香港城市大學
City University of Hong Kong

CDFO

Campus Development and Facilities Office
校園發展及設施管理處

Environmental Report 2011
二零一一年拾荒者年報

March 2012

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Message from the Director

The aspect of "Environment, Health and Safety" is now an integral part of the value of social responsibility of the University under the University Charter of Social Responsibility established in May 2011. The University's vision to create a low carbon campus bonds strongly with this which underscores CDFO's continued commitment to a sustainable campus for the University.

In this report, we summarize what CDFO has done in 2011 towards turning the University's value and vision into reality.

Despite of our heavy workload in constructing new campus buildings, our works in protecting the environment remain fruitful. We have achieved encouraging result in our 2009 – 2011 Energy Saving Plan where energy consumption and carbon emission were reduced by 8.8% and 5.1% respectively.

2011 also saw CDFO's first attempt to offer internship places to CityU's students whereby we contribute our expertise to teaching and academic programme.

The said programme was a collaboration between CDFO and the Department of Public and Social Administration (SA), offering a 6-week internship programme for four students majoring in environmental policy studies. The internship was extremely successful and highly valued by the faculties and students concerned.

I hope you will enjoy reading this Report, and as always, I appreciate and treasure your valuable feedback, suggestions and involvements that would help improving our environmental performance.

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Environmental Performance

Being an ISO14001 certified office for the 11 consecutive years and several environmental awards receiver, CDFO has achieved the following in 2011 :

Waste Recycling

- The first local tertiary institution to recycle food waste into fish feed.
- Initiated recycling of glass bottles for making bricks.
- Saved over 280 tonnes of solid wastes through recycling.
- Initiated waste audit on campus.
- QR Code established with 90 pieces posted around campus to facilitate self-guided touring of campus environmentally friendly facilities.

Energy Efficiency

- Reduced roadside pollution (305 kg of CO_2-e) by using electric vehicle.
- Saved energy by implementing weekly Campus Earth Hour, first of its kind among local tertiary institutions.
- Generated 45,050 kWh renewable energy.
- Consumed 8.8% less electrical energy or reduced carbon emission by 5.1%.

Water Conservation

- Saved 7,482m^3 flushing water.

Contribution to Teaching

- First internship programme provided for four SA students in the history of CDFO.

Award

- Won the Class of Excellence Wastewi$e Label in succession of 10 years and a total of 22 targets achieved.

1. Environmental Performance

1.1 Waste Management

1.1.1 Solid Waste

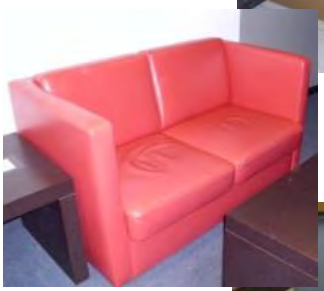
In addition to adoption of the 3 “R” strategy of reduction, reuse and recycling set out in the University’s Charter of Social Responsibility, CDFO, to exhibit CityU’s development direction of discovery and innovation, seeks out not only new and improved ways for reduction and reuse but also recycling opportunity which is evident in the following :

(a) Reuse

- **Used Furniture**

The prevailing University policy is that whenever you need furniture / equipment for your department / office, go to “Go Green” first and search for used furniture / equipment meeting your requirements. If no suitable furniture / equipment can be found on “Go Green” to meet your requirements, complete a Purchase Requisition with justification on the purchase. This policy has been strictly adhered to in the newly completed Run Run Shaw Creative Media Centre (CMC) and Academic 2 (AC2) where existing furniture are mostly reused.

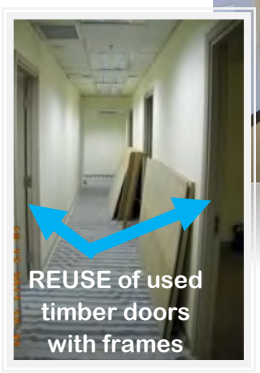
To eliminate the need to dispose of / replace old or damaged sofas in Academic 1 (AC1), over 30 numbers of old / damaged sofas were re-conditioned for reuse.



- **Salvaged Building Materials**

  The following salvaged building materials were reused :

  - ♦ Used wooden doors;
  - ♦ Used wooden doors with frame; and
  - ♦ Used metal partitions.



(b) Recycle

- **Recovery of Solid Wastes**

  CDFO is responsive to opportunities. In addition to collection of paper, aluminium cans, plastic bottles, printer cartridges, plastic bags, batteries, CDs, foams, mercury-containing florescent tubes and lamps for recycling, glass bottle is the latest recyclable identified for recycling to make bricks.

In order to extend our good environmental practice to treasure resources to new buildings, 3 sets of recycle bins (for collection of paper, plastic bottles and metal cans) were provided for the newly occupied AC2 and order has been placed for the purchase of 9 sets of environment matching recycle bins for CMC.

- **Recycling and Deferred Replacement of Lubrication Oil**

  We do not replace lubrication oil in chiller compressors unnecessarily. The lubrication oil in chiller compressors is only renewed in accordance with the analysis results of the condition of the oil. Deferment of yearly replacement of 2,000 litres of lubrication oil being used in our 60 odd chiller compressors not only contributes to protection of the environment but also has a potential cost saving of about HK$900,000 a year (HK$15,000 per compressor).

  Even used lubrication oil in chiller compressors is to be changed, it is required to be taken away for recycling by the contractor in the course of chiller compressor maintenance.

- **Recycling of Food Waste**

Senior management of CityU saw the seriousness of the environmental problems posed by meaningless food wastage. Subsequent to signing the "Cutting Food Waste Charter [減少廚餘約章]", a series of campaigns and exhibitions were launched on campus to encourage the University community to be more sensitive to food waste issues and to contribute to more sustainable ways of living. The ultimate aim is to encourage cutting food waste at source.

These include "CityU – Cutting Food Waste Kick-off Ceremony" held on 25 March 2011 with our Council Chairman as the officiating guest, University Campaign on Reduction and Recycling of Food Waste held on 26 September 2011 with the Secretary for the Environment and our Council Chairman as the officiating guests and exhibitions on "Food Waste Management".

Since food waste will inevitably be generated, with the support of University senior management, processing of food waste into fish feed was chosen among the various methods of treating food waste studied / investigated, which include using composter to turn food waste into fertilizer and using decomposer to convert food waste into liquid and carbon dioxide. A contractor was eventually engaged in August 2011 to collect and sort food waste generated on campus for converting it into fish feed in their factory.

Collection of Food Waste Trolleys in Action

Fish Feed

As a trial to tackle food waste generated from staff residential quarters, three mini electric organic waste decomposers were purchased in September 2011 for recycling food waste into fertilizer. Up to 31 December 2011, about 87 kg of food waste were collected and 28 kg of fertilizer were produced. Some of the fertilizer was applied to landscape areas on campus and some of them given to the Department of Biology and Chemistry (BCH) for teaching and research purposes.

Electric Organic Waste Decomposer

(c) Reduction

We care about the scarcity of our landfill portfolio so much that we do not want to dispose of even 10 malfunctioned electronic ballasts which were successfully repaired and put back in service on campus during the reporting period.

In this regard, our scope and scale of repairing defective equipment parts / items and hence conserving resources was extended in 2011. A considerable number of ball valves, gate valves, equalizing filling valves, non-return valves, etc. were repaired and put back into service. An estimate of saving is around HK$80,000.

Ball Valves and Gate Valves

A handsome quantity of hinges, locks and door closers were also repaired and reused.

In the office of CDFO, we practice the following to reduce the waste of paper :

- print if only necessary;
- use double-sided printing;
- use re-used paper for printing and photocopying; and
- work with our contractors to use less paper as possible in submitting their service reports and invoices.

Summary of Solid Wastes Recovered :

Reduced
280
tonnes
solid wastes

	Year 2009	Year 2010	Year 2011
Waste paper recycled (kg)	243,676	214,955	180,996
Aluminium cans recycled (kg)	445	798	822
Plastic bottles recycled (kg)	2,348	1,873	1,942
Printer cartridges recycled (kg)	1,213	696	864
Compact discs recycled (kg)	100	280	54
Batteries recycled (kg)	120	250	0
Expanded polystyrene (kg)	131	25	32
Mercury-containing fluorescent tubes and lamps recycled (kg)	10,000	11,300	10,400
Electronic ballasts repaired for reuse (pieces)	38	23^	10^
Green waste and plant trimmings reused (kg)	320	190.5	208
Glass bottles recycled (kg)	Nil	Nil	3,043 (Aug – Dec)
Food waste collected and recycled for making fish feed (kg)	Nil	Nil	82,553 (Aug – Dec)

Remark : ^ Less and less electronic ballasts are available for repair due to improvement in product reliability and life span.

1.1.2 Hazardous Wastes

Hazardous wastes (including chemical, clinical and radioactive) are generated from daily and ever-expanding teaching, research and operational activities on campus and off-campus (such as Hong Kong Science Park).

Radioactive Waste Store

Chemical Waste Store

To prevent contamination of the environment and protect the health and safety of the researchers, the CDFO continues to manage, on behalf of the University, the disposal of hazardous wastes according to established management procedures and in compliance with relevant statutory regulations and requirements.

The quantities of hazardous wastes responsibly disposed of in Year 2009, Year 2010 and Year 2011 are listed in the table below :

	Year 2009	Year 2010	Year 2011
Liquid Chemical Waste # (L)	10,949	9,710	11,685
Solid Chemical Waste # (kg)	11,170	11,309	10,990
Clinical Waste * (kg)	1,572	2,015	1,734
Liquid Radioactive Waste + (L)	8	8	8
Solid Radioactive Waste + (kg)	4	4	4

Remark : # *As defined under the Waste Disposal Ordinance (Cap. 354). These wastes include fluorescent tubes, lamps, batteries, oily rags, paint pails, etc.*

* *Mainly blood contaminated waste from Young Chung-Yee Health Centre of the University).*

\+ *Use of storage / decay strategy being applied to radioactive waste with very long half-life.*

1.1.3 Construction and Demolition Wastes

All our contractors carrying out renovation and construction works were required to dispose construction wastes and debris in accordance with the “Trip Ticket System” laid down by the Development Bureau.

For capital projects, all construction contractors have joined the Considerate Contractor Site Award Scheme jointly organized by the Development Bureau and Construction Industry Council to promote a considerate attitude and good site safety, health and environment practices for sites.

1.2 Pollution Control on Campus

1.2.1 Outdoor Air Quality

In order not to add to the heated environmental problem in Hong Kong which is the rapid decline in air quality, we have taken the following new initiatives to control exhausts from laboratories, construction sites, vehicles and sewage for protection of the health and well-being of the University community as well as the whole environment :

(a) Discharge of Contaminated Air

- **Laboratory**

  To protect the health and safety of staff, students of CityU and the neighbouring community, fume extraction systems on roof level used for removing hazardous gases from laboratories were reviewed and extended by 3 metres above upper roof level to ascertain not only adequate dispersion of gases but also to prevent fresh air intake being polluted by exhausts which were previously discharged in the vicinity.

- **Vehicle Exhaust**

Reduced
385
kg CO_2-e

  In addition to replacing vehicles of the University fleet with environmentally friendly / hybrid ones and using Euro 5 fuels for vehicle emissions control, an electric vehicle (EV) was deployed to our fleet in September, 2011 to further cut down the carbon footprint of the University fleet and also eliminate roadside pollution. Tremendous effort is being spent to maximize usage of the EV in order to achieve maximum benefits and results for carbon reduction.

  The EV has been used as a piece of teaching equipment and offered learning opportunities for students of CityU and secondary schools.

  Also, in order to ensure that high fuel efficiency of the University fleet is maintained, training sessions on eco / green driving technique / hints were provided to all drivers.

- **Ambient Foul Smell**

  Due to growing student and staff population, soil water and wastewater generated from intensive use of sanitary fixtures and high turnover rate of dining has made the 20-years-old underground soil water and wastewater drainage pipe system on campus insufficient to meet the loading capacity and resulted in “full-bore flow” condition. The problem we face is that foul smell comes out of various external areas through the manholes. The main underground soil water and wastewater pipe system is being enlarged, whereby it should not only eliminate the foul smell but also improve the outdoor air quality and display a hygienic image.

- **Maintenance and Construction Works Sites**

  CDFO is aware of the importance of the co-operation of contractors and sub-contractors to cherish a pollution-free and hygienic campus. Therefore, we work closely with our contractors who are reminded and monitored to put in place effective environmental mitigation measures to minimize the impacts of noises, dusts, dirt and irritating odor to campus users and to the environment when carrying out works, such as to tidy up construction sites regularly, not to use canvas of plastic sheet as cover, and to check for any accumulation of water to eliminate chance of mosquito breeding.

