from Chris Briers, Project and Engineering Manager, P&S, showing consumption trends over the period 2003-2009. A working session was held which focused on gathering and checking the data for the calculation of electricity consumption in terms of the agreed metric, kWh/m² per annum being the annual consumption across all of the buildings on Main Campus. The schedule of building areas for Main Campus was examined and found to need revision and alignment with the metered area to produce an accurate result (refer Appendix 1: *Schedule of Buildings on Main Campus*). It was agreed that the revised list of building areas should become the standard, uniform list used for a range of monitoring activities.

Assumptions to be confirmed:

- Method of measurement of floor area – i.e. Gross Square Metres (GSM) versus Net Floor Area (SANS 204)3

[1] 'National Savings Target' means the percentage of the Annual National Baseline Electricity Consumption required to be reduced to achieve a sufficient margin between the demand for electricity and the supply of electricity, as determined by the Minister.

[2] 'Billing Period' means the duration from one Measurement Date to the next Measurement Date and Monthly Energy Allocation is defined as the maximum amount of electricity which a customer is permitted to use during a Billing Period.

[3] Net Floor Area - sum of all areas between the vertical building components (walls, partitions), excluding garages and storerooms (SANS 204 Definition) and total internal area of a building when measured on the

- Buildings to be included in Main Campus in terms of metering
- Classification of Occupancy – Office, Place of Instruction, Residence

Key Information

- Total annual electricity consumption (2008) = 44,131,840 kWh
- Total Building Area (Net) = 293,045m²
- Energy consumption = 150 kWh/m² per annum
- SANS 204 benchmark for Offices, maximum energy consumption = 185 kWh/m² per annum
- SANS 204 benchmark for Places of Instruction, maximum energy consumption = 390 kWh/m² per annum

Progress

Measures for monitoring were defined as follows:

- Method of measurement of floor area – Net Floor Area (SANS 204)
- Buildings included in Main Campus (and included in municipal Electricity Account 1)

Consumption data for recent years, going back to 2003, and trend reporting has been undertaken by Chris Briers at P&S.

Next Steps

Install meters in each building (or group of buildings) and calculate electricity consumption according to an agreed benchmark.

1.3 Reset all computers under ICTS management to energy saving modes

Activities

Some data had been received from ICTS during 2009, including a schedule of all computers under ICTS management; the exact quantities thereof; the daily operating period thereof; and the type of monitors, either Cathode Ray Tube (CRT) or Liquid Crystal Display (LCD), the latter being more energy efficient.

In early 2009 the ICTS Department updated their website with respect to 'Green IT' and published notices by desktop 'Pop-up' messaging and in the Monday Paper.

Key Information

- The number of computers under ICTS management in 2009 was 1668; this increased to 1674 by the end of 2010.
- The number of computers with CRT monitors in 2009 was 686; reduced to 645 by the end of 2010.

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inside of the perimeter walls excluding open areas within the walls (i.e. flat roof of shopping centres or offices, covered balcony, atrium, roof garden)

For further details, refer to spreadsheet in Appendix 2: *Database of ICTS Computer Labs*.

Progress

In terms of power management of these computers, ICTS confirmed that the power management of these computers has been optimised. All of them are now set to automatically switch to power saving mode, and some are set to automatically switch off at certain times.

Next steps

- Expand power management practices to all other computers not managed by ICTS.
- Continually upgrade hardware and monitors through the supply of the most energy efficient equipment available.

1.4 Launch Programme of behaviour change to switch off lights

This initiative was to be driven by the Green Campus Initiative (GCI) as part of their Building-to-Building Roadshow that deals with a range of behaviour change actions for energy, water and waste. The first two buildings targeted were the Kramer Law and the Shell Environmental and Geographical Science (EGS) Buildings. The intention was that once these had been successfully trialled, the project would be extended to other departments.

Activities

Signage reminding users to switch off lights was posted at the Kramer Law and Environmental and Geographical Science department.

Progress

Progress in behaviour change was not monitored and a strategy for this Action would still need to be developed.

At the Shell EGS Building, an audit was undertaken of light switching during a one week period, providing an indication of typical behaviour. Lights were accidentally left on over the weekend in a large lecture room. Such a space would be an appropriate location for the installation of automatic lighting control, using movement sensors to eliminate human error.

Next Steps

- Define a set of behavioural actions to be addressed during GCI Roadshow, i.e. saving energy and water, and reducing waste.
- Select a short list of target buildings as a first phase.
- Obtain funding for signage and casual labour for monitoring.

1.5 Install equipment and software for gathering and analysing of resource use information

Due to advances in technology available, this Action has become linked to Action 1.1 so that the meters and software are part of one solution. Refer to Action 1.1 above for progress on this Action.

This Action should be removed from the next Action Plan.

1.6 Replace all magnetic ballasts on fluorescent lights with electronic ballasts

The P&S policy is to upgrade to electronic ballasts and T8 technology only after having physically measured 'before and after' samples to determine energy savings. T8 technology is typically commercial energy-saving lamps with electronic ballasts, which are more efficient than older T12 lamps, see Key Information sub-section below.

Activities

July 2009: A discussion was held with Andre Thys regarding the monitoring measures for lighting ballasts and the number of buildings retrofitted to date was reported:

- Fluorescent lamps,T8 type (commercial energy-saving lamps with electronic ballasts, more efficient than older T12 lamps) have been retrofitted to Main Campus buildings (completion approximately 85%) but the ballasts have not always been replaced with electronic ballasts (approximately 50%).
- The Molecular and Cell Biology Department have had all luminaires retrofitted with T8 lamps with electronic ballasts.
- Considerable premature T5 lamp (smaller, potentially more energy efficient lamps) failures had been experienced in the larger lecture venues at UCT. Therefore, T5 fluorescent tubes were not being considered until the stability of voltage in South Africa improved, or until manufacturers produce T5 lamps suited to UCT supply.
- By the end of 2010 this scenario had changed and T5 lamps had advanced. UCT now installs T5 lamps where fittings specified are only available with T5 lamps. Although the T8 and electronic ballast combination remains the UCT specification of choice.

By September 2008, the Faculty of Law in the Kramer Building had completed an audit and costing report for retrofitting the fluorescent lamps in the building. Some retrofitting was undertaken using departmental funds to serve as a pilot project and to demonstrate their commitment to sustainability. Refer to *Sustainable Kramer Project Report* (Herbstein, 2008). Further funds for retrofitting were sought from P&S. However, P&S did not support the use of the T5 lamp technology used in the Kramer Law Building and therefore this retrofit was not undertaken.

Key Information

- Installation of efficient lamps in fluorescent fittings has been an ongoing maintenance practice for a number of years; however, the ballasts are not necessarily replaced.
- Ballasts are fluorescent light control gear. Magnetic ballasts waste energy in building up the heat necessary to operate, while electronic ballasts do not. Electronic ballasts therefore allow an instant energy saving of between 12- 15% , plus an indirect saving in energy not used to cool the heated air created by the magnetic units.
- Electronic ballasts increase the life span of lamps, remove the need to replace starters and capacitors, reduce lamp flickering and 'tired eyes', and significantly improve efficiency in the bulk power factor.

- Payback period for replacing magnetic with electronic ballasts is between 2 - 2.5 years (refer to *Electricity Savings Proposal for Kramer*, Electro Sense, 2008), at 2009 energy prices.

Progress

The retrofitting of fluorescent lamps (T8) had been completed to a level of approximately 85%. The replacement of magnetic with electronic ballasts, was only approximately 50%.

Next Steps

- Find consensus on the appropriate technology for maintenance retrofits.
- Budget and obtain financing for replacing lamps and ballasts.
- Programme the retrofitting to avoid disruption to building occupants.

1.7 Install lighting controls (movement sensors, timers, daylight sensors) to selected spaces to activate lighting

This Action is applicable to all new buildings; however some retrofitting in existing spaces should be investigated.

Since retrofitting of sensors carries a high capital cost, until UCT adopts a financial model that promotes a 'spending to save' approach, further retrofitting is unlikely to occur.

Activities

2008: A proposal for retrofitting of movement sensors to control lighting at Kramer Law Building had been produced by Electrosense, however this was not implemented due to the substantial funds required.

2009: Meetings were held with potential lighting control suppliers to investigate the lighting control gear in terms of performance and cost.

October 2009: An audit of the Shell Environmental and Geographical Science (EGS) Building was undertaken by Electrosense (Alex Hegerstrom) to identify opportunities for savings through installation of lighting control. Data loggers were installed in selected spaces in the EGS Building. The results of measurement showed that the potential savings (average across all space types) were approximately 33%, while the large lecture venue (Studio 5) had over 60% potential savings. The data was circulated to the head of department and discussed by a department greening task team. This Action was not implemented due to cost constraints, as the department would have to pay for the installation.

Key Information

- Savings of electricity would be specific to the typical usage of a space and would need to be estimated by installing data loggers in a space to establish feasibility and payback period.

Next Steps

- Develop proposals for specific buildings and seek funding for retrofitting movement sensors to selected spaces.

1.8 Upgrade all BMS equipment with new web-based technology

Due to advances in technology, this Action has become integral with the meter installation described in Action 1.1. This Action should therefore be removed from the next version of the Action Plan.

1.9 Install solar water heaters to small and medium residences

In March 2009, a list of 30 small and medium residences was provided by Andre Theys and John Peters of P&S, all of which were considered suitable for the installation of solar water heaters (SWH). These retrofits were to be undertaken using maintenance funds when the hot water supply needed to be upgraded, or cylinders required replacement. It was acknowledged that if these installations were to be carried out more quickly, funds would have to be sought motivated by the cost-benefit and payback period.

In 2007, the large Graca Machel Residence was built with heat pumps and solar heating installed however there were problems with the integration of the two systems and hence the solar heating has not been operational. Responsibilities for the latent defects in the system were not clear, i.e. the main contractor, plumbing sub-contractor or the heat pump supplier. Jan Bester, the project manager for Graca Machel Residence, undertook to resolve the matter.

Activities

Cadbol House was identified as the first small residence to undergo retrofitting with SWH. This is because this residence had a shortage of hot water supply due to an increase of students to 17, with an existing hot water system designed for only 8-10. Tenders were invited from three companies considered to be of the same standard, Solarheat Services (Solahart agents), Atlantic Solar, and Solardome. All of the companies had SABS approval for their products, and were thus eligible for Eskom subsidies. The products differed from each other, having cylinders of various materials including copper, steel and fibreglass.

A detailed evaluation of the quotations was undertaken. A wide price range was found between the quotations, leading to more investigation of the offer made by lowest tenderer, Atlantic Solar. Atlantic Solar was appointed and the installation was completed.

A student in the EGS Department, Elliot Firestone, published a thesis on the 'Financial Payback and Other Benefits of Solar Hot Water at the University of Cape Town' and this was submitted to P&S for consideration (refer to Appendix 3).

Mid-2010: Andre Theys met with building contractors to resolve the outstanding defects of the solar heating and the heat pumps in the Graca Machel Residence. Lack of clarity remained about whose responsibility it was to carry out the controls for the integration of the two systems. Andre Theys undertook to meet with the heat pump supplier and devise a control integration plan. Subsequently,

it transpired that the project manager for the Graca Machel Residence (Jan Bester) already had a control plan, and that he was awaiting funds from P&S in order to proceed. No further progress reports could be obtained from the project manager at the time.