  It is our work practice that noisy work is scheduled to be carried out in non-office hours so as to minimize disruption to departments concerned.

(b) Use of Refrigerant

In order to protect the Earth's protective ozone layer and not to contribute to global warming, CDFO recovers and reuses refrigerants in the process of equipment alteration and/or servicing. Environmentally friendly non-CFC/non-HCFC refrigerants will be used for new chillers in the replacement programme.

In addition, a non ozone depleting refrigerant ISPoint HR422/427, which is claimed to save 25% energy of chiller compressors, is being trialed in existing air-cooled chiller.

1.2.2 Indoor Air Quality (IAQ)

CDFO recognizes the significance of maintaining good IAQ for the staff and students of CityU. We are not just satisfied with maintaining indoor air to at least "Good Level" of the IAQ Objectives recommended by the HKSAR Government by just performing daily operational building services and preventive maintenance. To further enhance IAQ, the following new measures / improvement works have been implemented / done :

(a) Maintenance of Hygienic and Pleasant Campus Environment

CDFO continues to put emphasis on delivering a quality cleaning service to uphold the University's hygiene standards to support IAQ and minimize the potential effects of infectious disease.

In staff toilets, 20 ventilators were installed to replace existing oscillating fans to enhance ventilation by providing not only a gentle air movement and a refresher feeling while in the toilets but also a dryer toilet environment due to its wider coverage of air movement. Such ventilator will be installed in more communal toilets.

Ventilator

BioZone Air Purifier

In some communal areas and toilets where foul smell exists, BioZone Air Purifiers which make use of Photoplasma Purification Process by creating highly purifying compounds to destroy unwanted chemicals, microbes and contaminants have been / will be installed to eradicate the unpleasant odours.

(b) Elimination of Biological Contamination on Campus

In order to eliminate one of the breeding grounds for biological contaminants and pollutants on campus, carpets in all the classrooms of AC1, which trap dust, dirt, pests and other airborne pollutants, were replaced with vinyl sheets. In doing so, cleaning has also been made easy. Disinfection of air ducts was also conducted in majority of the classrooms by applying a medical grade absorber.

Ingress / infiltration of moist air which leads to problem of high humidity in some laboratory areas was stopped by provision of full height partition wall, sealing holes on ceiling, filling gaps in partition wall and / or raising room temperature.

Periodic microbiological tests for legionella for potentially high risk areas, such as cooling towers, drinking fountains and shower heads in shower rooms of Sports Centre were conducted.

(c) Improvement of Ventilation System

An energy efficient centralized water-to-water heat pump plant was installed to provide humidity control for laboratories of the Department of Electronic Engineering (EE) on Floor 1, Purple Zone, AC1.

The ventilation system for the University Concourse, Floor 4, AC1 was upgraded with fresh air quality tally with the population to cater for its ever increasing use as the focal point for interaction, collaboration and discussion during the class recess times and also for University exhibition and institutional events and functions, and growing number of students.

Energy Recovery Ventilator

Also, to improve the fresh air supply and circulation for the Finance Office on Floor 1, To Yuen Building, where staff density is high, energy recovery ventilators were installed with the view to providing the staff with a better working environment. In the process of extracting "used" cool air in the office, the cool air is reused to lower the temperature of fresh air drawn from outside.

(d) Assurance of Quality Fresh Air

Fresh air intakes of AC1 and Administration Buildings currently located near car parking spaces or exhaust air louvres were relocated to Floor 2 level to mitigate the possibility of fresh air contaminated by exhaust air.

In addition, fume exhaust stacks of the Department of Physics and Materials Science (AP) laboratory currently on high level of Floor 1 were extended to the roof level of buildings to prevent "short-circuiting" or retrenching of exhaust air. Routing of exhaust ducts was so carefully planned so as not to affect the aesthetic of the campus envelope.

(e) Enforcement of Smoking Ban on Campus

A series of control measures which include warning of smokers via heads of departments, reporting of smoking complaints to Tobacco Control Office of Department of Health of the HKSAR Government, posting of warning notices at strategic locations, increased guard patrol of black spots, issuance of email broadcasting messages, installation of detector alarms, etc., was vigorously enforced. Increase in smoking complaints had not been recorded in 2011.

(f) IAQ Survey

Another round of university-wide IAQ survey / measurement is now being conducted to assess IAQ conditions and help to identify any potential IAQ problems. So far, the survey confirmed that ventilation on main campus conforms to "Good Level" of the IAQ Objectives recommended by the HKSAR Government at least.

1.2.3 Noise Control

(a) Enhancement of Teaching Environment

In 36 classrooms on campus, the return air plenums of fan coil units were relocated away from the fan motors to reduce noise distracting students' attention in class. Modification work for another 14 classrooms is in the pipeline.

1.2.4 Wastewater Treatment and Neutralization

(a) Effluents Discharged from Catering Operation

The two electroflocculation systems, which are the only few of its type in Hong Kong, were managed to control the annual 80,000 m^3 of wastewater produced from the kitchens of various catering outlets on campus to within the Chemical Oxygen Demand, oil and grease limits stipulated by the Environmental Protection Department (EPD) of HKSAR Government.

(b) Wastewater Discharged from Laboratories

In the past year, our effort was also successful in ensuring the proper working condition of the Neutralization System which had processed about 36,000m^3 of wastewater discharged from laboratories, meeting EPD's discharge limits, thereby reducing the loading of government treatment facility.

1.3 Water Conservation, Consumption and Management

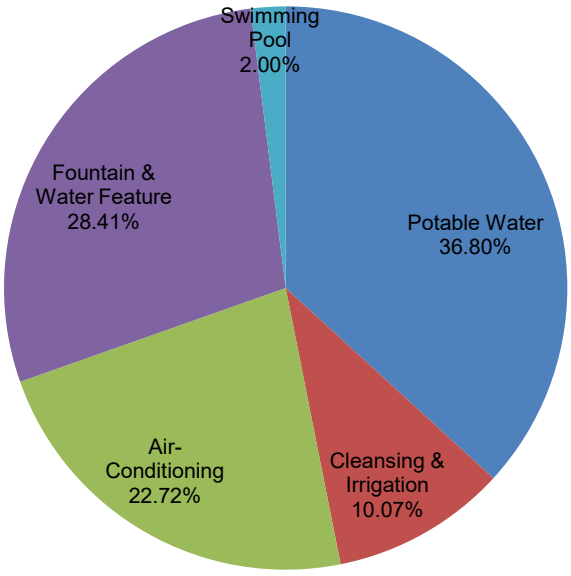
1.3.1 Water Consumption and Management

The fresh water consumption on campus for various purposes in year 2011 are depicted in the following table and pie chart.

		2010		2011		Yearly Changes (%)
		m^3 (x1000)	%	m^3 (x1000)	%	
1	**Potable Water**					
	AM & Sports Complex	18.80	13.67	17.82	9.97	-5.21
	AC1 & AD	44.96	32.69	47.12	26.37	4.80
	To Yuen Building	0.42	0.31	0.83	0.47	97.62
	Subtotal	64.18	46.66	65.77	36.80	2.48
2	**Cleansing & Irrigation**					
	AM & Sports Complex	6.49	4.72	5.03	2.81	-22.50
	AC1 & AD	3.36	2.44	12.85	7.19	282.44
	To Yuen Building	0.23	0.16	0.12	0.07	-47.83
	Subtotal	10.07	7.32	18.00	10.07	78.75
3	**Air-conditioning**	31.42	22.84	40.61	22.72	29.25
4	**Fountain & Water Feature**	28.24	20.54	50.77	28.41	79.78
5	**Swimming Pool**	3.63	2.64	3.56	2.00	-1.93
	Yearly Total (x1000m^3)	137.53		178.71		29.94
	Consumption / month (x1000m^3)	11.46		14.89		29.93
	Consumption / day / person (litre)	14.38		19.00		32.13

AM = Amenities Building
AC1 = Academic 1
AD = Administration Buildings

Used
30%
more water



Distribution of Major Water Usages

1.3.2 Water Audit

Since we treasure water as a valuable natural resources, we exert our effort in each year to conduct an audit on the water consumption on campus with an aim to reduce water wastage and increase the water usage efficiency on the demand side. The results of the audit were reported below.

Compared with that of year 2010, the annual fresh water consumption in year 2011 increased by 29.94% and the following particulars were observed :

(a) The cleansing and irrigation water consumption was increased by 78.75%. The reason is mainly due to the temporary suspension of grey water system from February 2011 to November 2011. As the condition of the plants using grey water for irrigation was found unsatisfactory, we needed to examine the effect of grey water for plant irrigation before the grey water system was resumed for its application. The system was then resumed operation in December 2011 after the water quality was improved by adjusting the chlorine content.

(b) The water consumption for the evaporative cooling tower of air-conditioning plant was increased by 29.25% as compared with that of year 2010. It is because one new water-cooled chiller (750 Rton) was put into operation after May 2010. Thus water consumption was found increase mainly in the first half year.

(c) The water consumption of fountain & water features was increased by 79.78%. The cause was due to water leakage at underground pipes which rectification work had been arranged to avoid wastage.

(d) Potable water consumption maintained quite consistently between year 2010 and year 2011 because the number of staff and students had very minute changes.

(e) Compared with that of year 2010, the water consumption due to water replenishment for swimming pool in year 2011 varied little. This phenomenon is explained by the minute change of outdoor mean temperature and insolation in summer months when water loss was caused by evaporation. At the time of swimming pool's closure in December, the water was reused for cleansing and flushing purposes so as to avoid wastage of direct discharging into government drain.

From the above analysis, it can be seen that fresh water demand of various types is dependent on some external factors including staff and student population, rainfall quantity, outdoor dry bulb and wet bulb temperature, and insolation. However, we have tried our best effort to recover water through grey water system for irrigation, minimize water usage through the application of "waterless" urinals, and reduce water wastage by reusing the bleed-off from cooling towers for flushing purpose. We will extend the use of water recovery (e.g. rainwater harvesting) in new buildings and our performance will be gauged by the water recovery efficiency.

1.3.3 Use of Waterless Urinal System

Saved
7,482m³
flushing water

The use of the 'Desert Cube Waterless Urinal System' was extended to 31 male toilets of To Yuen Building (TYB), Amenities Building (AM Building), AC1, Mong Man-wai Building (MMW Building), Fong Yun-wah Building (FYW Building), Cheng Yick-chi Building (CYC Building) and Chak On Centre, a total of over 7,482m^3 of flushing water was saved in 2011, which is equivalent to an annual reduction in CO_2-e emission of about 1.3 tonnes.

Trial use of this System in the busy male toilets on Floor 5 of AC1 was carried out.

1.3.4 Potable Water Saving Measures

Saved
2,430m³
potable water

About 75 sets of water saving aerators were installed for washbasin taps in toilets of the newly completed AC2. An annual saving of about 2,430m^3 of potable water was achieved which is equivalent to an annual reduction in CO_2-e emission of about 0.4 tonnes. The measure will be gradually extended to all washbasin taps.

To save both energy and water, a self-activated water saving aerator is used on trial for all washbasin faucets in some toilets in AC1 and FYW Building.

Similarly, water saving aerators and shower heads were installed in visitor quarters of Wong Fung Ling Hall and Jockey Club Hall respectively to reduce water by 50% compared with original fittings.

1.3.5 Water Recycling

(a) Swimming Pool

Last year, discarded pool water after closure of the Swimming Pool was put to trial use to displace potable water for watering plants and vegetation on campus with an aim to further save valuable water resources. Unfortunately, test performed on shrubs, lawn and seasonal flowers confirmed that discarded swimming pool water was not suitable for irrigation.

However, we were able to use the discarded pool water for cleansing floor and ground and flushing of toilets instead.

(b) Rainwater Harvesting

Development with more buildings constructed on campus resulted in coverage of porous or previously vegetated areas, which in turn decreased rainfall infiltration and leads to polluted run-off.

In order to make up for the above and to displace a proportion of water that would otherwise be a demand for the supply mains, a system to harvest rainstorm to be used for irrigation, cleansing and consumption by water features and fountains was incorporated in our Academic 3 (AC3) which is being constructed on campus.

1.4 Campus Energy Efficiency

1.4.1 Energy Efficiency Improvement

(a) Energy Efficiency Improvement on Mechanical Ventilation and Air-conditioning System

(i) Trial Use of Eco-system for Existing Chillers

An "Eco-system", which uses water spray to assist the heat rejection of existing air-cooled chiller, was on trial. It is anticipated that the chiller will be operated at 10% higher efficiency. This system will be applied extensively to more air-cooled chillers subject to the validation of results in energy saving and assessing the impact on the chiller's functionality.

(ii) Trial Use of Time-controlled Switch for Laboratory Room

A timer switch is being installed inside a research laboratory as a phototype to control (the switching of) lighting and fancoil unit. Whenever the switch is activated manually (each time by the user) at night period, the lighting and fancoil unit will be operated continuously for 2 hours only. Thus, wastage can be avoided because the service equipment is operated only on "need" basis. This energy saving initiative will be carried out widely in laboratory rooms if the study on functionality and cost benefit are found satisfactory.

(iii) Thermostatic Control of Ventilation Fan Operation in Lift Machine Room

Reduced
7.9
tonnes CO_2-e per year

To reduce the energy wastage of exhaust air fan operating round-the-clock inside lift machine room, temperature senor was installed to switch off the fan when the room temperature was below 28°C. Such energy saving measure has been installed to 21 number of lift machine rooms.

(b) Energy Efficiency Improvement on Lift System

Reduced
7.2
tonnes CO_2-e per year

(i) Use of Energy Efficient P-M Motor for Lift Upgrading

.

Three aged passenger lifts were upgraded in year 2011. Energy efficient P-M motors were used for the traction machine in the replacement. Compared with the old installation, over 40% of energy was saved after the lifts were upgraded.

(c) Energy Efficiency Improvement on Lighting System

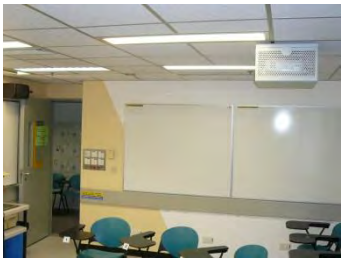
(i) De-lamping in Public Corridors of Laboratory Areas

Survey was conducted to measure the existing lighting levels in communal areas and corridors in laboratory areas. It was found that lighting level could be reduced to meet the required illumination standard of circulation. Thus, "de-lamping" was initiated at corridors of laboratory areas on Floor 2, AC1.

(ii) Trial Use of LED Lamps for Various Functional Areas on Campus

Reduced
6.9
tonnes CO_2-e per year

On trial basis, energy efficient LED lamps have been used in classroom, University Concourse, Library and Pedestrian Subway to replace existing T-5 florescent tubes, compact florescent downlights, 14W T-8 florescent tubes and 36W T-8 florescent tubes respectively. Also, 8W LED lamp bulbs were used to replace 50W halogen spotlights in various areas on campus. The total energy saving for the above-mentioned replacement is anticipated to be 11,660 kWh per year. The application will be extended to more areas in future if the technical performance and cost benefit are found satisfactory.



(iii) Implementation of "Campus Earth Hour"

Since April 2011, CPFO introduced the "Campus Earth Hour" energy saving initiative to switch off some non-essential lighting in public areas from 2030 hours to 0700 hours on all Sunday nights. This measure will be extended to more areas in future provided that it will not compromise security, safety and other functional needs.

(d) Energy Efficiency Improvement in Hot Water System

(i) Use of Energy Efficient Air-to-water Heat Pump for Hot Water Pre-heating in Student Residence

Reduced
354
tonnes CO_2-e per year

Energy efficient air-to-water heat pump system was installed as water pre-heating for seven halls at Student Residence. The system comprises of 2 nos. of 30 kW air-to-water heat pumps (COP of 2.6) completed with hot water storage tank and controls. Potable water is pre-heated to 40°C and supplied to the instantaneous electric water heater in each bathroom. Compared with the old system, over 60% of energy consumption for hot water heating can be saved in operation. The anticipated saving per year is about 600,000 kWh.

(ii) Use Energy Efficient Water-cooled Chillers in lieu of Air-cooled Chiller for 24-hour Service

It has been our practice to use aged air-cooled chillers (COP of 1.6) to support air-conditioning demand at night time. Subsequent to the completion of water-cooled chiller installation in year 2010, its performance and reliability of automatic operation without technical staff's support was critically assessed. We decided to switch to using water-cooled chillers in night time since October, 2011, whereby energy saving could be accrued due to higher energy efficiency of water-cooled chillers (COP of 5).

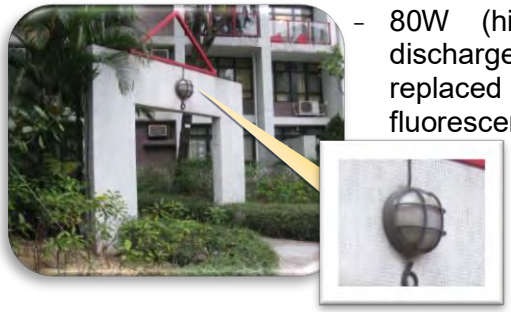
(e) Energy Efficiency Improvement in Senior Staff Quarters

Our efforts in energy saving and energy efficiency improvement were extended to the residential estates on campus. The energy saving measures mainly comprise the replacement of lighting fixtures by the energy efficient types and shortening the operating time of lighting in some communal areas. The details of the energy saving measures for various senior staff quarters are summarized as follows:

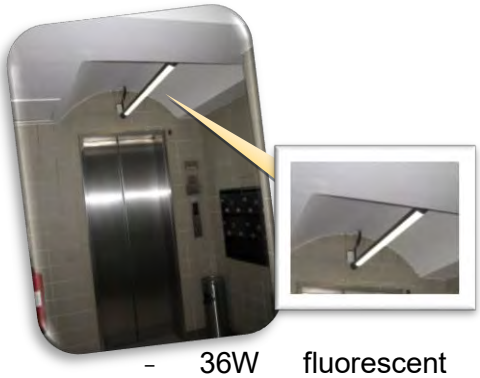
(i) **Tak Chee Yuen**

Reduced
16.2
tonnes CO_2-e per year

- 102 sets of lamps were replaced with energy efficient ones fluorescent lamps with details as below:-

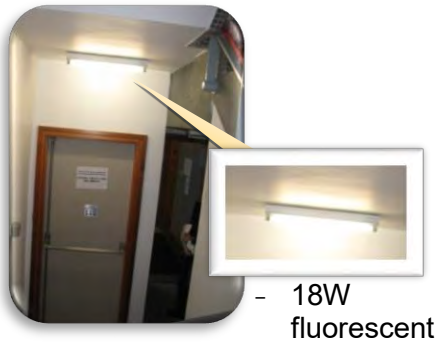


- 80W (high pressure sodium discharge) Lamp SON lamps replaced with 23W compact fluorescent lamps



- 36W fluorescent tube replaced with 18W LED lamps

- Metal halide 125W lamps replaced with 24W compact fluorescent saving lamp



- 18W fluorescent tube replaced with 9W LED lamps

A total of about 27,432 kWh of energy was saved per year.

(ii) **Nam Shan Yuen**

Reduced
18.9
tonnes CO_2-e per year

- 15 sets of SON lamps were replaced with 24W/20W energy saving compact fluorescent lamp. A total of about 28,141 kWh of energy was saved per year.
- The operating time of 15 sets of lamps in carpark areas were adjusted from 24 hours to 14 hours daily. A total of about 3,920 kWh of energy was saved per year.

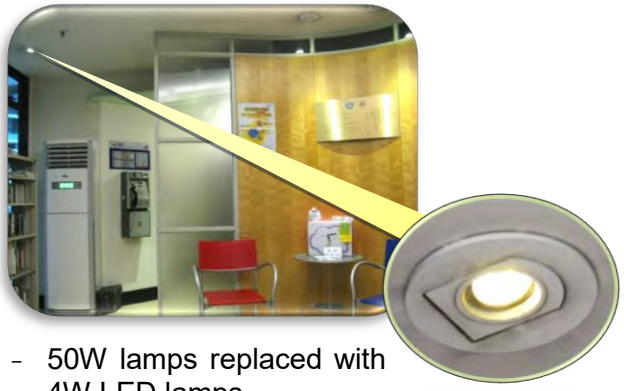
(iii) **Academic Exchange Building**

Reduced

9.8

tonnes CO_2-e per year

- 64 sets of fluorescent tube/halogen lamp were replaced with different types of LED / compact fluorescent lamp. A total of about 16,667 kWh of energy was saved per year.



- 50W lamps replaced with 4W LED lamps

- 500W lamp replaced with 50W LED lamp

(f) Summary of Energy Efficiency Improvement Initiatives Completed in Year 2011

Reduced
910
tonnes CO_2-e per year

Description	Estimated Annual Saving (kWh)
Replacement of about 600 sets of compact fluorescent luminaire and downlights by LED lamps in lecture theatres, classroom, library and U-Concourse	63,478
Replacement of 156 sets of florescent tubes by LED lamps in Pedestrian Subway	11,660
Use of energy efficient P-M motor in lift upgrading (3 nos. completed)	12,276
Use of air-to-water heat pump for hot water pre-heating for bathrooms in Student Residence	600,000
Thermostatic control of ventilation fan operation in lift machine room (21 nos.)	13,318
Use of energy efficient water-cooled chillers in lieu of air-cooled chiller for 24-hour service	764,460
Implementation of "Campus Earth Hour"	1,456
Replace lamps in staff quarters by energy efficient areas (e.g. LED or fluorescent tubes)	76,160
Total (kWh)	**1,542,808**
Total reduction in carbon emission per year	**910 tonnes** *(equivalent to planting 39,580 trees)*

1.4.2 Use of Renewable Energy

(a) Inventory of Installation

Offset
26.6
tonnes CO_2-e per year

By the end of year 2011, the total renewable energy installation on campus contributed an annual energy generation of about 45,050 kWh which is equivalent to an emission reduction of 26.6 tonnes CO_2-e. The installation mainly consists of photovoltaic / thermal solar panels on roof of To Yuen Building, "evacuated tube" type thermal solar panels on roof of Sports Complex, solar panel/wind turbine hybrid lamp poles at Student Residence, and solar PV panels on roof of Student Residence.

(b) Connection of PV Panel to Electrical Power Distribution Grid

The new photovoltaic (PV) system, which was lately installed on roof of the Student Residence, comprises of 30 nos. horizontal PV panels of 5.55 kW total power rating. This system is of the first kind on campus connecting to the power company's 380V, three-phase, 50 Hz electrical distribution network through three grid-connected inverters, completed with associated control, protection and monitoring devices. The total electrical energy per year converted from the installation is 6,150 kWh.

1.4.3 Operational and Maintenance Measures

In 2011, we continued putting our effort into upkeeping the operating efficiency of the physical plants. Some new initiatives for energy saving in operation are described as follows :

(a) Limit chilled water supply to Chan Tai-Ho Sports Hall in winter season.

(b) Minimize the use of air-cooled chillers which are comparatively less energy efficient than the water-cooled chillers.

(c) At building entrances, set room temperature at 27°C for energy saving.

(d) Split the control zones of lighting and air-conditioning into smaller size in the Chan Tai-Ho Sports Hall so as to minimize the wastage in operation when the Hall is partially used.

(e) Switch off some air handling units in Student Canteen during winter season.

(f) Raise chilled water supply temperature from 7.2°C to 9.5°C in winter season so that higher COP in chiller plant operation can be achieved.

1.4.4 Power Management

(a) Energy Audit

The campus-wide energy audit financed by the Building Energy Efficiency Programme (BEEP) through the Environment and Conservation Fund of the HKSAR Government was completed in March, 2011. Based on the recommended energy saving opportunities, we have turned it into an AA&I project submitted to UGC for funding application.

(b) Power Quality

Power quality at AC1, Administration Buildings, Amenities Building and Sports Complex is now being monitored through the web-based power management system. Its use will be extended to new buildings such that the power quality can be centrally monitored so that prompt actions can

be taken against any irregularities. Power factor can be attained averagely at 0.96 and above in the power distribution system. Also, the percentage of total harmonic distortion (THD) due to non-linear load measured at the main incomer can meet the operation limit specified by CLP.

(c) Energy Consumption Statement

In order to raise user departments' awareness of environment protection, data and statistics of electricity consumption will be sent to them quarterly for reference. Such move will become a self-regulated mechanism that each department can monitor and improve their own energy usage performance according to their needs.