John Critien, Director of P&S, and Sandra Rippon, Sustainability Consultant, discussed the financing of installation of SWH with the UCT Chief Financial Officer, Prof. Enrico Uliana. He indicated that Business Plans could be submitted to his office for consideration and that payback periods as long as 10 years would be considered acceptable. No such Business Plans for SWH have been produced to date due to lack of data from the installed systems. It could be argued that there is already widespread evidence of the electricity savings typical of these installations and that writing Business Plans would be unnecessary to prove the business case.

Progress

- The SWH was installed at Cadbol House, in June 2009, comprising a 300 litre tank with two collector panels, with a value of R23,929. The existing 200 litre tank was retained, increasing the overall capacity of supply in the residence.
- SWH was installed at Edwin Hart Residence (35 Students) and 11 Woodbine Road (6 Students) during 2010.
- A table of the Residences and status of SWH installations is included in Appendix 4: *Status of Solar Water Heating in Residences*.

Next Steps

- Obtain feedback on the effectiveness of the systems installed and adequacy of hot water supply by reporting on trends reflected in the electricity accounts.
- Develop a Business Plan for obtaining funding from UCT Central Finance for further SWH installations.
- Repair of defects to the Graca Machel Residence solar water heating system is considered a priority. Due to the large size of this residence, this Action would significantly increase the renewable energy contribution to the campus.

1.10 Commence a programme of upgrading all HVAC equipment to energy efficient technology

This Action was pursued directly by the P&S staff (John Critien and Chris Briers). A consortium was formed with other higher education institutions including SUN, Cape Peninsula University of Technology (CPUT), and University of Western Cape (UWC), to seek funding for energy efficiency across these campuses. By the end of 2010, John Critien reported that the talks with Eskom and the Central Energy Fund (CEF) had unfortunately failed. They initially committed to funding the campus audit process for six of the 23 universities but subsequently reneged.

Some upgrading of Heating Ventilation and Air-Conditioning (HVAC) equipment is undertaken on an ongoing basis using maintenance budgets. During the Audit period, upgrading of equipment was already underway at Beattie, Menzies and Bremner Buildings. The Kramer, Chris Barnard, and

Barnard Fuller Buildings were under consideration, but implementation would be dependent on availability of funds.

1.11 Change cooking methods to gas wherever practical

No opportunities have as yet been found for conversion to gas for cooking. The government introduced a subsidy for Liquid Petroleum Gas (LPG) during 2010 and this should make gas more economically attractive as an alternative to electricity.

However, there was one small project involving the installation of a gas biodigester at Leo Marquard Hall Residence which has contributed to progress of this Action. The Biogas Digester project was the concept of Assoc. Prof. Harro von Blottnitz of the Department of Chemical Engineering, and was managed by a team consisting of Rethabile Melamu (Chemical Engineering), Anya Boyd (Energy Research Centre), Brett Roden (UCT's Environmental Officer), and Greg Austin (AGAMA Energy, the technology supplier). This was actually a research project and it was proposed that the digester would be operated on monitored diets for a period of 12 months, and its performance regularly evaluated. Upon completion of the research phase, the unit was to be handed over to UCT Residences.

This project aimed to demonstrate that it is technically feasible to produce methane gas from source-separated wet waste on campus, and to use this gas for cooking purposes. A 6m³ pre-fabricated biogas digester was brought to campus and installed near one of the residence kitchens where waste is already sorted into recyclables and wet waste. The unit receives between 20 and 40 kg of kitchen waste per day. The unit can typically be installed above-ground although a below-ground installation is usually preferred. Treated effluent enters the sewer, and sludge is recovered and disposed of (or utilised for composting) from time to time.

The Chemical Engineering research group secured funding for the acquisition and installation of the unit and also employed research and technical personnel for a period of 12 months to operate and monitor the unit.

The biodigester was installed by November 2010 at Leo Marquard Hall Residence. It was connected to the sewer, and the gas pipeline was also installed. Priming to start the digester was expected to commence in January 2011 and full scale operation was to start about a month later.

2 WATER

Water is listed as one of four priorities by the *Green Campus Policy Framework* (Hall and Murray, 2008), along with Energy, Climate Change and Waste. However, no reporting is currently being done by P&S to identify trends of consumption, seasonal patterns, or substantive uses. A major obstacle to obtaining data and understanding water consumption patterns is the fact that only one global meter exists for the entire Main Campus. By contrast, some detailed reporting is being done for electricity since the tariffs are considered high and expected to increase dramatically.

Water restrictions can be expected in Cape Town in dry years. The Municipality have a scheme in place to charge tariffs on a sliding scale, rising with higher consumption. During the period 2009-2010, the storage dams in the region were full and the lowest tier of tariffs (10% restriction) was being charged. Tariffs for periods of drought are in place, for 20% and 30% restriction tariffs.

As with electricity infrastructure in South Africa, a lack of maintenance of water supply and waste water treatment infrastructure has been identified as a national issue. Annual escalation of tariffs in coming years can be expected to be in the region of 15% to deal with infrastructure expenditure.

The City of Cape Town Water By-Law (2006) requires all major users (> 3,650 kilolitres per annum) to undertake an annual water audit. Details of what the audit should comprise are provided, and include number of people permanently working/living on the stand or premises; seasonal variation in demand (monthly consumption figures); details of water pollution monitoring methods; details of current initiatives and plans to manage their demand for water; comparison of the above factors with those reported in each of the previous three years; and estimate of consumption by various components in use. No annual audits of water consumption have been undertaken at UCT.

Of potential significance for UCT expenditure on water is the fact that sewage is charged at a percentage of water use. If potable water is used for irrigation, this would result in unnecessary cost for sewer tariffs. UCT should make application to the Municipality to decouple the cost of irrigation. This is a strategy which has been allowed by the City for schools with playing fields. Such an application would require that the domestic use and irrigation use on Main Campus be measured, as is proposed in Action2.1 below.

2.1 Install water sub-meters to each building to identify leaks and consumption with remote data logging and monitoring

Activities

- Research on current digital water metering technologies available in South Africa.
- Meeting with Chris Schlimper of Applied Metering Innovation to determine what information would be needed in order to produce a costing proposal for a first phase.
- Requested information and assistance from P&S and awaiting input.

Next Steps

- Undertake site investigation and gather water reticulation information with P&S staff to determine numbers and type of water meters for a first phase installation for Main Campus. This would aim to provide better data of the main water uses, particularly the split between domestic and irrigation uses. A review of the water reticulation system on Main Campus is required to determine the number of pipe feeds, their location; the best place to install meters and monitoring equipment), and the pipe feed diameters. It is estimated that a relatively small number of meters, say 5-8, would comprise the first phase, installed on Upper Campus, Middle Campus, Lower Campus, the Storage Dam used for irrigation of sports fields, the Area North of Woolsack Drive, and Kopano and other Residences.

2.2 Establish baseline of water consumption by volume and use and set reduction targets

Activities

Activities included consultation with Fahmza Jaffar, Finance Manager, P&S, and Ebrahim Abrahams, Finance Office, P&S, to determine the nature of water use information available.

The accounts were reviewed and analysed to arrive at estimates of monthly and yearly consumption.

Key Information

- Monthly consumption June 2009 (from Accounts): 26,388 kL
- Estimated average annual potable water consumption 2009: 350,000 kL
- The annual budget for water (approximately): R4.5 million/annum
- Total budget estimate for water for 2010: R4.572 million
- Total budget estimate for sewerage: R3.673 million

Next Steps

- Monitor and report on water consumption to highlight trends in consumption and develop strategies for demand management.

2.3 Retrofit all urinals at UCT with waterless urinal valves and ensure adequate maintenance

It is argued that this retrofitting action would contribute to water conservation significantly at UCT. The estimated water saving from each urinal converted to waterless, (allowing for water to clean the bowl) is approximately 22,000 litres per annum, costing approximately R300.00. However, this Action is not currently supported since the cost of the replacement values is equivalent to the cost of water used in a urinal annually.

As part of the 'Sustainable Kramer Project', the twenty urinals at Kramer Law Department, Middle Campus, were retrofitted with waterless urinal valves in June 2008. Maintenance of these urinals was undertaken in May 2009; comprising the replacement of 20 Sannitree 'One-way' valves costing

R200 each for the valve and the labour, at a total cost of R4, 605. This valve replacement is likely to be required at intervals of approximately 12 months depending on usage levels.

The payback period for retrofitting the urinals with waterless, one-way valves is very short, less than one year. However, the valves need to be replaced annually thus the expenditure recurs every year. From a sustainability perspective this retrofit is desirable due to savings of both water and energy (used in the treatment and pumping of potable water), but from an economic point of view it is less attractive due to recurring maintenance costs.

During 2009, UCT was paying a rate of R7.20 per kL for potable water and R5.99 for sewerage, which totals R13.19/kL of water used to flush a urinal. A payback calculation has been included in the full report.

While the retrofit of the urinal valves was shown to have an acceptable payback period of less than one year, the cost of the water saved annually is close to the amount of replacing the valve each year. This Action is unlikely to be attractive from a cost-benefit viewpoint, until the cost of water increases and the retrofit of the valves produces a saving. However, the environmental benefits of reduced water use should be considered by UCT as evidence of commitment to sustainability.

Refer to the detailed report on waterless urinals in Appendix 5: *Report on Waterless Urinals at UCT*.

Key Information

- Tariff for potable water as of 2009: R7.20/kL
- Tariff for sewerage 2009: R5.99/kL

Progress

- Piloting of the urinal values can be considered to be complete, with all the information required to inform a decision to retrofit these being available. Feedback has been obtained from the Kramer Law Department on a range of issues, namely acceptability, maintenance costs, and training of cleaning staff.

Next Steps

- Write a Business Plan to seek funding for retrofitting urinals.

2.4 Commence a programme of upgrading irrigation to surface drip technology for planting beds only

Much of the irrigation water used on Upper Campus and the Sports Field is drawn from the dam, rather than from municipal potable water supply. The capacity of the dam is 47,500 m³ and this is reportedly adequate for irrigation needs, except during periods of drought. Given the scarcity of water and increasing demand in the Cape Town Metropole, it can be anticipated that water restrictions and increasing tariffs would occur in future and therefore the dam water should be used efficiently to avoid the use of potable water when dam levels are low.

Disagreement with the inclusion of this Action in the Plan was expressed by the Gardens Department, who do not envisage that drip irrigation would ever be widely used around the

campuses, due to maintenance issues. The main problems anticipated are that the outsourced garden contractors might inadvertently damage the pipework of sub-surface irrigation. In addition, small mammals can also damage surface irrigation piping. However, it is argued that surface- rather than sub-surface- drip irrigation may still be viable for certain planting beds.

Key Information

- Upper Campus Dam capacity: 47,500 m^3
- The Maintenance Department of P&S monitors the dam in accordance with the requirements of the National Water Act (36 of 1998) and have records of dam levels and outflows into the weir.

Next Steps

- Install meters to identify irrigation and domestic/custodial usage.
- Measure and monitor consumption and develop strategies and set targets for reduction.
- Identify specific areas where surface drip irrigation could be laid on planting beds without a high risk of damage.

2.5 Adopt Sustainable Urban Drainage practices including permeable paving to allow infiltration, attenuation and enhanced quality of stormwater

Sustainable Urban Drainage Systems (SUDS) are increasingly being adopted, not only by those innovative developments that aim to be green but even by local authorities. The impacts and unsustainable costs of conventional infrastructure systems are driving this change. Research in the arena of sustainable urban drainage was underway within the Department of Civil Engineering, led by Assoc. Prof. Neil Armitage. Dr. Kevin Winter of the EGS Department is also involved with this water research team.