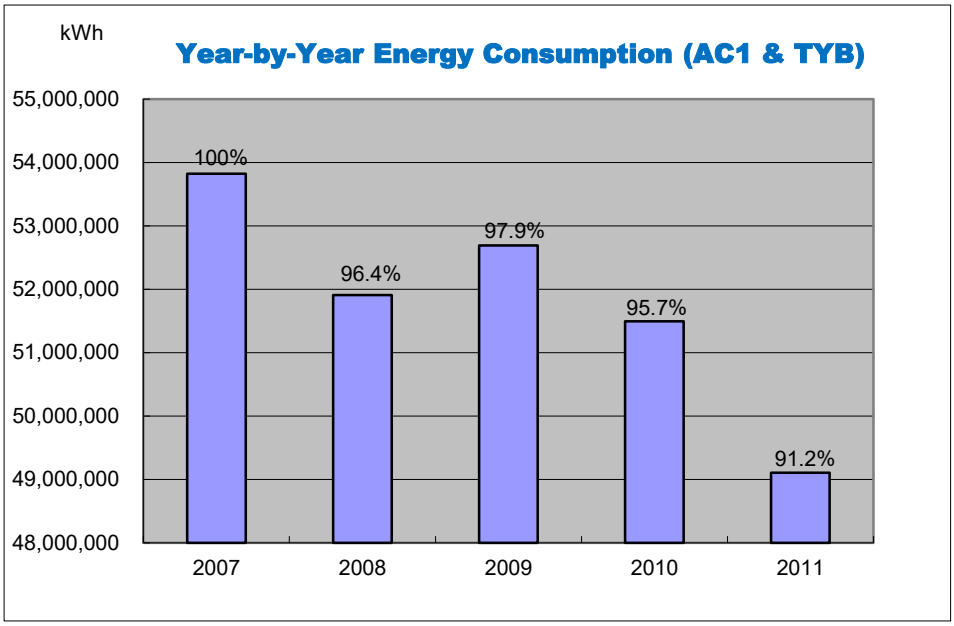
1.4.5 Energy Consumption Analysis

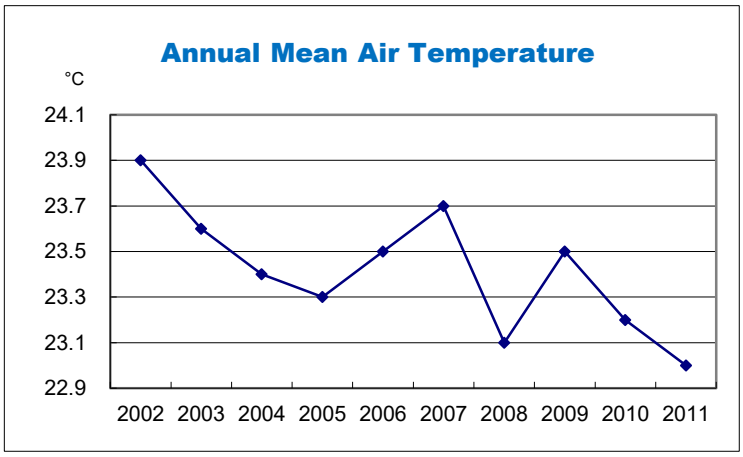
(a) Consumption

(iii) Performance

The energy consumption performance of the main campus (excluding AC2, CMC, Student Residence and University premises located off-campus) in year 2011 and its comparison with those of the preceding years are summarized as follows :

Period	2007	2008	2009	2010	2011
Energy consumption (kWh)	53,819,869 (100%)	51,906,241 (96.4%)	52,692,853 (97.9%)	51,491,662 (95.7)	49,105,201 (91.2)
Cost of energy	$39,779,790	$40,711,767	$40,831,557	$40,972,059	$40,242,421
Cost per kWh	$0.739	$0.784	$0.775	$0.796	$0.820
Total campus gross floor area (m^2)	166,109	166,109	166,109	166,109	166,109
Total no. of student and staff	28,728 (100%)	28,832 (100.4%)	27,063 (94.2%)	26,207 (91.2%)	25,764 (89.7%)
Consumption per capita (kWh)	1,873 (100%)	1,832 (97.8%)	1,947 (104%)	1,965 (105%)	1,906 (101.8%)
Energy consumption per m^2 (kWh/m^2)	324.00 (100%)	312.48 (96.4%)	317.22 (97.9%)	309.99 (95.7%)	295.62 (91.2%)
Energy cost per m^2	$239.48 (100%)	$245.09 (102.3%)	$245.81 (102.6%)	246.66 (103%)	242.27 (101.2%)



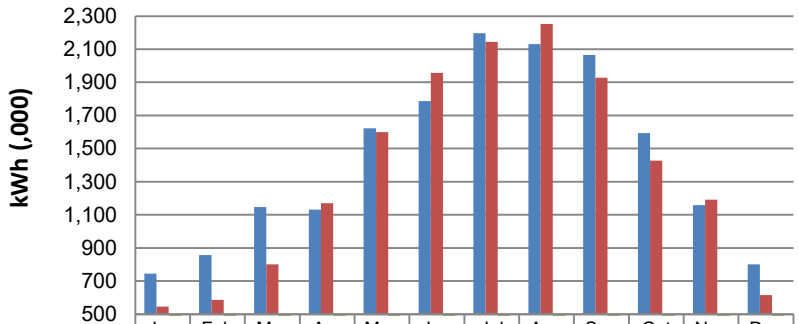


Source : Hong Kong Observatory

In year 2011, the main campus consumed 49,105,201 kWh of energy which, when compared with that of year 2010, has decreased by 4.64%. When compared with that of year 2007, despite considerable increase in campus activities, an applausive drop of 8.8% was realized. The decrease in energy consumption in year 2011 was attributable to the following factors :

- Since May 2010, about 43% of our chiller plant capacity was converted from air-cooled chillers to energy efficient water-cooled chillers. Referring to the chart below, the energy consumption in chiller plant saw a significant reduction of 5.9% using year-to-year comparison. The effect is quite obvious in the period (between January and March) that the energy saving achieved in the chiller plant operation varied from 8.4% to 19.2%. (note: it is the net saving which has discounted the weather factor). The energy saving contributed by chiller plant operation is 1,016,360 kWh which represented the large share of 39.6 % in total saving.

Energy Consumption of Chiller Plant (2010 -2011)



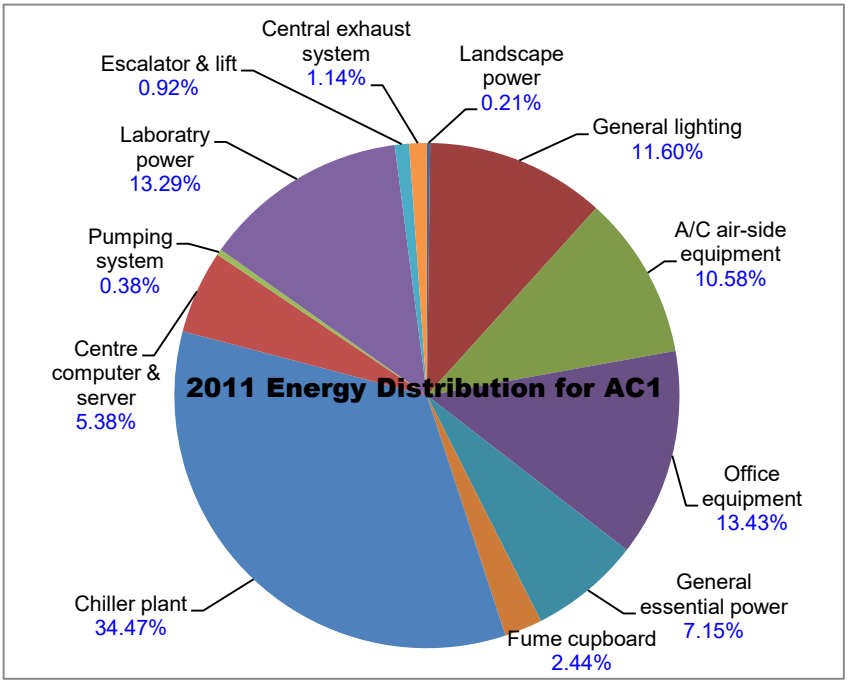
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010 kWh(,000)	746	856	1,147	1,132	1,622	1,788	2,196	2,131	2,066	1,593	1,158	801
2011 kWh(,000)	546	587	802	1,170	1,599	1,956	2,144	2,253	1,928	1,427	1,191	616
Saving (%)	-26.8	-31.5	-30.1	3.3	-1.4	9.4	-2.4	5.7	-6.7	-10.4	2.9	-23.1

- Energy saving was resulted from using energy efficient T-5 fluorescent lighting fittings because in year 2010, more than 700 sets of T-8 fluorescent lighting had been replaced by T-5 counterpart.

- Air-cooled chillers of low COP were minimized for operation in night time since October 2011.

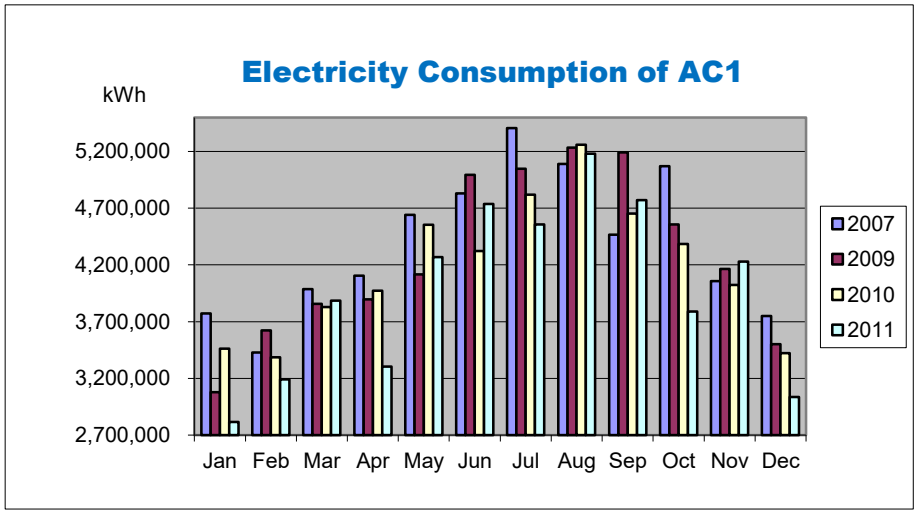
(iv) Consumption Distribution

From the following pie chart, one can see that the biggest energy consumption is attributed to the central air-conditioning plant which used 34.5% of total energy consumption on campus, followed by laboratories (13.3%), office equipment (13.4%), general lighting (11.6%) and air-conditioning air-side equipment (10.6%).



(v) Month-to-month Energy Consumption Pattern

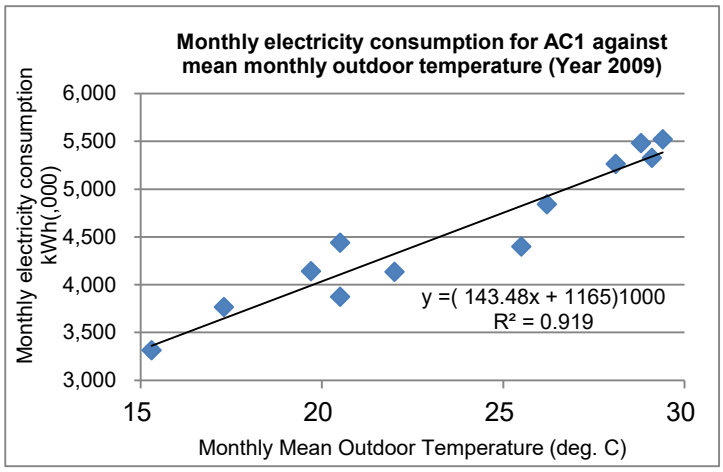
When compared with that of year 2010, generally the monthly consumptions in 2011 are lower, particularly in the period between January and April summer months. It is because water-cooled chiller plant installation was completed in May, 2010 to replace the aged air-cooled chiller serving Amenities Building and Sports Complex. In addition, higher energy consumption was found in June and November because of the comparatively high mean outdoor temperature in these two months. In effect, it caused a higher cooling load demand in the air-conditioning system.

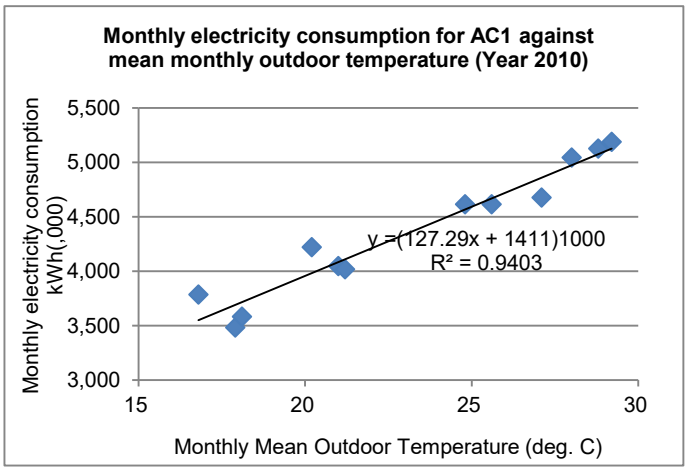


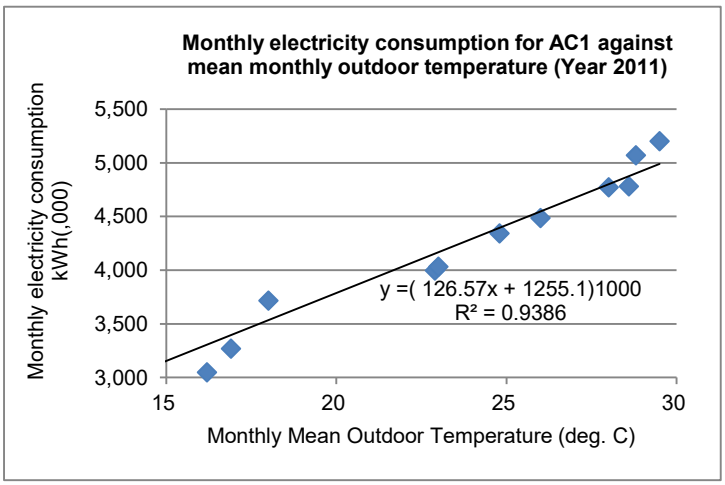
(vi) Patterns of Energy Consumption

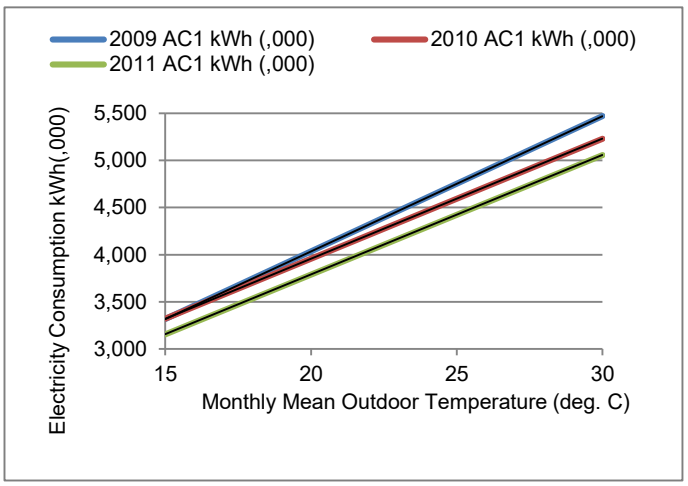
Air-conditioning energy consumption accounts for a substantial portion of the overall energy used in buildings. Regression analysis is used to show the correlation between the monthly electricity consumption and monthly mean outdoor temperature. Thermal performance line (TPL) (i.e. correlation curve) is drawn for the last three years (2009-2011). A steeper slope of TPL implies the energy use of the building subject to greater influence by weather changes, which is related mainly to air-conditioning energy use. The energy use level at the lower temperature end reflects the steady loads (e.g. lighting, computer, etc.) in the building.

The TPLs of the buildings on campus in year 2009 to 2011 shown in the charts below unveil that the electricity consumption of the campus bears closely a linear relationship with the monthly mean outdoor temperature. There are only marginal differences in the slopes of the TPLs for these three years, which suggests that there were no significant differences in weather dependent energy use among the three years, such as significant deterioration in the performance of chillers. However, the slope of TPL for 2011 is gentler than previous years, which can be explained by the more energy efficient operation of chiller plant by using water-cooled chillers. Also, the TPL for year 2011 stays consistently below those of the other two years, which is an indication that there had been a decrease in the base load, which is not weather dependent. The reasons are possibly due to less running hours or more energy efficient operation of lighting fixtures and other electrical equipment.



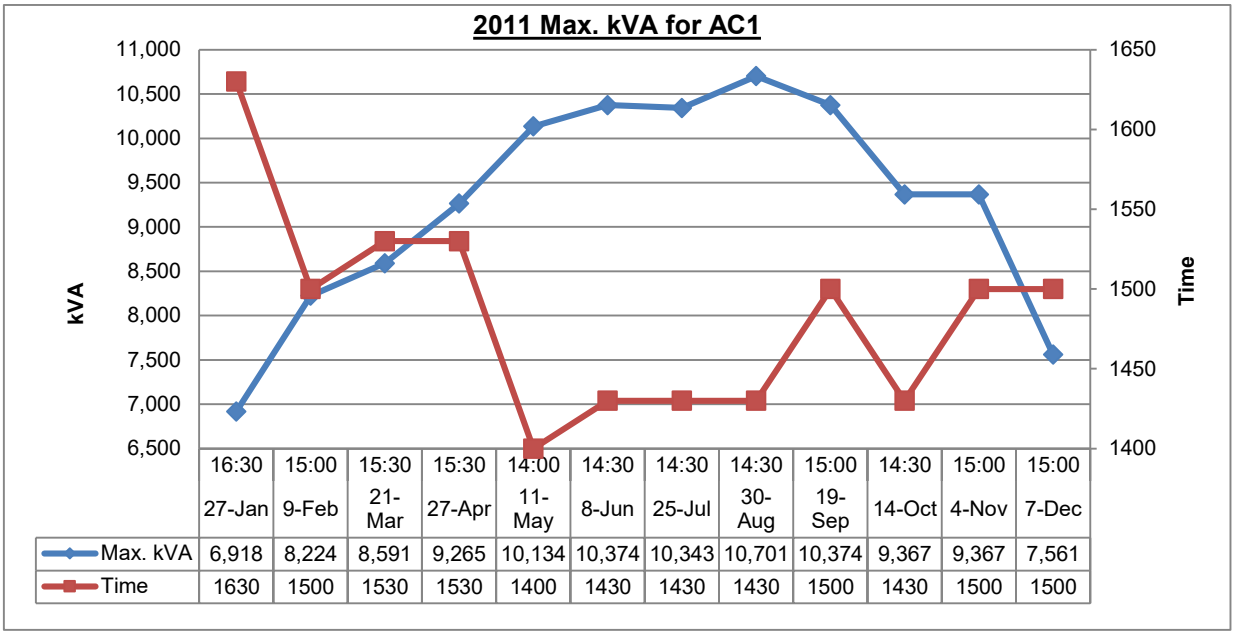






(vii) Electricity Demand in Peak Hours

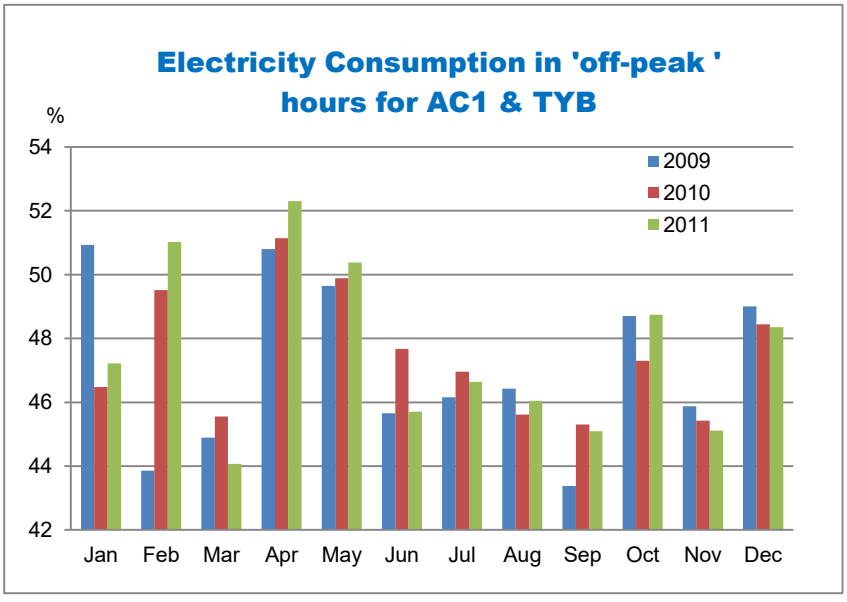
The graph below shows that the maximum kVA demand during peak hours (i.e. 0900 to 2100 on weekdays) occurs consistently in a short period between 1400 and 1700 in each month except January. This occurrence is in good coincidence with the period of maximum cooling load, when the air-conditioning plant operates at its highest loading. This information also enables us to fine-tune the discharge period for the PCM thermal storage system so that the tariff on maximum kVA demand can be cut down through maximizing the use of thermal storage instead of chillers.



	16:30 27-Jan	15:00 9-Feb	15:30 21-Mar	15:30 27-Apr	14:00 11-May	14:30 8-Jun	14:30 25-Jul	14:30 30-Aug	15:00 19-Sep	14:30 14-Oct	15:00 4-Nov	15:00 7-Dec
Max. kVA	6,918	8,224	8,591	9,265	10,134	10,374	10,343	10,701	10,374	9,367	9,367	7,561
Time	1630	1500	1530	1530	1400	1430	1430	1430	1500	1430	1500	1500

(viii) Consumption during Off-peak Hours

The following graph shows that energy consumption at off-peak hours (i.e. 2100 to 0900 on weekdays and Saturday, and all hours on Sunday) maintained at a relative high percentage (48% in average of the total). It reveals that campus activities continue during off-peak hours and users keep on using most energy-consuming equipment, office appliances, computer workstations, lighting and air-conditioning services. This phenomenon is more pronounced in February, April, and May when Library and other areas open for extended hours for revision and study near or during the examination periods.



(ix) Request for Extended Air-conditioning and Lighting Provision

Compared with that of year 2010, requests from user departments for additional air-conditioning and lighting services after normal hours dropped significantly by 30% in year 2011. Details of the top 10 user departments who made the most requests are shown in ***Appendix I***.

Students' Union maintained the highest requests among other users. However, their requests have been dropped significantly by 20.1% compared with that of year 2010.

(b) Tariff and Expenditure

Being a large power consumer, CityU's tariff consist of two main elements – maximum kVA demand and energy charges.

Compared with that of year 2010, the maximum kVA demand charges decreased by 5.9%. Also, the load factor (unit consumed / on-peak max. demand) saw improvement in three consecutive years from 437 in year 2009 to 443 in year 2011. Such phenomenon was resulted from the use of PCM thermal energy storage system to reduce chiller plant operating capacity at peak hours and the dropping of annual mean air temperature from 23.5°C (year 2009) to 23.0°C (year 2011). For the energy charges, there are two factors at work – basic energy charges in consumption and Fuel Clause Charges. For the energy consumption, it decreased by 4.6%. Whilst, the energy expenditure on electricity bill in year 2011 decreased 1.8% only. It indicates that our effort in energy saving is diluted by the rise in Fuel Clause Charges by CLP. It is because the unit charge of electricity has increased by 3%.