Activities

- Meeting with Prof. Armitage and Dr. Winter to outline the objectives of GCAP and discover the nature of research being undertaken with a view to alignment.
- Site investigation of the Middle Campus development with the civil engineers and the Director of Physical Planning, Geoff de Wet, to look at proposed location of retention ponds on Middle Campus.

Progress

During 2009, UCT was seeking approvals from the City of Cape Town for two new buildings on Middle Campus. For the first time the City required that stormwater be attenuated on site rather than being discharged into the municipal stormwater infrastructure.

The UCT Physical Planning Department together with the project team considered the use of ‘bioretention’ ponds to filter, attenuate, and infiltrate stormwater. These ponds were to be located in the open area of garden to the south of the Glenara Residence. The existence of a vulnerable frog species, the Cape Rain Frog, in this habitat gave rise to the appointment of a specialist consultant, James Harrison, for the assessment of the impact of the proposed ponds on these frogs. The frogs

are the only recorded Red Data species on campus and have value as an indicator of environmental quality. The findings and recommendations of Harrison's report were that the unmitigated development proposal assessed was unacceptable. A revised development plan was adopted, using permeable paving in parking areas to attenuate stormwater in lieu of the ponds.

Next Steps

- Monitor and report on the effectiveness and any lessons learned in the Middle Campus Development.
- Adopt sustainable urban drainage practices for all future developments.

2.6 Ensure adequate dry season flows to maintain natural streams on Upper Campus

No progress

2.7 Investigate establishment of second storage dam on Table Mountain property in adjacent tributary

Subject to Specialist research to establish ecological impact

No progress

3 INDOOR ENVIRONMENTAL QUALITY

3.1 Upgrade ventilation systems to best practice air quality standards for all copy centres, and printing rooms to ASHRAE standards

Substantial funding would be required to implement this Action. An audit or survey of all copy centres and printing rooms would be required and current equipment performance measured.

No progress

3.2 Minimise all materials containing Volatile Organic Compounds (VOCs) and specify low VOC materials

The benchmark used for this Action is compliance with Green Star SA rating system. Due to the current lack of suppliers of these products and materials, this Action would require some research and in-situ testing on products to check performance.

Until very recently, there were few suppliers of environmentally acceptable paint, adhesives and floor coverings in South Africa. The Green Star SA Building rating system was introduced by the Green Building Council of South Africa (GBCSA) in 2008. The system has done much to transform the paint, adhesive and carpet industry towards developing more sustainable products and production processes.

By the end of 2009, the paint industry was involved in an industry transformation as evidenced by the annual exhibitions of the GBCSA in November 2009 and 2010. The mainstream paint manufacturers in the South African market (e.g. Dulux, Plascon) have developed new product ranges that comply with European and Green Star SA standards for Volatile Organic Compounds (VOCs). For paints, varnishes and coatings the maximum total VOC content limits are specified as grams per litre of ready-to-use product, for example a maximum of 16 g per litre for a typical interior, flat, washable or low sheen paint (GBCSA, 2008: p. 107).

The carpet industry has also responded to the growing demand for more environmentally acceptable products, through product research and development and redesign of production processes.

Activities

At UCT some problems were experienced with the use of alternative products for the renovations to the EGS Department a few years ago, resulting in a reluctance to experiment further. For example, the drying time for these paints is longer than conventional paints and thus needs to be taken into account when planning the construction or refurbishment programme.

Key Information

- Paint products that are less environmentally damaging include the Dulux ‘Ecosure’ range; Plascon ‘Evolution’ range and Harlequin Paints.

- The local carpet manufacturer Belgotex Floor Coverings (carpets, vinyls and laminates) has achieved ISO 14001 and ISO 9001 certification. Their carpets and underlay meets the requirements of Green Star SA for low VOCs. Some carpet products have a recycled content comprising recycled polyester made out of Polyethylene terephthalate (PET) plastic bottles.
- Progress has also been made in the adhesives industry and low VOC adhesives for carpeting and vinyl tiles are available from companies such as Smoothedge.

Progress

There has been no progress in terms of change to UCT typical specifications, however awareness of the issues has increased.

Next Steps

- Test new products to confirm acceptable performance standards.

3.3 Purchase furniture and fittings with low or no Formaldehyde emissions

No progress

3.4 Enhance thermal comfort by retrofitting insulation to roofs

Insulation material with the best (available/practical) environmental profile to be selected.

No progress

3.5 Retrofit daylight glare and heat control mechanisms to facades to enhance comfort, create productive work environments and reduce energy consumption

No progress

3.6 Adopt standards of ventilation rates and air distribution effectiveness, for all new buildings, that are higher than minimum requirements of the building code SABS 10400-O

If UCT requires its new buildings to be designed and built to a Green Star 4-Star standard, then this will be adopted as it is a requirement of the Green Star SA rating system.

4 SOLID WASTE

4.1 Establish baseline information on waste production by volume and type, by undertaking detailed audits, setting reduction targets, monitoring and reporting

The key objective is to reduce as far as possible the volume of wet waste which contaminates the recyclables in the waste mix. Based on waste audits at UCT over the years, the target is approximately 70% dry waste.

Activities

- A working session was held with Duke Metcalf and Sandra Rippon to review available data.
- Duke provided waste volume information collected by Wasteman.

Key Information

The following volumes of waste were measured by the waste contractor, Wasteman, over a three month period in 2009 and provide a baseline of waste generation:

Table 1: Waste Volumes for 2009

VOLUMES OF WASTE (TONNES) AT UCT SORTED BY 'WET' AND 'DRY'			
	April 09	May 09	June 09
WET	42.2	47.4	30.4
DRY	33.9	56.2	42.4
% DRY	45%	54%	58%

Note: The lower volume of waste recorded in June 2009 relates to the winter vacation break.

The percentage of dry waste ranges from 45-58%, which is well short of the 70% target.

Progress

December 2010: Recycling statistics were received from Wasteman for the period July 2009 to November 2010 (refer to Appendix 6: *UCT Recycling Statistics, November 2010*).

By November 2010 the percentage of the total waste being recycled reached 65%, which was the target set in 2009. There is still scope for improvement as an average of 14% potential recyclable material is being mixed with contaminated waste and going to landfill. However, this was significantly improved by reaching only 10% of recyclable material going to landfill in November 2010, which is down from 38% in July 2010.

Sale of waste to small businesses remains a widespread practice within UCT departments with a number of departments selling their good office paper waste and other materials. This is sometimes undertaken independently by the cleaning staff.

The recycling results from the 12 month period between December 2009 and November 2010 are set out in Table 2 below.

Table 2: Waste Volumes for 2010

WASTE SORTING RESULTS FOR YEAR DECEMBER 2009-NOVEMBER 2010		
	TONNES (Monthly Average)	PERCENTAGE (Monthly Average)
Waste to landfill	13.95	21%
Condemned recyclate to landfill	9.43	14%
Dry waste (recyclate)	43.69	65%
TOTAL WASTE	67.06	

The average percentage of total waste to landfill: 21% + 14% = 35%

Next Steps

- Publish information to the UCT community and seek their inputs regarding improvements to the system.
- Set revised targets and monitor and report on these.
- Focus on recovery of paper waste – office/white paper.

4.2 Establish and monitor a waste recycling system for outdoor areas and within buildings

The outdoor waste recycling system was commenced in 2008, driven by the GCI in collaboration with P&S. A 4-bin system was selected and the bin lids designed and procured.

Activities

An outdoor waste audit was conducted by the students in the Department of Chemical Engineering in 2009, supervised by Assoc. Prof. Harro von Blottnitz. Results are contained in a Conference Paper that was delivered to the 20th Waste conference and Exhibition, 2010 (refer to Appendix 7: *Recycling at UCT, Warambwa et al 2010*).

The findings indicated that both Campus and Residence recycling systems were performing sub – optimally, exhibiting notable levels of contamination and a significant loss of recyclable material. Reasons for this were sought using student surveys, which identified a lack of detailed knowledge as one of the prime causes. The pilot-scale source-separation interventions implemented in residences showed promising improvements in the separation of waste.

During 2010, a new indoor two-bin system was installed in the EGS Department (refer to Report in Appendix 8: *Report on Environmental and Geographical Science Department Indoor Waste Recycling Scheme*). A series of three indoor waste audits were conducted by the GCI in the EGS Department in September and October 2010. The results showed that sorting to the recycling bins was good

(approximately 95% correct) while sorting to the non-recyclable bins was less effective (approximately 65-75%) (refer to separate Report for further detail).

Key Information

In the EGS Department Indoor Recycling Scheme, the following lessons were learned:

- Detailed labelling was found to be essential to success, since knowledge of what can be recycled is still fairly limited amongst users (refer to Table 3 below).
- Both recyclables and non-recyclables bins were needed side-by-side in each location.
- Clear bags to be used for the recyclable bins only and ordinary black for the non-recyclable bins. The different colour bags aid staff in the correct transfer to the Wasteman two-bin disposal system.
- Certain waste items confuse the users, namely coffee cups, tissues, candy/chocolate, and food wrappers.
- Wasteman announced that they were able to recycle Tetrapak (milk and juice cartons of multiple layers of plastic and paper) and polystyrene.

Table 3: Labelling of Indoor Bins

RECYCLABLES	NON-RECYCLABLES
Plastic	Food
Polystyrene	Food wrappers
Cans	Paper cups
Tetrapak	Used serviettes
Paper	

Progress

A high level of separation of waste at source cannot be expected to occur immediately after bins are provided. It requires a shift in behavioural patterns, awareness-raising, and education over time. It is expected that the UCT community will take at least a year to become reasonably consistent in their waste disposal behaviour. Waste separation is gradually being rolled out by municipalities and the students and staff will also be learning to separate waste at home, thus improvement can be expected.

Next Steps

- Develop monitoring or auditing measures.
- Start indoor recycling schemes in each department, within buildings.
- Adopt incentives through GCI run competitions.
- Educate and train Supercare cleaners with regards to the recycling and transferring the waste bags to the correct Wasteman wheelie bins, with their colour-coded green and yellow lids.
- Research the environmental impact of recycling items such as Tetrapak and polystyrene in the local context

4.3 Set up facilities and procedures for the responsible disposal of compact fluorescent lamps and batteries

A disposal system for fluorescent tubes is already in place whereby crushed lamps are disposed of by a specialist contractor managed by P&S.

It was identified that CFL lamps and batteries could in the future be included in the e-Waste collection and disposal system. At present only certain types of batteries are accepted by the e-Waste contractors. CFLs can be disposed of with fluorescent tubes, for which measures are in place.

4.4 Set up an e-Waste disposal system at strategic points on all campuses

Replacement of old electronic equipment in a large institution typically occurs every five years, yielding potentially large and toxic streams of e-Waste. However, the electronic equipment which is outdated for business purposes might, after an upgrade and overhaul, be perfectly suitable to satisfy the IT requirements of a local community organisation, library or school. It is more sustainable to recover the function of still workable equipment, rather than merely dealing with it as 'waste' and crushing such waste for the recovery of the material components as undertaken for conventional recycling of electrical equipment.

In the process of investigating this Action, it became apparent that e-Waste forms part of the broader issue of 'Green IT' which is not specifically addressed in the Action Plan. The key issues within the Green IT category were identified as:

1) Sustainable Procurement – purchasing energy efficient and broadly sustainable computers. The Electronic Product Environmental Assessment Tool (EPEAT) is a framework to rank products as either bronze, silver or gold based on 51 sustainability criteria.
2) Operation - Energy efficiency in Data Centres and power management.
3) Disposal of e-Waste.

Two broad objectives within e-Waste were identified for 2009:

1) Disposal of all old equipment that is presently stored at UCT to free up useable space and ensure it is diverted from landfill.
2) Establishing on ongoing e-Waste disposal system that aims to clear the e-Waste as soon as it reaches end-of-life, and avoid accumulation on campus.

The intention was to establish a similar system across all campuses including Main Campus, Graduate School of Business (GSB), and Hiddingh Campus. Co-operation with other educational institutions was identified as a longer term goal.

SUN has made some progress with respect to Sustainable IT and are willing to share knowledge and experiences.

Key issues in terms of e-Waste collections on campus include storage space requirements and security (due to the value of the waste). One option considered for collection points was the use of shipping containers, rather than taking up valuable internal space within buildings. Problems with

containers were that they use scarce land, are unsightly and need to be manned. The preferred alternative was therefore to house the e-Waste within buildings or outbuildings until volumes increase. Stellenbosch University have one depot for the drop off, storage, and point of collection of e-Waste.

Some e-Waste recycling is presently occurring at UCT, using a specialist recycling contractor, Desco. ICTS have been recycling through Desco for a number of years and are using a few garages to store e-Waste on Upper Campus. However, Desco's core business is material recovery rather than broader sustainable waste management.

At UCT, owners of equipment are responsible for removing data and taking the item off the asset register. ICTS then collect the equipment. None of the electronic waste is burned or incinerated.

Activities

March 2009: An initial meeting was held with ICTS on 13/03/09, with Sakkie Janse van Rensburg (Director, ICTS), and ICTS staff member Randolph Thompson.

April 2009: A follow up meeting was held at ICTS with a larger group including representatives of the e-Waste Alliance and Ralph Pina from the Stellenbosch University IT Department.

May 2009: A third meeting was held at ICTS with the director, Sakkie van Rensburg and Steffne Hughes. At this meeting it became apparent that there was not full agreement on the way forward, specifically the idea of appointing a new recycling partner. ICTS did not see the benefit of changing to another recycling partner. This may have been attributable to the fact that ICTS harvest computer parts for maintenance prior to removal by their recycling contractor, who also pays ICTS for the waste by weight. The arrangement with the e-Waste Alliance would be different in that the cost of collection and recovery is offset with the resale of any equipment.

The e-Waste Association of South Africa (eWASA) is the current platform for recycling of electrical and electronic waste in South Africa. eWASA is registered as a non-profit organisation and represents the interests of all the stakeholders in the e-Waste stream. The e-Waste Alliance is a member of eWASA and is a registered Section 21 Non-Profit Organisation aiming to provide a service to socially concerned South African businesses. The organisation guarantees that suitable electronic equipment gets a 'second lease of life' while real e-Waste is recycled and disposed of in the most environmentally friendly manner.

June 2009: UCT joined eWASA and the quarterly meeting in June was attended by Brett Roden, P&S Environmental Officer, and Sandra Rippon. The meeting presented a good opportunity to network around the issue. A contact was made that lead to a further meeting with the Woolworths Sustainability co-ordinator, Justin Smith. Woolworths are also members of eWASA. Support from Woolworths toward the implementation of the GCAP was offered, envisaged as seminars, presentations, and learning from their Reporting systems. Communication with their facilities and engineering services personnel was suggested for the future, however this was not taken up by P&S.

A plan of action for UCT was developed in consultation with Gerry Newson, Recover-E-Alliance, an affiliate of eWASA. The plan involved a once-off e-Waste 'Clear Out' project, aiming to remove the

old e-Waste stored on Main Campus. Approval for this was sought from P&S, ICTS and Procurement departments. A letter was sent to the Heads of Department and the Deans of Faculties.

The Clear Out project aimed to rid each of the faculties of their old, redundant electronic equipment (older than five years). Specifically, the Project aimed to:

- Reduce the risks associated with the hazardous materials that are a part of electronic components.
- Free up scarce floor space.
- Reduce the environmental impact of disposal in landfills.
- Reduce the use of raw materials by recycling and reuse.

A Service Level Agreement was negotiated and signed between UCT and Recover-E-Alliance by Brett Roden in early 2010.

April 2010: The e-Waste system was launched with posters and a competition to create awareness.

Key Information

A two pronged approach was agreed, ICTS would continue to gather and process e-Waste under five years old and P&S would deal with the waste older than five years via the Service Level Agreement with Recover-E-Alliance.

- ICTS would harvest any re-useable parts and send the remaining waste to Desco for recovery of metals.
- The waste collected by Recover-E-Alliance would be handled in a sustainable manner, prioritising job creation and skills development following the hierarchy set out in legislation: Re-use, Recovery, Recycling, and finally safe Disposal and includes the following:
  - Refurbishment for resale/reuse with 50% donated to charitable organisations.
  - Recovery of components and materials, some diverted to 'Waste-2-Art' and others to community projects.
  - Recycling of metals and plastic.
  - Safe disposal of toxic and hazardous materials.

Progress

Good and steady progress was made with this Action over the period 2009-2010.

ICTS have raised awareness of their e-Waste collection service through Intranet Pop-ups and the Monday Paper. They have offered an e-Waste collection service in the past, but there may have been a lack of awareness of this service. Calls logged requesting ICTS to collect and dispose of unwanted equipment between 2006 and 2009 are as follows:

- Jan 2006 - Dec 2006: 80 calls
- Jan 2007 - Dec 2007: 81
- Jan 2008 - Dec 2008: 112
- Jan 2009 - Aug 2009: 92

This reflects a fairly significant increase since 2008. It is not clear if this is attributable to greater awareness or an increase in the purchase of electronic equipment.

During 2010, clearing out of e-Waste older than five years from departments was arranged via P&S and a significant volume of e-Waste was diverted from landfill. See Table 4 below.

Table 4: Volumes of e-Waste diverted from landfill in 2010

MONTH	KGs
April	4426
May	174
June	1166
July	453
August	146
Sept	1153
TOTAL	7518

Next Steps

Seek continual improvement through measurement, monitoring, refining, and publishing waste data.

4.5 Reduce use of plastic water bottles by introducing alternatives

This Action could be achieved by the use of alternatives such as providing water dispensers, or by installing water filters on taps. This Action would rely on awareness raising campaigns via media, orientation talks and door-to-door GCI campaigns.

Some progress has been achieved at the executive level within UCT. Council and the senior committees (Senate, UB&DC, Audit, Finance & HR) no longer have bottled water and instead carafes and glasses are used. This policy was implemented in early 2010.

Next steps

Alternatives to bottled water for students and staff need to be clearly understood in terms of practicality and behaviour, before embarking on a campaign of change.

4.6 Purchase paper with recycled content, FSC certification and/or chlorine-free

Activities

March 2009: A meeting was held with Trevor Adams from the Procurement Department and John Critien. Enquiries were made about the prices of paper in the marketplace.

Key Information

- UCT use 'Rotatrim' (a Mondi brand) and 'Typek' (a Sappi brand). The current price of both is R30.50 per ream.
- The Rotatrim brand is the one most frequently used, due to the perception that it is a better quality refined paper.
- The Typek brand is sold as 50% recycled paper, which means the paper is made out of 50% recycled material but the process remains the same (i.e. conventional process).
- Procurement purchases more than 144,000 reams per annum, excluding the 3.5 million copies that are generated through the Document Centres and Knowledge Commerce Centres.

Progress

Procurement approached their suppliers to obtain cost proposals on recycled paper content where not only the paper was recycled, but the production process has been adjusted to be more sustainable e.g. less bleach. Alternative paper was found to be very costly as the demand in the market is still very small. The cost per ream is R42 per ream, which is an additional R11.50 per ream, and UCT buys more than 144,000 reams per annum.

Discussions were held with Mondi to ascertain what they are doing to enhance their sustainability. They claim to have made considerable progress by implementing the principle of 'best management practice' and achieving accreditation from the Forestry Stewardship Council (FSC). The FSC is an independent, audited international system for forestry management.

This accreditation is earned for consideration of social, ecological and economic aspects as prescribed by the FSC.

Next Steps

- Wait for market transformation to bring the price down and reassess to feasibility of this Action .
- Obtain feedback on market transformation from Trevor Adams of Procurement Department.

4.7 Establish procedures and responsibilities for recycling of printer cartridges

Activities

- Meetings with UCT Procurement Department.
- Discussions with Mzansi SA, a local company specialising in the collection of used empty ink jet and toner cartridges from businesses, schools, charities, and individuals throughout Southern Africa.

Key Information

- In 2009, UCT were buying printer cartridges from the three appointed Hewlett-Packard (HP) distributors in the Western Cape, namely Waltons; Introstat; and First Technologies.

- The major problem is the disposal of cartridges that cannot be recycled, such as Inkjets and some of the LaserJet cartridges.
- Mzansi SA is affiliated to Masons stationery and they will only collect the empty cartridges if stationery is ordered from them.
- An alternative program via HP was being investigated by the Procurement Department.

Progress

As the e-Waste disposal system developed, so has the possibility that the e-Waste Alliance could process printer cartridges too which would be an ideal scenario.

4.8 Reduce and phase out polystyrene in the waste stream, with a medium-term goal of zero polystyrene at UCT

Food packaging has been identified as a major contributor to this waste issue. Discussions and negotiations with suppliers of goods and services to UCT would need to be initiated. An opportunity to implement such Action arises when vendors are contracted to provide food at venues on campus. A stipulation could be included in the contracts to minimise polystyrene.

Activities

- GCI introduced a re-usable cup that students use at the canteens.
- Research on the recycling of polystyrene in the context of Cape Town and South Africa.

Progress

2010: Wasteman began recycling polystyrene.

Next Steps

- Assess the environmental impact and carbon footprint of recycling polystyrene.

4.9 Hazardous Substance Control

**Note: For completeness, hazardous substance control has been added to the GCAP for this Audit, as it was previously separately monitored.*

Hazardous substance control measures cover a range of matters including Hazardous Biological Agents (HBA) and Genetically Modified Organisms (GMO), Hazardous Chemical Substances (HCS) including pesticides, and sources of Ionising Radiation.

Over the last few years, systems were put in place at UCT to reduce the quantity of hazardous substances being acquired, handled, stored, and ultimately disposed of. Awareness programmes were also undertaken to improve the safe handling, storage, and disposal of hazardous substances.

Hazardous Biological Agents (HBA) and Genetically Modified Organisms (GMO)

A draft HBA policy was ready for review by a working group of experts. A Biosafety Committee for the Faculty of Science has been formed and their responsibility is to review all HBA and GMO work

and facilities. The Biosafety Committee at the Faculty of Health Sciences was in the process of being formed. GMO registrations with the Department of Agriculture, Forestry and Fisheries (DAFF) were up to date for the Faculties of Sciences and Health Sciences. A waste service provider had been audited by the UCT Safety Health and Environment Department and the company was providing quarterly reports and complies with National and Provincial legislation and regulations.

Hazardous Chemical Substances

The Hazardous Chemical Substances Policy was planned for review at Faculty boards during June/July 2011. The Policy was to be sent for UCT approval, once comments were collected and changes made. Other policies and management guides in draft form were awaiting review. Training for Hazardous Chemical Substance Co-ordinators begun with appointments and training at the Faculty of Health Sciences. This programme aims to raise awareness of the hierarchy of control measures that in turn should reduce risk and improve training and awareness. It was planned that an Inventory of Hazardous Chemicals would be collected and loaded onto the new database as required by the Occupational Health and Safety Act (85 of 1993).

UCT is a member of the Canadian Centre for Occupational Health and Safety (CCOHS) with access to Material Safety Data Sheets (MSDS) and their Chemical data system available from all UCT computers. This allows easy access to high quality and reliable information. Access to the resources should improve knowledge and awareness of chemicals in the workplace environment and thereby standards of safety.