For comparison, the average unit charge (cost per kWh) in year 2010 and year 2011 are $0.796 and 0.820 respectively. The unit charges for various buildings on campus are shown below :

Location	Unit Charge ($)	Tariff Type
To Yuen Building	0.965	Bulk
Academic 1	0.812	Large Power
Weighted average (based on the aggregated charge divided by the aggregated electricity units)	0.820	

The distribution of expenditures on energy consumption is tabulated here under :

Area	Category	Jan – Dec 2007	Jan – Dec 2008	Jan – Dec 2009	Jan – Dec 2010	Jan – Dec 2011
Campus	Electricity *[i]*	$39,779,790	$40,711,767	$40,831,557	$40,972,059	$40,242,421
	Gas *[ii]*	$77,249	$29,635	$6,053	$5,464	$4,458
Senior Staff Quarters *[iii]* (Public area)	Electricity	$420,051	$435,013	$365,626	$413,868	$373,260
Academic Exchange Building *[iv]*	Electricity	$724,951	$761,654	$781,425	$767,872	$709,410
External Offices *[v]*	Electricity	$562,630	$960,118	$1,172,352	$1,413,704	$1,322,835
Total energy cost incurred		**$41,738,024**	**$41,564,671**	**$42,898,187**	**$43,157,013**	**$42,652,383**

Remark :

[i] *include Academic 1, Administration Buildings, Amenities Building and Sports Complex, but exclude catering outlets, Bookshop and Hang Seng Bank, AC2 & CMC.*
[ii] *include gas-dehumidifiers installed in EE laboratory on Floor 2, Fong Yun-wah Building.*
[iii] *include Tak Chee Yuen and Nam Shan Yuen.*
[iv] *include public area and SCOPE.*
[v] *include offices in Festival Walk, Grandtech, Chak On Estate, InnoCentre, Grand Century Place, Science Park, Kin Fat and Hi-Tech Centre.*

1.4.6 3-year (2009-2011) Carbon Reduction / Energy Saving Plan

(b) The Plan

In regard to the 3-year carbon reduction / energy saving plan (with target to achieve a reduction of 4% (year-to-year) in energy consumption by end of year 2011, using year 2007 as the benchmark), the data shows that our performance is ahead of target as 8.8% reduction in energy consumption (5.1% reduction in terms of carbon emission) was achieved in year 2011. The performance data of both energy consumption and GHG emission are summarized as follows:

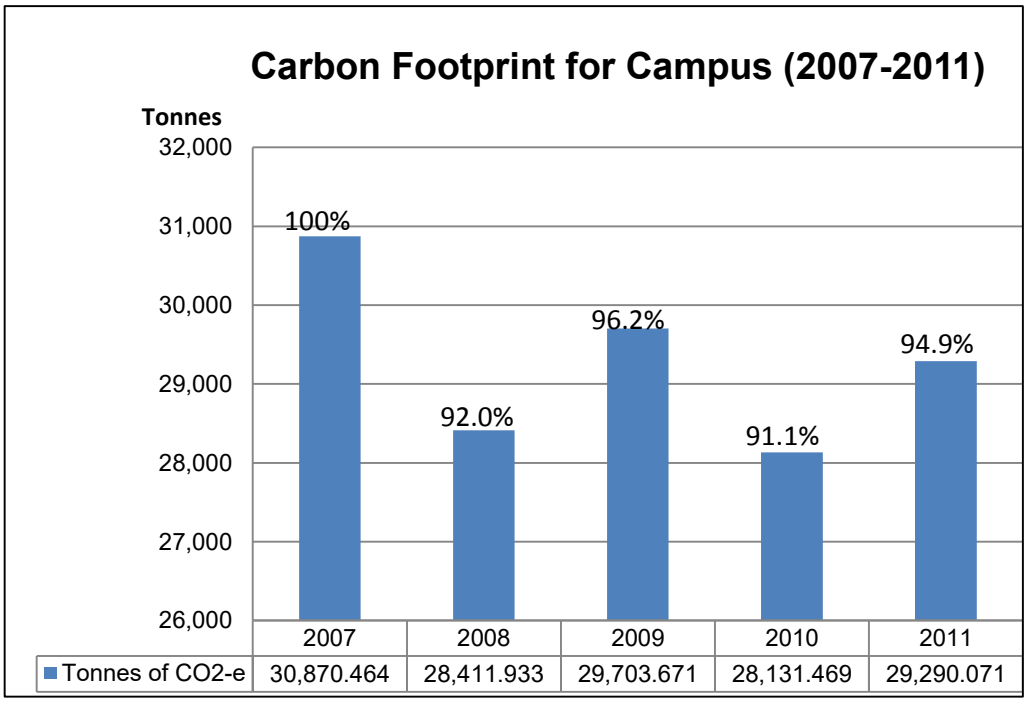
	Year 2007	Year 2009	Year 2010	Year 2011
Electrical Energy Consumption (kWh)	53,819,869 (100%)	52,692,853 (97.9%)	51,491,662 (95.7%)	49,105,201 (91.2%)
Net GHG Emission (tonnes)	30,870 (100%)	29,704 (96.2%)	28,131 (91.1%)	29,290 (94.9%)

(c) Carbon Footprint

The carbon footprint for the period (2008-2011) is shown in the chart below. Compared with that of year 2010, the total carbon footprint for campus (excluding the new Academic 2 & CMC) has been reduced by 5.1% (i.e. 1,580.4 tonnes CO_2-e which equates to planting of 68,713 no. of trees). In the last three years, carbon emission has achieved an accumulative reduction of 5,486 tonnes of CO_2-e (using year 2007 as the benchmark). The Performance Report on GHG Emissions and Removals for year 2011 is given in ***Appendix II*** and the key performance indicators of our GHG for Year 2011 are :

Total GHG Emissions : 29,290 tonnes of CO_2-e

Footprint per capita : 1.137 tonnes of CO_2-e/person



1.5 Campus Greening

CDFO continues to take effective measures to improve landscape and campus ambiance for the enjoyment of the University community, which was carried out in an environmentally friendly, effective and cost conscious fashion.

1.5.1 New Initiatives

To soften hard surface and enhance the greenery on campus, new flower plants and ground cover were created in prominent locations on campus.

(AC1)

With the completion of the new buildings to cater for the new academic system, in order for the staff and students to enjoy a campus that is both pleasant and functional, more than 150 potted plants were placed in CMC and AC2.

(AC2)

1.5.2 Tree Inventory and Management System

The creation of the in-house Tree Inventory and Management System (TIMS) was completed and is now in use for tree records and maintenance purposes. The first phase of inputting data for 265 trees in Chinese Garden was finished. The second phase of entering data for the trees on Campus Ground Level at Nam Shan Chuen entrance is in progress.

1.5.3 Use of Eco-fertilizer

We have been using eco-fertilizer in all landscape areas on campus and residential quarters since 5 years ago. Our landscape services contract requires the contractor to use eco-fertilizer. Apart from eco-fertilizer, in 2011 CDFO started to use fertilizer made from composted food waste collected from residential quarters.

1.5.4 Irrigation of Vegetation

In order to achieve conservation of water and effective watering for plants and trees on campus, close monitoring on use of water for irrigation is one of our focus in landscaping work. Irrigation frequency and duration will be reviewed and adjusted suitably to take into account various factors such as species of plants and trees, weather change, etc.

1.5.5 Green Roof

In addition to the 2 established green rooftops of total area of 92 sq.m. in the AM Building, roof gardens were provided on the newly completed CMC and AC2.

Study is being carried out to explore the use of planting without soil in order to extend the existing rooftop planting to other roof areas having less structural strength.

1.5.6 Reuse of Green Waste

To support water conservation, garden waste from tree pruning was shredded to turn into a reusable organic planting material “mulch” to apply on existing landscaping / shrub planting areas on campus as a cover on the soil to not only suppress weed growth but also retain moisture and improve appearance. Totally, 208 kg of mulch were produced during the reporting period.

1.6 Development of New Buildings

Same as our newly completed Run Run Shaw Creative Media Centre (CMC), Academic 2 and CityU Shenzhen Research Institute Building, the Academic 3 (AC3), which is being constructed on campus, embraces many green features in its design to improve human health, build a better environment and enhance work performance. The Building Environment Assessment Method (BEAM) Society has awarded AC3 for achieving the provisional rating of platinum standard in accordance with the BEAM for new building.

AC3 is a sustainable office building incorporated with the following energy efficiency features and green facilities :

(a) Energy Efficiency Feature

- Water-cooled chillers.
- Heat wheel for energy reclaim of exhaust air from all air-conditioned areas.
- CO_2 sensors to control fresh air supply.
- Lighting control by daylight sensors in classrooms.
- LED type exit signs.
- High efficiency T5 fittings.
- Lifts with Variable Voltage Variable Frequency (VVVF) Drive System.
- Automatic on/off switching off lighting and ventilation fan inside lift cars.
- Automatic demand control for ventilation fans in carpark.

(b) Renewable Energy Technology

- Photovoltic (PV) system fed into grid.
- Self-contained type PV cell landscape lights.

(c) Green Feature

- Green roof.

(d) Recycled Feature

- Harvesting of rainwater for irrigation and recycling of cooling tower bleed-off water for flushing.
- Recycling of air-conditioning (A/C) condensate water for A/C make-up water.

(e) Energy Management Feature

- Web-based energy metering.

An encouragement / recognition to our efforts to build sustainable buildings on campus were that the lead consultant of our CMC project has strongly recommended CMC to compete in the following three Awards :

i) Green Building Award 2012 which is organized by the Hong Kong Green Council with Professional Green Building Council to provide recognition to building-related projects with outstanding performance and contributions in sustainability and the built environment and also to transform the mainstream market towards wider adoption of sustainable planning, design, construction, management, operation, maintenance, renovation and decommissioning of buildings;

ii) FuturArc Competition is an award competition where green projects are recognized for their environmental contribution; and

iii) China Green Label which is similar to Hong Kong BEAM relating to green buildings achievement and assesses buildings based on the Chinese Green Building Evaluation Standard of China's Ministry of Housing and Urban-Rural Development, which is made up of six components: land efficiency, energy efficiency, water efficiency, resource efficiency, environment quality and operational management.

1.7 Benchmarking with Peer Institutions

Being a member of the Tertiary Education Facilities Management Association (TEFMA), CDFO continues to share campus sustainability data with other leading universities in the Asia and Australasia region in TEFMA's annual benchmarking survey.

2. Green Activities and Collaborations

To secure a long term solution to environmental problems through development of an improved environmental ethic within the University community and the public, CDFO conducted and / or participated in the following research, teaching, education, training, show-and-tell, campaign and publicity activities in 2011 :

2.1 Support of Student Green Activities

(a) **<u>"Greenlight CityU Proposal Competition" and Greenlight Angel Programme</u>**

Participated in the event on "Greenlight CityU Proposal Competition" and Greenlight Angel Programme organized by the Environmental Protection Society of SU in 2011 to promote environmental protection on campus by giving advice on the Proposal and serving the judge panel for assessing the proposals, providing environmental training to greenlight angels and serving as a member of interviewing / selection panel of greenlight angel programme to select greenlight angels.

(b) <u>「環保會」的 "城大減少廚餘推廣活動"</u>

The Environmental Protection Society of SU was facilitated to hold the captioned exhibition in front of i-Café to promote cutting food waste at source at CityU for the period from 8 to 9 November 2011 by providing required information and food waste.

(c) **<u>Waste Audit</u>**

CDFO initiated waste audit in CityU and trained a group of environmental protection ambassadors of the Environmental Protection Society of SU to conduct audit on all the waste generated from all lecture theatres on Floor 4 and some classrooms on Floor 5, AC1 for the period from October to November 2011.

The collected waste was sorted to paper (recyclable), paper (non-recyclable), plastic bottles, plastic (recyclable), plastic (fork, spoon), aluminium cans, metal, glass bottles (beverage, wine), glasswares (other than glass bottles), wood, styrofoam, food and others and then weighted. The analysis revealed that about 50% recyclables including paper, plastics, aluminium cans and other recyclables were ended up in garbage bin instead of recycling bins.

(d) Guided Tours

In coordination with the Environmental Protection Society of SU, CDFO provided guided tours to the environmentally friendly facilities of CityU to primary students, CityU staff and CityU students, and also provided training to student environmental protection ambassadors of CityU to train them as tour guides to lead guided tours for interested staff and students CityU and members of the public.

2.2 Contribution to Student Learning and Teaching

(e) Internship Programme

Four students of SA majoring in environmental policy studies had the opportunity to benefit from the 6-week in-house internship programme (which was credit bearing) offered by CDFO from 7 June to 15 July 2011. Each of them had been assigned with specific focus area to conduct carbon auditing on campus. Introduction of indoor air quality and on-site measurement technique were also given / shown to the students (see photo). The internship was highly valued by the staff and students.

(f) Participated in the academic research study headed by a professor in the School of Energy and Environment (SEE) on "Carbon footprint benchmarking of buildings in Hong Kong" commissioned by the Environmental Protection Department of the HKSAR Government for development of the overall and sector-specific carbon footprint benchmarks and improvement of carbon auditing practices and the quality of future carbon audit reports in general.

(g) 6 students of the Department of Management Sciences (MS) were met and supplied with detailed information on the "Cutting Food Waste" campaign of CityU for them to propose their coursework group project.

(h) A group of BCH students working on a group project was provided with waste collection data for them to make a short documentary on waste generation and solution on CityU campus.

(i) A student of the Department of System Engineering & Engineering Management of Shaw College of the Chinese University of Hong Kong was provided with detailed information and a brief site visit of the food waste recycling system in CityU to enable her to propose a food waste recycling system for Shaw College.

2.3 Collaboration with Others

(j) **<u>VTC's Symposium on Good Environmental Practices for Office / Campus Operation</u>**

In response to the invitation of the Corporate Environmental Office of Vocational Training Council, we participated in their "Symposium on Good Environmental Practices for Office / Campus Operation" held on 23 May 2011 and presented a paper entitled "ISO 14001 EMS and its Implementation in CityU" to over 100 VTC staff to showcase CityU's experience and achievements.

(k) **Talk on "Low Carbon Office"**

As part of the University's promotion of a low carbon / sustainable campus, talks on "Low Carbon Office" were conducted jointly with World Wildlife Fund Hong Kong on 10 and 17 January 2011 to promote adoption of green practices amongst staff and students.

(l) **Environmental Roving Exhibition of Environmental Protection Department of HKSAR Government**

The captioned Exhibition, which showcases the work of EPD and its commitment in enhancing the environment and quality of life for the people of Hong Kong, was organized and held in U-Concourse during the Orientation Week between 22 and 25 August 2011.

(m) A one and a half years' "Zero Food Waste in CityU" campaign proposal was jointly formulated with Greeners Action for submission to the Environment and Conservation Fund for funding to promote reduction of food waste on campus.

(n) Information on the Power Management (smart metering) System being used on CityU campus supplied to a professor of the Department of Civil and Architectural Engineering (CA) for his presentation.

(o) **Hong Kong Electric Vehicle Exhibition**

Attended the Opening Ceremony of Hong Kong Electric Vehicle Exhibition held on 24 October 2011, which aims to feature the latest electric vehicles (EV) and charging technologies available in Hong Kong and to promote the wider use of EV in Hong Kong.

(p) Green Tour of Fuji Xerox (HK) Ltd.

A joint tour of the local universities to the recycling centre of Fuji Xerox (HK) Ltd. was held on 2 September 2011. The recycling centre adopts "zero landfill" concept by reusing all parts of spent photocopiers and toners in their products.

Spent toners and parts of copiers packed for sending to Thailand for reuse

(q) Hong Kong No Air-Con Night

The "Hong Kong No Air-con Night 香港無冷氣夜" campaign organized by the Green Sense held on 29 September 2011 was a 12-hour-long air-conditioning out action starting from 7:00 p.m. to encourage the whole society to save energy. More than 100 students residing at Student Residence participated in the event.

CityU actively supported the event by raising the indoor temperature in some communal areas on CityU campus - lecture theatres, Library, Sports Complex, Canteen and Wei Hing Theatre – to 25°C to lower power consumption. The chilled water supply for public areas was also shut off.

2.4 Enhancing Community Awareness

(r) A CityU Announcement Portal (CAP) on "Saving of Resources" was issued to all staff and students to seek their support and cooperation to implement green practices regarding the awareness of paper and resources saving.

(s) In order to promote the CityU environmentally friendly facilities to students, a webpage entitled "Reducing CityU's Environmental Impact" accessible by QR Code created. Since it was established in August, 2011, the website had been hit over 3,200 times by the University community.

(t) **<u>WWF Earth Hour 2011</u>**

As in the past, CityU continued participating in the "WWF Earth Hour 2010" campaign 26 March 2011. Staff and students were encouraged to support this meaningful event by turning off lights in office and at home with the aim to arouse awareness on global warming, energy saving, and reducing emission of pollutants and greenhouse gases.

(u) **<u>Power Smart Contest 2011</u>**

CAPs were issued to encourage CityU's staff, students and their families to participate in the "Power Smart Contest 2011 知慳惜電節能比賽" organized by the Friends of the Earth, which aims at arousing public awareness to climate change.

(v) **<u>"CityU - Cutting Food Waste" Campaigns</u>**

Two campaigns orchestrated by representatives from the Environmental Protection Society of Students' Union, Dean of Students, SDS, Student Residence Office (SRO), Finance Office (FO), Office of Chief Administration Officer (OCAO), CDFO and Communications and Public Relations Office (CPRO) were conducted separately in March and September, 2011 to promote food waste reduction in CityU.

3. Achievements

Evidence of our efforts to create a low-carbon campus being widely recognized is clearly seen in the many awards received.

3.1 ISO 14001 : 2004 Certification

Certified to be in compliance with the requirements of ISO14001 EMS for the 10th year, which is a recognition of CDFO's commitment in applying internationally recognized green practices at work.

3.2 Certificate of Fresh Water Plumbing Quality Maintenance Recognition Scheme

Gold certificate was awarded for the second year for our dedication to maintain good water quality to the University community through proper maintenance of water tanks, pumps and water pipework in buildings, satisfing the prescribed requirements of the Fresh Water Plumbing Quality Maintenance Scheme of the Water Supplies Department of the HKSAR Government.

3.3 Wastewi$e Label of the Hong Kong Awards for Environmental Excellence (HKAEE)

The CDFO won the Class of Excellence Wastewi$e Label for the ninth years, which recognized the Office's outstanding performance in waste reduction and environmental protection.

3.4 2010 Hong Kong Awards for Environmental Excellence (HKAEE)

The CityU was again awarded a Certificate of Merit under the Sectoral Awards of the 2010 HKAEE from the Environmental Campaign Committee in recognition of the all-round and outstanding environmental performance within the public sector.

3.5 Commendation Scheme on Source Separation of Commercial and Industrial Waste

The CityU was awarded the "Bronze Award" of the other building types of the captioned programme organized by the Environmental Protection Department of the HKSAR Government in recognition of our consistent effort in carrying out waste separation and recovery arrangements.

4. The Way Forward

The third 3-year Energy Saving Plan for 2012 – 14 has been devised by CDFO and made known to the Environment Committee at its 3rd Meeting held on 26 October 2011, which targets to save 6% of energy consumption using 2011 as the baseline. With the support of the University community, we shall strive to surpass this target.

While sustainability development requires vigorous efforts from every member of the University and the community, at institutional level CDFO aims to manage challenges of supporting the University in creating a low-carbon campus by continually improving our environmental performance and, at Hong Kong level, by sharing our expertise not only with the stakeholders of CityU but also interested members of the public to raise their awareness of CityU's initiatives exemplifying how our campus proactively supports the environmental protection commitment.

Appendix I

Appendix I

Top Ten Departments Making the Most Requests for Additional Air-conditioning and Lighting Provisions

Rank	2009			2010			2011		
	Department	Total number of service requests	Total hours extended	Department	Total number of service requests	Total hours extended	Department	Total number of service requests	Total hours extended
1	SU	443	3,934.5	SU	628	5,648.0	SU	108	930.3
2	EE	354	1,368.0	EE	181	554.5	EE	200	749.8
3	EF	101	810.0	EF	62	430.5	EF	162	565.0
4	CTL	115	579.0	MEEM	97	266.5	SS	159	477.3
5	CS	140	553.0	CTL	68	235.5	SLW	188	455.4
6	EN	96	472.0	SS	67	218.0	MA	45	336.0
7	BCH	99	466.0	BCH	34	205.0	AC	91	318.8
8	MEEM	109	360.0	MGT	56	168.0	CTL	84	283.2
9	SA	99	358.0	EN	35	149.0	CS	53	271.1
10	MGT	125	352.0	CS	49	144.0	MS	84	233.2
Total number of hours extended for the year	10,878.5			8,019.0			4,620.1		
Total number of service requests for the year	2,417.0			1,277.0			1,174.0		
The month of highest extended hours	Jan			August			October		

Appendix II

Appendix II

Performance Report

on

Greenhouse Gas (GHG) /

Carbon Reduction

for

City University of Hong Kong Campus

2011

1. Reporting Entity

This is the Performance Report on Greenhouse Gas (GHG) / Carbon Reduction for City University of Hong Kong (CityU) Campus 2011 prepared by the Campus Development Facilities Office, City University of Hong Kong.

2. Campus Development Facilities Office (CDFO)

The CDFO is charged with the responsibility for administering, managing and coordinating all efforts related to the provision of the required facilities and support services to meet the strategic objectives of the University whose occupiers include students, faculties, staff, staff of affiliated business entities, workers of contractors, and visitors. The affiliated business entities include bank, bookstore, caterers, and health centre. The contractors include the companies who provide the services for cleaning, security, maintenance and construction works.

Energy management and environment protection are part of the duties of CDFO. CDFO had represented the University to sign the Carbon Reduction Charter which was organized by Environmental Protection Department of the HKSAR Government in July 2008. Commitment is made to conduct carbon audit on campus buildings on a yearly basis and to improve the GHG performance.

3. Reporting Period

This report covers the period from 1 January to 31 December 2011.

4. Scope of Physical Boundaries

(a) The physical boundaries for this report include the Campus of the City University of Hong Kong which comprises the following:

- Academic 1, Administration Buildings, Sports Complex and Amenities Building within the Site Lot at 83, Tat Chee Avenue, Kowloon Tong.
- To Yuen Building within the Site Lot at 31, To Yuen Street, Kowloon.

(b) These buildings are mainly used for the following functional purposes:

- Academic 1: offices, lecture theatres, classrooms, library, computer rooms, plant rooms, machine rooms, workshops, laboratories and research centres.
- Administration Buildings: offices, laboratories, conference rooms, classrooms, workshops, reading room, machine rooms and plant rooms.
- Sports Complex and Amenities Building: sports halls, student activities rooms, exhibition rooms, health centre, canteen, restaurants, and offices.
- To Yuen Building: offices, meeting rooms and conference rooms.

(c) The gross floor areas of the reporting buildings are summarized as follows:

Building	**Approx. Gross Floor Area (GFA) (m^2)**
Academic 1, Administration Buildings, Sports Complex and Amenities Building	159,471 m^2
To Yuen Building	6,638 m^2

(d) The Academic Exchange Building, Academic 2, Run Run Shaw Creative Media Centre, Student Residence and all off-campus premises are excluded for carbon accounting in this report.

5. Scope of Operational Boundaries

The carbon accounting in this report will include:

a) Scope 1 (Direct Emissions) Activities

- Stationary Combustion Sources: emergency genset, and towngas-driven dehumidifiers;
- Mobile Combustion Sources: car fleet serving staff and logistics; and
- Fugitive Emissions: Air-conditioning equipment.

The following will be excluded:

- Motor vehicles operated by outsourced contractors for any activities associated with CityU;
- HFCs and PFCs emissions from laboratory equipment; and
- HFCs and PFCs emissions from refrigeration and air-conditioning equipment which are removed from Campus for disposal.

b) Scope 2 (Energy Indirect Emissions) Activities

- Electricity purchase from China Light and Power Company (CLP).
- Towngas purchased from the Hong Kong and China Gas Company (HKCG).

c) Scope 3 (Other Indirect Emissions) Activities

- Methane gas generation at landfill due to disposal of paper waste
- GHG emissions due to electricity used for fresh water processing by WSD
- GHG emissions due to electricity used for sewage processing by DSD

6. Methodologies for quantifying emissions and removals

a) The calculation of scope 2 energy indirect emissions is based on the information from CLP electricity bills, HKCG towngas bills, and Water Supplies Department water bills.

b) In the lack of accurate information on the paper purchase and inventory, the quantity of paper waste is estimated based on paper collected for disposal and recycling.

7. Information on GHG emissions and removals

The results for GHG emissions and removals for scope 1, scope 2 and scope 3 activities are shown in the Summary Table with detailed calculations shown in Tables 1 – 9 attached.

8. Information on GHG emissions and removals over time

The report format, methodology of accounting and carbon calculations is based on the 'Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Buildings (Commercial, Residential or Institutional Purposes) in Hong Kong, 2008 Edition' issued by Environmental Protection Department of the HKSAR Government.

9. Information on GHG offsets and programmes

(a) The part of GHG emissions due to the electricity and towngas consumption will be sent to Tertiary Education Facilities Management Association (TEFMA) each year. The information will be published in the annual benchmark survey to all member institutions of TEFMA for reference.

(b) Apart from the figure on net carbon emission, the kg. CO_2-e/floor area and kg. CO_2-e/person will be used as the ratio indicators to measure performance.

(c) A 3-year (2009-2011) Plan was formulated to reduce the annual carbon emission by 4% by end of year 2011, using the emissions in year 2007 as the 'baseline'. A campus-wide energy audit has been conducted and completed in March, 2011.

(d) In year 2009, 35 nos. "vacuum type" solar panels (with daily solar energy collection in average total capacity of 85 kWh) were installed on roof of Amenities Building to generate hot water as supplementary heating for shower rooms in Sports Complex.

(e) It was already a practice adopted by the University to collect paper separately for recycling in the waste disposal process.

10. Contact Persons

This report was prepared by the CDFO of the University. Any queries or suggestions can be directed to Mr. P.K. Chan at 3442 6908 or Mr. Tony Tung at 3442 6850 or write to fmwork@cityu.edu.hk.