Hazardous chemical storage (mainly corrosives and flammables) was an issue that requires more effective control. However, there had been a steady improvement in numbers and quality of suitable storage since the availability of relatively cheap, high quality cabinets having arrived from the United States of America (USA).

The hazardous chemical waste service providers for UCT are audited and comply with National and Provincial legislation and regulations. However, they have not provided regular quarterly waste reports and this should be addressed and rectified. Waste systems were in place with all the science based departments. Waste storage was improving and a new facility at the Faculty of Science was planned to come on-stream early 2011. Two new waste facilities were also planned for Chemistry and Chemical Engineering Departments.

There was an ongoing disposal programme for reducing the stockpiles of redundant, out of date, or unwanted chemicals in departments and this is managed by the UCT Environmental Risk Officer. Large numbers of chemicals have been removed and safely disposed of since 2009. It was noted that if this was successful, the programme should become redundant (apart from minor occurrences) in the following year or two.

Pesticides

UCT has two service providers for pest control operations. Both are members of the South African Pest Control Association (SAPCA) and comply with National and Provincial legislation and regulations. The service providers are aware of the UCT Policy for Pest Control Operators. P&S has

formulated the Integrated Pest Management (IPM) policy that had not yet been adopted due to lack of consensus.

Radiation Control

The UCT Radiation Control Policy has been accepted and adopted by the Radiation Control Committee. All authorities have appointed a Radiation Protection Officer (RPO) and Assistant Radiation Protection Officer (ARPO) and comply with National and Provincial legislation and regulations. The RPO and ARPO undergo formal training every three years, the latest of which was held in 2010. New radiation workers are required to undergo training prior to registration. The Department of Health, Directorate Radiation Control, make occasional inspections of authority holder facilities. Radiation use and the reduced use of radio-nuclides in research at UCT has dropped throughout the years as has the number of active authorities. There is an issue with the lack of registered service providers for removal of low-level radioactive waste in the Western Cape. However, by the end of the 2010, the UCT Environmental Risk Officer was in consultation with the Directorate and other institutions to address the situation. UCT complies with National and Provincial legislation and regulations.

5 CARBON EMISSIONS

5.1 Continue the Carbon Footprint study, to include Tier 2 emissions and complete the further data collection and analysis proposed in the Stage 1 Methodology Report.

The study of UCT's carbon footprint was undertaken by the Energy Research Centre (ERC) over two years (refer to Appendix 9: *UCT Carbon Footprint Analysis, ERC, 2009*).

Key Information

- UCT's carbon footprint for the year 2007 was found to be about 83,400 Tons CO_2-eq
- Campus energy consumption, transportation, and goods and services, contribute about 81%, 18% and 1% of the footprint respectively
- As per Figure 1 below, electricity consumption alone comprises approximately 80% of all the emissions associated with UCT's activities.

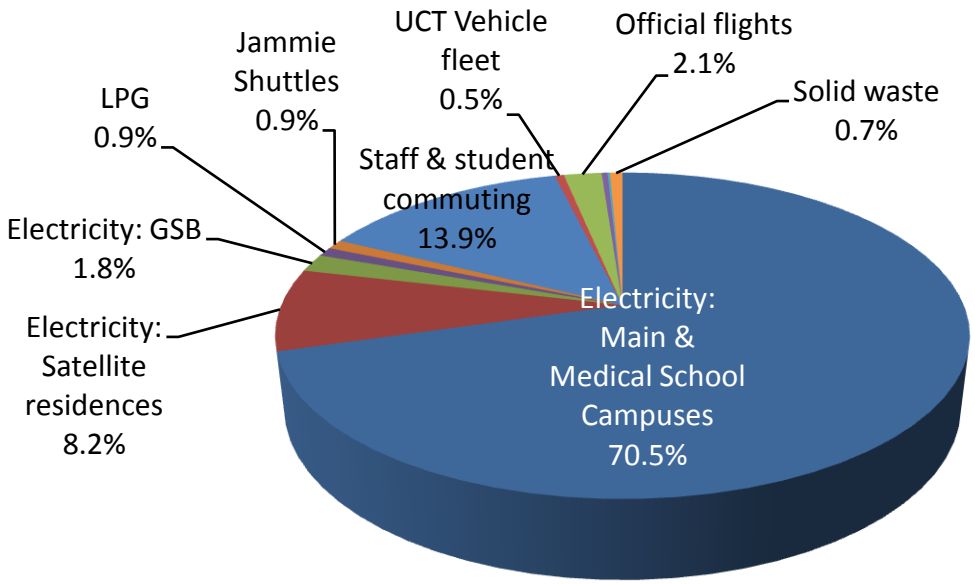

Figure 1: Overview of UCT's carbon footprint for 2007 (Source: Energy Resource Centre)

Progress

The Stage 1 Report was completed in 2008. The next phase of this work did not proceed until the second semester of 2009 due to lack of available persons at the ERC. The Tier 2 Carbon Footprint Report was completed in August 2010 (refer to Appendix 9: *UCT Carbon Footprint Analysis, ERC, 2009).*

Next Steps

The Carbon Footprint Report provided a general recommendation that all activity data including electricity consumption for all UCT campuses, LPG consumption data, Acetylene consumption data,

UCT fleet data, Jammie Shuttle diesel consumption, and waste data, should constantly be monitored and updated at least on a yearly basis. More specific recommendations were that:

- Electricity consumption data for all campuses of UCT would be monitored centrally and updated regularly.
- Database of all official travel should be kept and updated regularly.
- Paper consumption data should either be monitored at faculty level, or all printing and photocopying on the campus should be handed over to Nashua.
- Solid waste data should be constantly monitored.
- Data should be more disaggregated for different recyclables.

5.2 Purchase and hire vehicles that are fuel efficient and have lower emissions.

As set out in Figure 1 above, the UCT vehicle fleet contributed 0.5% to the carbon footprint . The level of carbon emissions from suppliers of rental vehicles should be included as a standard requirement of procurement contracts.

Activities

In March 2009 the Procurement Department reported preliminary meetings with the car rental service providers and air carriers, to determine their compliance to legislation and future strategies in their respective industries. There was no feedback at the time of this report. A generally limited response was experienced from the Procurement Department and their buy-in to sustainability strategies would need to be secured at a high level.

Progress

No progress

Next steps

- Obtain feedback and work with service providers to respond to the challenge.
- Obtain high-level commitment to a Sustainable Procurement Policy.

5.3 Develop the use of renewable energy technologies through further pilot schemes

The only renewable energy project was the Biodigester Project as detailed in Action 1.11 above.

If the target of 5% renewable energy is to be reached by 2015, much research, investigation, and piloting of on-site renewable energy generation alternatives is required. It is disappointing that there is not more evidence of innovation in this arena at UCT. However, it was noted that a wind energy project was under development in the Mechanical Engineering Department during the period.

6 TRANSPORT

The ERC's study of UCT's carbon footprint found that student and staff commuting comprises 13.9% of the total carbon footprint, which is the highest contribution after electricity (approximately 80%). Recommendations made by the UCT Council on the *Green Campus Policy Framework* in (Hall and Murray, 2008) included the aim of reducing the carbon footprint related to personal transport of UCT staff and students. It was deemed a priority to reduce single car transport to UCT because of rising fuel prices, traffic congestion, limited parking space on campus, and widespread support expressed by students.

6.1 Provide adequate, secure bicycle storage (and shower facilities) at key locations and at transport hubs

There is limited use of bicycles for commuting at UCT at present and the reasons for this are unknown. However, it is thought to be due to the weather (both Summer heat and Winter rain), the steep slopes, and the lack of infrastructure. Cycling is not well provided for in the city as a whole; however the City's non-motorised transport (NMT) routes are under development and UCT should align with the City's initiative in terms of routes and type of infrastructure being provided. An opportunity exists to promote the use of cycling in order to reduce motorised transport and alleviate congestion, as well as to reduce carbon emissions. In addition to bicycle storage, signage, and showers, this Action should consider a bike maintenance scheme on campus to encourage and support cycling.

Activities

An inspection of the Upper Campus bicycle facilities was undertaken in November 2010 with a group of roleplayers both from the university, including the Physical Planning Department; the Student Cycling Club; and the GCI, as well as other organisations namely Pendulum Consulting and the Bicycle Empowerment Network. Refer the notes of the meeting Appendix 10 (*Notes of Site Investigation for UCT Bicycle Initiative, November 2010)*. In general, the facilities appeared to be adequate for existing users. It was planned that some new infrastructure, bicycle racks, were to be installed on the southern portion of University Avenue before the first Semester of 2011.

Secure bicycle storage, particularly at the Tugwell transport hub was identified as being needed.

An initiative to provide rental bikes has been under consideration since mid-2010, driven both by P&S and the GCI. The purchase of an initial 200 second hand bikes through an NGO, Bicycle Empowerment Network (BEN), was under consideration. The concept was to rent these to students at a nominal annual fee, with students being responsible for maintenance. It was agreed that transport for these bikes up the hill to Upper Campus was an essential part of such a scheme, and this could possibly be done by the Jammie Shuttle contractor. Secure storage for these rental bikes would also need to be provided.

6.2 Provide dedicated parking for scooters and motorbikes by converting existing vehicle bays in preferential locations

The number of users or potential users of this mode of transport is unknown. A survey relating to actual present use could be conducted by GCI or through a student project.

Activities

Inspection of the Upper Campus bicycle facilities was undertaken in November 2010. In general, the facilities appeared to be adequate for existing users. However, there were certain areas where additional parking would be required for example outside the EGS Building.

6.3 Develop Park and Ride schemes to limit private vehicle use on campuses

Activities

During the FIFA 2010 World Cup soccer tournament, UCT provided a successful Park and Ride service in partnership with the City of Cape Town. Parking was made available for soccer fans on campus and they travelled to and from the stadium in the City's buses.

Progress

Land acquisition negotiations had not progressed due to lack of response from City officials.

Next steps

- Build on this experience to develop Park and Ride schemes to serve the UCT students and staff.
- Provide further similar services for other major events in the City.

6.4 Promote and support web-based 'Ride-link' car pooling scheme and provide preferential parking to encourage multiple occupancy vehicles

Since launching in January 2009, Ride-link experienced a number of problems that delayed progress. These included slow internet connection speeds, the need for improvements to the user interface, poor communication from site owners, and a lack of adequate 'Help' documentation for first time users. Lack of continuity also caused delay as the person who started the project left.

Activities

Since June 2009 these issues had begun to be addressed. The website was redesigned and became more navigable. Talks were held with UCT ICTS and Communications and Marketing about hosting the server on campus to make it run as fast as Vula. The alternative of paying a private company to host it was considered but would require funding. Lastly, aspects of the carpooling database itself that needed to be changed were identified and a part-time web developer was sought.

P&S agreed to fund the required web development and a brief was developed in consultation with ICTS, GCI (Kimon de Greef) and web developer (Norman Hooper).

Progress

Ride-link was re-launched during Green Week, October 2010. A dedicated parking area, P4 was allocated to car poolers as an incentive, which has about 60 bays. Approximately 900 persons signed up to the website.

Next Steps

- Monitor and report on progress of the scheme.

7 EMISSIONS

While carbon emissions are dealt with under Section 5, all other emissions to water, land and air are considered within this Section.

7.1 Identify products, run trials of alternative products and implement 'Green Cleaning' programme at UCT

Activities

July 2009: An initial meeting was held with Adele Moller of Supercare and Sandra Rippon to request information. This was followed by undertaking research on Green Cleaning and suppliers of chemicals. Supercare provided a list of all chemicals that were in use at UCT.