Summary Table on Greenhouse Gas (GHG) Emissions and Removal
for Campus of City University of Hong Kong for 2011

Updated : 13 Mar 2012

Description (by sources, areas, etc.)	Emissions by gas type [(in tonnes of CO_2-equivalent) (CO_2-e)]					
	Carbon dioxide (CO_2)	Methane (CH_4)	Nitrous oxide (N_2O)	Hydrofluoro-carbons (HFCs)	Perfluoro-carbons (PFCs)	Total
Scope 1 Direct Emissions						
Stationary Combustion Sources						
Standby-generator	0.303224	5.82204E-05	0.000266104	**N/A**	**N/A**	0.304
Dehumidifier in CS laboratory	0.36032	0.000119885	0.000392832	**N/A**	**N/A**	0.361
Mobile Combustion Sources						
Vehicle	55.31346408	0.098524322	6.084053685	**N/A**	**N/A**	61.496
Fugitive Emissions						
Refrigerant used in A/C plant	**N/A**	**N/A**	**N/A**	160.23		160.230
Other Direct Emissions						
NIL						0.000
Scope 1 Emissions Total	55.97700808	0.098702427	6.084712621	160.23		***222.390***
Scope 1 Direct Removals						
Planting of Additional Trees based on year 2007						
Campus	-2.116	**N/A**	**N/A**	**N/A**	**N/A**	-2.116
Other Direct Removals						
Wind & solar light tower	0.054					0.054
Vacuum tube solar panel for shower	10.98					10.980
Scope 1 Removals Total	8.918	0	0	0	0	***8.918***
Scope 2 Energy Indirect Emission (To be reported in general without being classified into specific gas type)						
Electricity Purchased						
Campus						28,972.069
Towngas Purchased						
Campus						0.076
Scope 2 Emission Total						***28,972.145***
Scope 3 Other Indirect Emissions						
Methane Generation at Landfill due to Disposal of Paper Waste						
Campus	**N/A**	No data	**N/A**	**N/A**	**N/A**	No data
Electricity for Processing Fresh Water (To be reported in general without being classified into specfic gas type)						
Campus						73.931
Electricity for Processing Sewage (To be reported in general without being classified into specfic gas type)						
Campus						30.523
Others						
NIL						0.000
Scope 3 Emissions Total						***104.454***
Other GHG Offsets / Removals						
On-site Renewable Energy Sources for Off-site Uses						
NIL						***0.000***
Off-site GHG Reduction Projects in Hong Kong						
Waste paper for recycling		868.7808				***868.781***
Off-site GHG Reduction Projects outside Hong Kong						
NIL						***0.000***

Summary of Results

Total Scope 1 Emissions :	**222.390**	Tonnes of CO_2-e
Total Scope 1 Removals :	**8.918**	Tonnes of CO_2-e
Total Scope 2 Emissions :	**28,972.145**	Tonnes of CO_2-e
Total Scope 3 Emissions :	**104.454**	Tonnes of CO_2-e
Total other GHG Offsets / Removals :	**868.781**	Tonnes of CO_2-e
Total Net GHG Emissions :	**29,290.071**	Tonnes of CO_2-e
GHG Performance in Ratio Indicator :	**1.137**	Tonnes of CO_2-e / person
	0.176	Tonnes of CO_2-e / m^2

Table 1 : GHG Emissions from Stationary Sources for 2011

Step 1	Step 2			Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
A	B	C	D	E	F	G	H	I	J
Source description with location (e.g. boilers, furnances, ovens, and emergency electricity generator etc.)	Fuel Information			CO_2 emission factor	CO_2 emissions in tonnes of CO_2 equivalent ((B x E) / 1000)	CH_4 emission factor	CH_4 emissions in tonnes of CO_2 equivalent ((B x G) / (1000 x 1000) x GWP)	N_4O emission factor	N_2O emissions in tonnes of CO_2 equivalent ((B x I) / (1000 x 1000) x GWP)
	Fuel used		Fuel type						
	Amount	Unit							
Standby-generator	116	litre	diesel oil	2.614	0.303224	0.0239	5.82204E-05	0.0074	0.000266104
Dehumidifier for CS Laboratory at Floor 2, Administration Building	128	48MJ	Towngas	2.815	0.36032	0.0446	0.000119885	0.0099	0.000392832
Total					**0.663544**		**0.000178105**		**0.000658936**

Note : The towngas being consumed by commercial sector (caterer) is not included.

Table 2 : GHG Emissions from the Mobile Sources for 2011

Step 1	Step 2		Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
A	B	C	D	E	F	G	H	I
Source description (by different vehicle and fuel tpyes)	Fuel Information		CO_2 emission factor [Note 1]	CO_2 emissions in tonnes of CO_2 equivalent ((B x D) / 1000)	CH_4 emission factor [Note 2]	CH_4 emissions in tonnes of CO_2 equivalent ((B x F) / (1000 x 1000) x GWP [Note 4])	N_2O emission factor [Note 3]	N_2O emissions in tonnes of CO_2 equivalent ((B x H) / (1000 x 1000) x GWP [Note 4])
	Amount of fuel used (in litres)	Fuel type						
Road Transport(vehicle no.)								
MH4999 passenger car	2372.38	petrol	2.36	5.599	0.253	0.013	1.105	0.813
LY7643 passenger car	2355.27	petrol	2.36	5.558	0.253	0.013	1.105	0.807
FL8988 passenger car	2494.69	petrol	2.36	5.887	0.253	0.013	1.105	0.855
MU6235 passenger car	2865.18	petrol	2.36	6.762	0.253	0.015	1.105	0.981
KP8936 passenger car	1545.12	petrol	2.36	3.646	0.253	0.008	1.105	0.529
FY880 passenger car	2450.74	petrol	2.36	5.784	0.253	0.013	1.105	0.840
JW7858 passenger car	1633.57	petrol	2.36	3.855	0.253	0.009	1.105	0.560
GG7750 medium goods vehicle	2922.66	diesel oil	2.614	7.640	0.145	0.009	0.072	0.065
HS783 (Nissan) van	2208.11	diesel oil	2.614	5.772	0.072	0.003	0.506	0.346
EK1983(Hiace) van	1839.95	diesel oil	2.614	4.810	0.072	0.003	0.506	0.289
Navigation								
NIL								
Aviation								
NIL								
Total				**55.313**		**0.099**		**6.084**

Table 3 : HFC and PFC Emissions from Refrigeration / Air-conditioning Equipment (Operation Process) for 2011

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
A	**B**	**C**	**D**	**E**	**F**	**G**
Type of refrigerant	Amount of HFC / PFC at the beginning of the reporting period (kg)	Amount of HFC / PFC purchased during the reporting period (kg)	Amount of HFC / PFC disposed (through environmentally responsible means) during the reporting period (kg)	Amount of HFC / PFC at reporting period (kg)	GWP of refrigerant	HFC / PFC emissions in tonnes of CO_2 equivalent ((B + C - D - E) x F / 1000)
R22	9	13	9	13	0	0
R407C	11	33	33	11	1526	0
R407C	105				1526	160.23
R22	102.3				0	0
Total						**160.23**

Note : R22 is not covered as recognized gases group in Kyoto protocol, the GWP is considered to be zero as stated in EPD's guideline.

Table 4 : Direct GHG Removals from Newly Planted Trees for 2011

Step 1	Step 2	Step 3	Step 4	Step 5
A	**B**	**C**	**D**	**E**
Source description (Location of the trees planted)	No. of trees planted (unit)	No. of trees removed (unit)	CO_2 removal factor [Note] (kg/unit/year)	CO_2 removals in tonnes of CO_2 equivalent ((B-C) x D / 1000 x length of reportingperiod (in years))
Within physical boundary of the Campus as defined	5	97	23	-2.116
Total				**-2.116**

Note : 1. The default figure for the removal potential of each unit of tree is trees commonly found in Hong Kong which are able to reach at least 5 metres in height.

2. The nos. of trees planted or removed in step 2 and 3 are based on year 2007.

Table 5 : GHG Emissions from Electricity Purchased from Power Companies for 2011

Step 1	Step 2	Step 3		Step 4	
A	**B**	**C**		**D**	
Facility / source description (i.e. Area / facilities the electricity bill is reporting)	Amount of electricity purchased (in kWh)	Emission factor (kg / kWh)		Indirect GHG emissions in tonnes tonnes of CO_2 equivalent	
		Power company - specific	Territory-wide default value	Power company - specific	Territory-wide default value
Academic Building, Administration Building, Amenities Building and Sport Complex	47,765,840	0.59	0.7	28,181.846	33436.088
To Yuen Building	1,339,361	0.59	0.7	790.223	937.5527
Total				**28,972.069**	**34373.6407**

Note : The electricity being consumed by commercial sector (caterer, bank and bookshop) is not included.

The Power company specific emission factor 0.59 is extracted from CLP Substantiability Report 2011.

Table 6 : GHG Emissions from Towngas Purchased from the Hong Kong and China Gas Company for 2011

Step 1	Step 2	Step 3	Step 4
A	**B**	**C**	**D**
Facility / source description (i.e. Area / facilities the Towngas bill is reporting)	Amount of Towngas purchased (Unit [Note])	Emission factor (kg / Unit)	Indirect GHG emissions in tonnes of CO_2 equivalent (B x C / 1000)
Dehumidifier for CS Laboratory at Floor 2, Administration Building	128	0.595	0.076
Total			**0.076**

Note : Each unit registered by gas meter represents that the town gas with a heat value of 48 MJ. The emission factor only accounts for the emissions during the production of Towngas within the company. The GHG emission associated with combustion of Towngas within the physical boundary is reported under Scpoe 1.

Table 7 : Methane Generation at Landfill in Hong Kong due to Disposal of Paper Waste for 2011

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
A	B	C	D	E	F	C
Source description (i.e. Area / floor)	Amount of paper in storage at the beginning of the reporting period (kg)	Amount of paper purchased during the reporting period (kg)	Amount of paper collected for recycling during the reporting period (kg)	Amount of paper in storage at the end of the reporting period (kg)	Emission factor (kg CO_2-e / kg of waste) Note 1	Indirect emissions in tonnes of CO_2 equivalent ((B + C - D - E) x F / 1000)
Campus	0	180996 Note 2		0	4.8	-868.7808
Total						**-868.7808**

Note 1 : For simplifying the accounting process, the default emission factor assumes that the total **raw amount of CH4 emitted throughout the whole decomposition process of the paper waste disposed at** landfills will be emitted into the atmosphere within the same reporting period as paper waste collected. In addition, the default value does not take into account the reduction in emission due to collect, recovery and utilization of landfill gas due to the management practices at landfills.

Note 2 : The quantity is based on the amount of waste paper collected for recycling. The amount of GHG avoided is also reported as part of the off-site GHG emission reduction efforts.

Table 8 : GHG Emission due to Electricity Used for Fresh Water Processing by Water Supplies for 2011

Step 1	Step 2	Step 3	Step 4
A	**B**	**C**	**D**
Source description (i.e. Area / facilities the water service bill is reporting)	Amount of water consumed as listed on the water service bill (m^3)	Emission factor (kg / m^3) Note	Emission in tonnes of CO_2 equivalent (B x C / 1000)
Academic Building, Administration Building, Amenities Building and Sport Complex	177752	0.4137	73.536
To Yuen Building	955	0.4137	0.395
Total			**73.931**

Note : 1. The emission factor used for year 2007 is 0.4137 kg CO_2-e /m^3, which is the approximation provided by EPD's guideline.

2. The fresh water being consumed by commercial sector (caterer) is not included.

Table 9 : GHG Emission due to Electricity Used for Sewage Processing by Drainage Services Department for 2011

Step 1	Step 2	Step 3	Step 4
A	**B**	**C**	**D**
Source description (i.e. Area / facilities the water service bill is reporting)	Fresh water consumption (m^3)	Default Emission factor (kg / m^3) Note	Emission in tonnes of CO_2 equivalent (B x C / 1000)
Academic Building, Administration Building, Amenities Building and Sport Complex	177752	0.1708	30.360
To Yuen Building	955	0.1708	0.163
Total			**30.523**

Note : The default emission factor is determined according to the purpose of water used as follows:

Source description	Default Emission Factor (kg / m^3)
Restaurants and catering services	(0.7 x Emission Factor) assuming 70% of the fresh water consumed will enter the sewage system.
Other commercial, residential and institutional purposes	(1.0 x Emission Factor) assuming 100% of the fresh water cosumed will enter the sewage system.

In which emission factor is the emission factor of GHG emissions due to electricity used for processing fresh water derived from the following equation :
Emission Factor = Unit electricity consumption of processing sewage (from DSD) x Territoy-wide default value (i.e. 0.7kg /kWh) of purchased electricity provided in Table 5.
The emission factor used for year 2007 is 0.1708 kg CO_2-e / m^3 which is the approximation provided by EDP'S guideline.

Note : The fresh water being consumed by commercial sector (caterer) is not included.