May 2010: A key meeting was held between Duke Metcalf (UCT Estates), Adele Moller, and Sandra Rippon, to review the outcomes of a 'call for proposals' issued to existing cleaning material suppliers. A good response was received from a few companies, namely Wetrok, Johnson-Diversy, and Prime). Wetrok had developed a green range called 'Envirocare' that is certified by the European organisation *Ecocert.*

Key Information

- Supercare has a staff compliment at UCT of 350, many of whom are long term. Some of their ongoing training takes place via a PC-based interactive programme that has potential as a means of instruction about Green Cleaning.
- Cleaning products were being purchased every month from six different suppliers making the analysis of the products more complex.
- Green Cleaning involves two main issues: a) human health and safety, and b) damage to the environment.
- Strategies include use of 'Microfiber' cloths, low-foaming solutions, chlorine- free products, phosphate-free products, reduced/recycling of packaging, reduced VOC emissions, and biodegradability of chemicals.
- While alternative products were generally more expensive per litre, the differing dilution rates change the actual cost in use and need to be tested in practice. Use of the special mixing systems would improve accuracy of dilution.

Progress

A change in practices resulting from this review of chemicals was the elimination of the use of bleach and substitution with 'greener', safer alternatives. Supercare rationalised and reduced the number of chemical suppliers towards improved environmental control.

The cost of more sustainable products can be higher which might indicate the need for top-up funding initially, until market forces reduce the price of the items. Availability in South Africa of less toxic chemicals that function effectively was initially a barrier; however the situation changed and improved during 2010.

Next Steps

- Test performance of proposed alternative products prior to roll-out at UCT.
- Identify products that are best practicable option, compare costs and performance, and resolve costing issues.
- Supercare was to publish a list of chemicals in use at UCT. This was promised from March 2010 but was never forthcoming in spite of numerous requests.
- Communicate the successes and changes to cleaning products and practices both within UCT and beyond. The better practices adopted at UCT may also be expanded to other Supercare sites so that UCTs efforts would contribute to transformation in the custodial industry.

7.2 Reduce the use of pesticides by seeking alternative products and methods, adopting Integrated Pest Management (IPM) principles

The Estates and Custodial Department of P&S reports that currently, the pest control operators contracted to UCT use the minimum quantities of what they consider to be the best products on the market taking into consideration the type of pests, environmental impact, time, cost, effectiveness, and reliability. They are constantly seeking alternatives that are allowed by the South African authorities.

In 2007 a draft IPM Policy was developed but was withdrawn from discussion due to a lack of consensus within the EMWG on the policy.

Next Steps

- Seek consensus within the EMWG on the need and nature of pest control management policy for UCT.

7.3 Avoid refrigerants and gaseous fire suppression systems with ozone depleting potential (OPD) and specify refrigerants with zero OPD

The avoidance of substances with ODP is already in practice with respect to air-conditioning refrigerants.

Key Information

- The ODP of refrigerants such as the R134a, R407c, and R410, all have ODPs of 0, compared to R11, R12, and R22, which have ODPs of 1.0, 0.83, and 0.05 respectively.

Progress

UCT made good progress as all R11 and R12 refrigerants were replaced and R22 was in the process of being phased out. Carbon dioxide as a gaseous fire suppression system is under development in the United Kingdom (UK) and P&S are monitoring this closely.

7.4 Avoid refrigerants with Global Warming Potential (GWP) and aim for GWP of less than 10

All new chillers or air conditioning units are specified with R134a, R407c, or R410, which have GWPs of 1,300 to 1,900. This is still much less than the older R11, R12, and R22 refrigerants which had a GWP of 4,000 to 8,500. The only refrigerants that have GWPs of less than 10 are Ammonia and some exotic gases, which are not an option for UCT since there are other hazardous side effects and the skills to maintain these plants are not adequate as yet in South Africa. Aiming for GWP of less than 10 in South Africa at present is not a realistic target.

7.5 Contain refrigerant leaks to comply with Green Star SA requirements for new buildings and existing central air-conditioning systems

No progress

7.6 Minimise watercourse pollution from stormwater run-off through a range of strategies

Watercourse pollution from stormwater can be minimised by promoting infiltration, attenuation, and filtration of water on campus.

Progress

Refer to Action2.5: Sustainable Urban Drainage.

Next Steps

- Undertake a study of current design at UCT and develop proposals for pollution control.

7.7 Reduce light pollution through considered lighting design to meet requirements of Green Star SA

UCT Physical Planning Unit has been considering the avoidance of light pollution for some years and has an approach to lighting that has seeks to balance a number of considerations.

Security is a key issue and cannot be compromised. In the past, problems were experienced with the lighting interfering with the many external CCTV cameras. The fittings must be designed to throw the light down below the level of the cameras, otherwise the as the lens closes down when it reads a strong light source in an otherwise dark setting, affecting the image. However, this problem is overcome by recent camera designs that area able to compensate.

A further consideration is the view of the campus at night from the surrounding areas of Cape Town. The concept is to present the iconic buildings as a gently lit group with the historic lights dominating and other light clutter removed.

Energy efficiency of the lamps has also been a factor in lighting design and specification. The current preferred specification is the Unilux IP44 8081.51 symmetrical pole top luminaire, with 150W Metal Halide Discharge Lamp.

In certain locations of the Upper Campus, where there are still the original light fittings along University Avenue, Rugby Road, Residence Road and the central stairway below Jamieson Hall, heritage considerations are paramount.

7.8 Specify insulation materials with zero ODP and no loose fibres in ducting and ceiling insulation

No progress

8 CONSTRUCTION

8.1 Adopt the Green Star SA rating system and build new buildings to a minimum 4-Star rating

Activities

An enquiry regarding the cost of professional fees for a Green Star accredited professional to guide the certification process was made and discussed in the University Building and Development Committee (UB&DC) committee meeting in June 2009. This was with particular reference to the new buildings on Middle Campus, namely the new Economics and Student Administration Buildings. The cost of professional fees was considered a deterrent to the appointment of a consultant.

In April 2010 when a new Engineering Building was at the planning stage, the issue of Green Star rating for this building arose again. Sandra Rippon was requested to submit a report in motivation of Green Star certification to the UB&DC (refer to Appendix 11: *Short Report on Use of the Green Star Building Rating System for UCT Developments, March 2010*). A preliminary assessment of the proposed new building was undertaken by Sandra Rippon, using the Australian Green Star Tool. A score of 47 was achieved which is considered adequate for a 4-Star rating. The UB&DC voted to aim for 4-Star Green Star certification through the Green Building Council of South Africa (GBCSA). Since no South African Green Star Education Tool had yet been launched (only an Office tool), the Australian Education tool and the SA Office Tool would be used in the design stage.

The professional team was appointed in August-September 2010 and an independent sustainability consultant, Agama Energy, was appointed to guide the certification process and to undertake the energy modelling.

UCT then considered sponsorship of an Education Tool and Sandra Rippon was tasked with making initial enquiries and establishing interest from other universities to partner on this project. Sandra met with the Technical Director of the GBCSA and reported back to John Critien (refer to Appendix 12: *Short Report on Development of Green Star SA Building Education Tool, July 2010*). The cost of the GBCSA developing a rating tool was approximately R1.2-1.4 million and the process would take 10-12 months once commenced. A number of other rating tools were in the pipeline at the GBCSA so that there would be a waiting period once the sponsorship was procured. There are typically eight sponsors for each tool so that UCT's contribution would be approximately R200,000 for a Principal Sponsorship. This was considered too high and the alternative of approaching the Department of Education (DoE) for funding for the development of an Education Tool was mooted. The DoE would then require all recipients of funding to achieve a certain standard, for example 4-Star Green Star SA. This opportunity would arise with the next tranche of DoE funding due to be tabled in early 2011.

Progress

The decision by the UB&DC that the New Engineering Building would be designed and built to achieve a 4-Star Green Star Rating could be considered a significant breakthrough for sustainability

at UCT. However, subsequently, the goal of achieving a 4-Star Green Star rating was subsequently set aside.

8.2 Issue a sustainable design brief to all project consultants

The sustainable design brief should include a requirement to design for compliance with the Green Star SA rating system, which would provide clarity on the performance to be achieved.

However, these sustainable design guidelines were not implemented in the design of the new buildings on Middle Campus, Economics and Student Administration, which were under construction between 2009 and2010. This was despite such guidelines being developed more than 5 years previously within P&S.

Progress

During 2010 when proposals were requested from the professional team for the New Engineering Building, a sustainable design brief was included for the first time. This brief was developed by the Physical Planning Unit in conjunction with the Physical Planning and Landscape Subcommittee of the UB&DC. The approach adopted required that the building be designed to achieve a 4-Star Green Star Rating.

8.3 Implement and monitor Environmental Management Plans (EMPs) on all construction sites, both new build and major refurbishments

During the Plan period, the use of EMPs, often as a condition of building plan approval, was becoming standard practice in the South African construction industry. Thus, it was recognised that UCT needed to adopt these practices early and complete the learning curve associated with the implementation of EMPs. For larger developments, this would entail the appointment of a dedicated and experienced Environmental Control Officer to monitor compliance. For smaller works and alterations this would be handled internally by P&S using a generic and simplified EMP.

Activities

Inclusion of an EMP in the tender documents for the new Economics and Administration Buildings on Middle Campus was proposed by Sandra Rippon, however this was not adopted. It was proposed that P&S make use of the standard EMP created by the City of Cape Town, which could be modified by inclusion of some site specific clauses such as ‘no-go’ areas. Cost of enforcement and monitoring for compliance was viewed as an obstacle, although it would cost only a few thousand Rand per month for an environmental control officer.

Subsequently, in early 2009 and after the construction had commenced on site, the authorities made the implementation of an EMP a condition of approval. P&S eventually appointed an environmental consultancy, Ecosense, to develop and implement a Construction EMP for the Middle Campus development. Environmental Reports were submitted on a monthly basis, however it seems these were not reviewed by the UCT Project Implementation Committee (PIC).

Progress

Some reports of poor performance by the contractor in terms of compliance with the EMP were received. Penalties were awarded to the contractor It was not decided what the penalty monies would be used for.

Next Steps

- Ensure oversight of the compliance with an EMP by and take the necessary action to rectify non-compliance.
- Establish the financial and institutional arrangements for the expenditure of any penalties incurred for non-compliance.

8.4 Adopt sustainable urban drainage practices using Green Star requirements to define standards

For the building development on Middle Campus between 2009 and 2010, the City of Cape Town as the local authority stipulated a requirement for attenuation and filtration of stormwater in retention ponds on site. This was the first time that the municipality had required this for a development at UCT and it provided an opportunity to develop an innovative design in terms of the South African building industry.

Initially, the engineers and project team began developing a design for retention ponds according to the specification provided by the municipality. The issue of the impact of the retention ponds on the environment was raised and the notion of undertaking a specialist study was investigated.

September 2009: A specialist Impact assessment of the proposed stormwater ponds was commissioned by P&S. This report was submitted in January 2010 (refer to Appendix 13: *Survey of Rain Frogs on Middle and Lower Campuses of UCT and Impact Assessment of New Development, Harrison J.A., 2001*).

The findings and recommendations of Harrison's report were that the unmitigated development proposal assessed was unacceptable. A revised development plan was adopted, using permeable paving to allow infiltration and the ponds were not constructed.

8.5 Encourage and support Green Star SA training and accreditation within P&S, project professional teams and contractors management staff on new buildings

Progress

Two of the staff at P&S attended the Green Star training and one (Andre Theys) had written the exam and been Accredited.

8.6 Minimise the footprint of parking to conserve land

Modifications to the Lower Campus Precinct Plan were made in the final stage of developing the plan to incorporate under building parking for the proposed new buildings in this precinct. The aim

was to reduce the footprint of the required parking provision expected by the City of Cape Town. The Lower Campus Precinct includes components of the campus green belt system, as identified in the Development Framework Plan of the University, so it is important to minimise parking intrusion into current green belt environments such as the Glenara gardens.

8.7 Provide the minimum number of car parking spaces to encourage the use of alternative modes of transport

Alternative modes of transport would include car-pooling, walking, cycling, and public transport. The Green Star Office v1 Technical Manual provides guidance on this strategy.

Progress

There had been no development of additional parking on campus during the two year Plan period. The availability of preferential parking space is an incentive towards car-pooling.

8.8 Adopt a PVC minimisation strategy including plumbing pipes, electrical cabling, and flooring

Andre Theys at P&S, reports that PEX (cross-linked Polyethylene) piping is becoming a standard preferred specification. Vinyl is still favoured for its performance as a flooring material in areas where hygiene is important and therefore alternatives need to be considered and researched.

9 LANDSCAPING AND BIODIVERSITY

The Talloires Declaration signed by UCT in 1990 has, as one of ten principles, the requirement to:

> "*Manage and protect the university's natural environment in a sustainable manner and enhancing the environmental quality of the estate to reflect the unique character of the indigenous flora and fauna*."

The most recent framework document guiding landscaping on the UCT Main Campus is the *Landscape Framework Plan for UCT* (Oberholzer, 2006), prepared by Bernard Oberholzer, Landscape Architect. The framework principles are founded on a belief in acknowledging the evolving nature of the cultural landscape and the importance of understanding the continuum between the urban and natural contexts. The document advocates a 'habitat approach' that ensures that landscaping ensures that ecosystems continue to function within micro-habitats, within the open space system on Campus. This approach, along with considerations of heritage, is considered to be of paramount importance.

The principles outlined are based on an understanding of the role of open space system as ecological, recreational, and educational and include:

- Ecological Sustainability
- Legibility
- Accessibility
- Safety and Security
- Comfort

The following are selected policies that were informed by the philosophy and principles:

- Policy 1: Reinforce open space corridors (and their ecological, heritage, recreational and educational roles).
- Policy 3: improve the Campus habitat by investing in planting precincts that have a greater diversity of species, in particular endemic species. This planting must also be considered in relation to visibility and safety issues.

Consensus needs to be built around this issue, and a common vision was still lacking at the end of 2010.

9.1 Enhance the quality of the estate vegetation to reflect the unique character of the Cape flora and fauna, while respecting planting with heritage value

The Landscape Framework Plan (Oberholzer, 2006) provides the necessary framework for enhancing the quality of the Campus vegetation. This framework notwithstanding, there was some controversy over the planting scheme for the Middle Campus development. The scheme used trees indigenous to Africa but not necessarily species that occur locally in the southern temperate forests that are

found in the gorges on the slopes of Devil's Peak. Some Renosterveld species were planted in one location within the Middle Campus redevelopment.

9.2 Enhance biodiversity and ecological value by planting indigenous vegetation and creating habitats to support local fauna and flora

The habitat approach and the principles and policies of the Landscape Framework Plan (Oberholzer, 2006) underpins this Action.

Progress

Progress on this Action was limited to some indigenous (South African) tree planting as part of the Middle Campus development as well as some limited Renosterveld planting. Planting of vegetation indigenous to the Cape region would provide more favourable habitat for local fauna and flora.

Next Steps

- Consensus needs to be built around this issue, and a common vision was lacking at the end of the Plan period.
- Apply the principles of the Landscape Framework Plan.

9.3 Conserve and enhance the Japonica Walk, Bremner Forest, and Glenara greenbelt as per the principles contained in the UCT Development Framework Plan (2006)

Activities

There is ongoing horticultural maintenance for the areas mentioned above. Steps have been taken in recent years to rehabilitate Japonica Walk through the planned replacement of the Plumbago hedge, installation of new irrigation, pruning of all of the historic Camellias, and ongoing arboriculture maintenance to other trees to ensure their good health.

During 2010, a section of the Japonica Walk was damaged by the Middle Campus building contractor. This raised serious concerns regarding the processes followed, namely communication, within the UCT P&S Department. A fair amount of damage was done to historic trees including disturbance of the understorey. It was recognised that it is vital for the horticulturist to be involved in all discussion regarding construction issues that affect gardens. There should be a direct line of regular communication between the horticulturalist and the Environmental Control Officer for construction projects on campus.

Next Steps

- Improve communication between the horticulturalist and the Environmental Control Officer for construction projects on campus.

9.4 Continue the practice of composting landscaping waste to produce mulch on site and develop composting techniques

The development of better composting techniques would aim to achieve faster decomposition and thus minimise space requirements on campus. Other objectives would be avoiding encroachment into more pristine areas and taking cognisance of views into the site from the surrounding national park, since the composting area is located close to the boundary. The composting area is used for illegal dumping, which looks unsightly.

Activities

This Action was discussed in a meeting with Duke Metcalf and Noeleen le Cordier and they agreed that further research would be required.

The Gardens Department reported that all the pruning and tree cutting material is being chipped and shredded to provide quality organic mulch to be utilised in campus gardens and to provide moisture retention and weed control. All leaf material is stacked in order to naturally promote decomposition. No accelerators, high nitrogen urea, or bio-stimulants are being utilised. These measures have potential to address space shortages for the processing of compost.

Next Steps

- Develop a set of management practices for the composting of vegetation waste and monitor adherence to these.

9.5 Reduce the use of chemical fertilisers and optimise the use of organic fertilisers with the aim of improving soil condition

The Gardens Department reported that all gardens are fed with organically sourced fertilisers.

9.6 Plant lawns using water-wise and indigenous, non-invasive grass species where possible (excludes sports fields)

No progress

9.7 Conserve topsoil on construction sites and protect it while stored to maintain productivity, adopting best practice

Refer to the Green Star SA Technical Manual for additional guidance on best practice.

Progress

Site works commenced in June 2009 on the Middle Campus development, including the new Economics and Student Administration Buildings. A civil engineering contractor was engaged in preparing the site which involved moving earth. This presented an opportunity to implement best practice topsoil management and some topsoil was conserved and replaced after construction. However, reports were received of topsoil piled inappropriately around the base of trees.

9.8 Develop and adopt an Upper Campus Forest Management Plan to deal with the replacement of senescent Pine trees, with due consideration to heritage and environmental issues

The issues pertaining to regeneration of the forest backdrop to Upper Campus on the lower slopes of Devil's Peak have been under discussion at UCT for almost a decade. It appears that forward progress has been hampered by a lack of consensus and conflicting approaches to forest management within the UCT community.

Activities

November 2010: the EMWG forum tasked Sandra Rippon and Richard Hill with seeking a consultant to conduct an assessment and participation process for the regeneration of the forest. Sandra Rippon convened a meeting with a potential consultant, Marlene Laros, to discuss the terms of reference. This was attended by Alderman Owen Kinahan in his capacity as Chair of the UB&DC.

December 2010: Terms of Reference were drafted by Sandra Rippon in consultation with Richard Hill and Owen Kinahan and this was issued to the consultant. A fee proposal was to be submitted in January 2011, followed by a formal appointment. It was expected that the first phase of the assessment would be completed by mid-2011.

Next Steps

- Develop and adopt a Forest Management Plan.

9.9 Continue to implement alien vegetation management practices, aiming for continual improvement

Alien vegetation clearing is undertaken as part of ongoing horticultural and environmental management practices.

9.10 Propagate indigenous and endemic plants in a nursery with an emphasis on rare species, giving due cognisance to planning for climate change

This Action was conceived as including partnership with the South African National Biodiversity Institute (SANBI) at Kirstenbosch, Table Mountain National Park (TMNP), the Department of Botany, and the GCI.

Progress

The Gardens Department reported that various ongoing programmes were in place at and on-going, including propagation partnerships being developed with 'other growers' (unknown) in the horticultural industry.

9.11 Adjust timing of lawn mowing to allow seeding of wildflowers

This relates only to areas where function allows the growth of longer grasses.

Progress

Measures are in place only in certain areas such as Japonica Woodland.

9.12 Ensure amphibian-friendly horticulture practices to protect the threatened Cape Rain Frog that is found on Upper, Middle and Lower Campus

The Cape Rain Frog (*Breviceps gibbosus*) is the only recorded Red Data species on campus and is thus considered an appropriate indicator of overall environmental quality. In addition, UCT is in a unique position to provide a long term habitat for this threatened species. Harrison (2009) describes the habitat and characteristics of the Cape Rain Frog:

> "*The species is endemic to a small region in the southwestern part of Western Province. Most of the known localities are in areas with loamy soils usually derived from shale and are associated with Renosterveld vegetation types. As approximately 95% of Renosterveld areas in the southwestern Western Cape have been transformed, the distribution and population strength of the Cape Rain Frog has decreased dramatically, hence the Threatened status of the species (Harrison, 2009).*
>
> *Cape Rain Frogs appear to flourish in shaded areas and are vulnerable to desiccation. Shade helps to keep soil temperatures moderate and, for this reason, they sometimes do well in plantations, parks and gardens, if other factors are favourable. However, unlike most other amphibians, rain frogs are not associated with wetlands but are terrestrial animals which actually avoid wetlands. They spend much of the time underground and emerge to mate and forage only during the rainy season, which is also when males are heard giving their calls to attract mates. Rain frogs forage for invertebrate prey on the surface, at night, when conditions are moist. Since dense vegetation at ground level is likely to make movement and foraging difficult, the frogs select habitats where there is relatively little obstructing growth at ground level. Such habitat is usually found under dense growths of trees and shrubs where there is deep shade preventing dense growth. Such habitat also provides plenty of leaf litter which contributes to keeping the soil moist and cool, and holds plentiful invertebrate prey. These frogs are at all times vulnerable to disturbance of the topsoil, as may happen in the course of routine garden maintenance.*
>
> *Although the Cape Rain Frog is known to occur in many parks and domestic gardens, the long-term prospects of most of these populations are uncertain because they constitute very small, isolated populations which are vulnerable to local extinction events, such as could be caused by pollution or further densification of development. The two UCT populations occupy relatively large, interconnected areas and probably comprise large enough numbers of individuals to be genetically viable. The UCT populations of the Cape Rain frog are thus considered to be of exceptional value and in addition, the species is Red Listed (status Vulnerable, i.e., having a high risk of extinction in the wild). They have managed to survive a protracted series of changes to their environment and they represent a relic of the original ecosystem – one of very few vertebrate survivors. In this light, the Cape Rain Frog can be considered an integral part of the heritage of the original Rhodes Estate*."

Progress

The planning of the new development on Middle Campus and the stormwater retention ponds that were proposed to attenuate the runoff from the hardened surfaces triggered the appointment of a specialist consultant, James Harrison, to conduct a survey. The survey aimed to establish the distribution of the frogs and to assess the impact of the proposed retention ponds, as part of the Middle Campus development, on these terrestrial frogs. As a result of the study a decision was taken not to build the ponds, as described under Section 2.5 above.

While the report by Harrison had been submitted to P&S (refer to Appendix 13), the recommendations of this report had yet to be implemented by the end of the Plan period. Key measures included:

- Avoiding creation of laydown and storage areas in rain-frog habitat. Manage parks and gardens where rain frogs occur according to a policy of benign neglect or "hands off".
- Avoiding the use of pesticides in the maintenance of gardens; also avoid all agrichemicals.
- Identifying additional areas, adjacent to existing frog-inhabited areas, where frog-friendly management can encourage expansion of the population into new habitat.
- Setting up a monitoring programme to determine population trends for the Cape Rain Frog on University properties.
- Creating an Environmental Advisory Committee. The committee should meet regularly and assist in formulating policy and taking management decisions for environmental management at the University, including rain-frog related issues.

A positive step was a decision during 2010 by P&S to consult James Harrison on an ad-hoc basis and he has been consulted from time to time, for example on the restoration of the Glenara gardens.

Next Steps

- Adopt the management recommendations of the Harrison Report.
- Educate gardening staff and monitor their performance.
- Seek funding and opportunities for further research of the distribution of the Cape Rain Frog. Future development projects would trigger an opportunity for further research.

10 INSTITUTIONAL CHANGES

In July 2009, Sandra Rippon and Dr. Merle Sowman convened a forum (named the 'Sustainable Development Forum'). The overall objective of the Forum was to share information on current sustainability initiatives at UCT and to discuss how to better integrate sustainability thinking and practice across all aspects of university life, including teaching, research, outreach, and operations. The group discussed institutional arrangements and funding for campus greening.

Prior to the Forum, a presentation was given by visiting lecturer Prof. Matt Heun from Calvin College, USA. The presentation which focused on 'student service learning' to support a sustainable campus and described institutional arrangements adopted at Calvin College.

The Forum began with a brief overview of UCT sustainability initiatives:

- A summary of the Partnership for a Sustainable Environment (PASE) Initiative (2003-2004) was provided by Dr. Sowman.
- The Sustainable Kramer Project was briefly described by Tom Herbstein from the Faulty of Law.
- The Green Campus Action Plan was described by Sandra Rippon.
- The GCI described their range of activities including organising an annual Green Week and; networking with other institutions through contacts with Stellenbosch University (EcoMaties), Wits University, and further afield in Africa.
- Sandy Patterson, Institute of Marine and Environmental Law, mentioned the Mainstreaming Environmental Sustainability in Africa (MESA) programme of UNEP.
- The Centre for Higher Education (CHED) described the sustainable development foundation coursework including some natural science and systems thinking.

This was followed by a discussion on how to integrate sustainability into education. Prof. Heun responded to the discussion with a range of comments and recommendations:

- A reporting system on sustainability at UCT should be developed.
- Accessibility of information regarding sustainability initiatives and research at a university is important and easily accessed information would signal its importance to the institution.
- Awareness could be raised regarding sustainability initiatives and projects (Student Service Learning) by presentations each semester to the 'Core Group' i.e. the committee responsible for allocating funding for campus greening.
- Identify institutional barriers and then plan how to break these down.
- Create a diagram of information and material flows for the institution.
- Use both formal and informal means of networking e.g. Vula network and ground based networking.
- Learn from the lessons and success of the transformation/social responsiveness initiatives at UCT.
- Overcome barriers using networks and institutional structures that are already in existence. Personal contacts are also important to achieving these objectives.

10.1 Establish a Green Campus Unit with a director, support staff, and students including start-up funding and a funding model for sustainability projects

An informal discussion group was held in February 2009 on the topic of institutional arrangements and financing of the Actions in the Plan. Attendees included Dr. Harro von Blottnitz, Environmental Process Engineering, Chemical Engineering; Andrew Marquard, Energy Research Centre; Denis van Es, Energy Research Centre; Jonathon Hanks, Graduate School of Business; Katinka Wagsaether, Green Campus Initiative; and Sandra Rippon.

Key questions for discussion were:

1) Whether a dedicated Green Campus Unit should be established to coordinate all matters relating to sustainability of campus facilities, (design, operations and maintenance)
2) If so, how should such a unit be financed, and how should the 'greening' projects in the Green Campus Action Plan be financed?

In response to the proposal for the establishment of a Green Campus Unit, a strong argument was made for integration of environmental responsibilities at Faculty and Department level. Departments should be responsible for their running costs, to provide an incentive to conserve resources. It was suggested that a requirement for continual improvement towards sustainability goals should be written into the performance contracts of staff such as Deans and Heads of Department. Some argued that there could be a defined, but limited role for a Green Campus Unit. For example, implementing projects or actions relating to awareness raising and behavioural change.

It was agreed that a forum for such discussions around sustainability issues was currently lacking at UCT. This might be provided by a Green Campus Unit (GCU), but in the meantime, another forum for participation on these issues was required specifically to discuss the implementation of the Green Campus Action Plan.

Potential funding sources for the Green Campus Action Plan were discussed, including UCT Central Finance; private sector, such the Development Bank of South Africa (DBSA); and the Clean Development Mechanism (CDM). It was suggested by Jon Hanks that Masters in Business Administration (MBA) students from the Graduate School of Business (GSB) could assist the UCT Financial Officer to set up the business model for the GCU.

10.2 Adopt the Green Star SA environmental rating system for all new buildings and major refurbishments, aiming for 4-Star Green Star rating

Progress

In June 2010, the UB&DC reached a decision that the New Engineering Building would be a 4-Star Green Star building. Agama Energy was appointed as sustainability consultant to guide the Green Star certification process and to undertake the energy modelling.

10.3 Increase skills and capacities within P&S for supporting sustainability programmes

By the end of 2010, two of the Staff of P&S had attending the Green Star SA training and one had become accredited.

10.4 Develop and implement a Sustainable Procurement Policy, as part of the overall Procurement Policy, by 2010

No progress

10.5 Integrate life cycle costing across UCT's financial decision making processes, with respect to facilities development and maintenance and triple bottom line decision-making

No progress

10.6 Prepare and disseminate biennial sustainability report that summarises progress and sets agenda for next two years

This sustainability report and the accompanying documentation summarises the progress made during the two years of the Plan period. A revised Green Campus Action Plan needs to be written, setting the agenda for the following two years.

11 CONCLUSION

The UCT Properties and Services department and the EMWG are to be commended for supporting the development of a campus greening action plan and then continuing to support the implementation thereof. In this respect they are leading the field amongst higher education institutions in South Africa. Where there has been good progress, the role of the energetic support of the student body, represented by the GCI and more recently the SRC should also be acknowledged and celebrated. Nevertheless this Audit report reflects a lack of progress in certain areas with the implementation of greening actions identified as priorities, and these areas should form the focus of future action for improvement.

Refer to the Summary Table at the front of this document for a graphical representation of progress made in implementing the Green Campus Action Plan.

Energy
Progress: Total Indicators for Category = 11 *Good= 0, Fair= 6, No Progress=5*

The progress made towards the installation of web-based electricity meters on Upper campus is very positive. Limited progress was achieved with the installation of solar water heaters at small and medium residences, while the fact that the solar heating system at Graca Michel was not functioning is a lost opportunity. The upgrading of the old air-conditioning systems in buildings across all campuses are a priority due to the significant contribution they make to the energy consumption of the university, and by the end of 2010 there was no plan for addressing this aspect.

Water
Progress: Total Indicators for Category = 7 *Good= 0 Fair= 1 No Progress=6*

Progress in terms of water conservation and management has been very limited, perhaps over-shadowed by the focus on energy. This can be attributed to the relatively low cost of water at present which is likely to change as prices increase or water restrictions occur in dry years.

Indoor Air quality
Progress: Total Indicators for Category = 6 *Good= 0 Fair= 0 No Progress=6*

While some of these actions, such as upgrading of the ventilation systems are potentially high-cost, actions such as a change in the paint specified present an opportunity that has not been taken up. This is attributed to reluctance by Properties and Services to adopt innovative products and technologies. It is disappointing that an educational institution, which should be more able to experiment than the commercial building sector, cannot be more open to innovation, and show leadership in the transformation to sustainability. However, now that the industry has transformed, providing products with low-emissions, it is expected that change will occur fairly soon. UCT could have driven the market transformation by demanding improved products; however this impetus has come from the commercial sector.

Solid Waste Management
Progress: Total Indicators for Category = 8 *Good=3, Fair= 2, No Progress=3*

Solid waste management is the most successful sector in the Action Plan. The reason for this may be the fact that work on this aspect began earlier than others and has been forcefully driven by the

student body, through the GCI, proving the proposition that sustainable practices at universities need to driven by both 'top-down' and 'bottom-up' initiatives. The well-designed 4-bin recycling system in outdoor spaces is attractive and has certainly raised awareness of recycling at UCT. New indoor containers have been developed for the food-courts and appear to be successful. Some discussion is currently underway as to the efficacy of the 4-binsystem, since the 2-bin system is simpler and aligned with the collection system. The e-Waste system for collection of electronic waste has also made good progress.

Carbon Footprint

Progress: Total Indicators for Category = 3 *Good= 1, Fair= 1, No Progress=1*

The completion of the Tier 2 Carbon Footprint Study by the ERC is a significant achievement. In May 2011, this was published in the Journal of Energy in Southern Africa (Letete *et al* 2011) making UCT the first university in South Africa to reach this milestone. Further progress on the renewable energy front is desirable, especially since there is now a national strategy to increase the contribution of renewable energy in the supply mix. Staff and student commuting at 13.9% of the total carbon footprint must be considered a priority in future.

Transport

Progress: Total Indicators for Category = 4 *Good= 1, Fair= 3, No Progress=0*

Transport is considered to be one of the more successful sectors. The Ride-link scheme is a flagship project, now needing monitoring and continual improvement. The transport focus is currently on the promoting of other modes of transport, such as cycling and the use of scooters/motorbikes. A bike rental scheme is under development on a pilot scale and cycling infrastructure upgrades are in the planning stage.

Emissions

Progress: Total Indicators for Category = 8 *Good= 0, Fair= 3, No Progress=5*

The Green Cleaning initiative is the most exciting project in the emissions category. However, concrete evidence of the changes made is lacking and would need some feedback from Supercare, preferably in the form of reporting to the Estates and Custodial Department.

Construction

Progress: Total Indicators for Category = 8 *Good= 0, Fair= 8, No Progress=0*

The Construction category has made moderate progress, with the most positive development being the adoption of the Green Star SA rating system and the issuing of sustainable design briefs on new developments. Unfortunately, the goal of achieving a 4-Star Green Star rating was set aside when budget pressures arose and a lifecycle costing approach could not be accommodated. The incorporation of a lifecycle financial model into project planning should now become a priority.

Landscaping and biodiversity

Progress: Total Indicators for Category = 12 *Good= 3, Fair= 6, No Progress=3*

Within Landscaping and biodiversity, there have been some areas of good to moderate progress, such as activities towards the conservation of Japonica Walk, alien vegetation management and the distribution study of the Cape Rain Frog. While the commissioning of this study is laudable, its recommendations need to be implemented.

Institutional Change

Progress: Total Indicators for Category = 6 *Good= 1, Fair= 1, No Progress=4*

Institutional changes have not made good progress. A lack of consensus exists around the desirability of a Green Campus Unit and uncertainty about the funding model for such a unit. As a result, the establishment of a Green Campus unit is not an active agenda. The development of a life-cycle costing approach within the financial model with which developments are procured is considered to be an essential institutional change.

Evaluating progress against the indicators as a percentage of Actions that have been progressed either to a 'Good' or 'Fair' extent, the highest categories are Transport, Construction, Solid Waste and Carbon Footprint; the lowest categories are Water, Indoor Air Quality, and Institutional Change and the remaining categories of Landscaping and Biodiversity, Emissions and Energy lie in the middle ground.

It is recommended that the Institutional Changes be prioritised as they will enable progress in the other categories. In addition, indoor air quality should be seen as of critical importance in places of instruction.

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