CDFO

香港城市大學
City University of Hong Kong
專業 創新 胸懷全球
Professional·Creative
For The World

Campus Development and Facilities Office
Environmental Report 2014-15

校園發展及設施管理處

拾荒者年報

Working together for a Sustainable Campus

November 2015

Table of Contents

Message from the Director

I am pleased to present Campus Development and Facilities Office's (CDFO) Environmental Report 2014–15 and would like to take this opportunity to thank each and everyone in CDFO for their dedication and support in maintaining a strong focus on environmental issues throughout 2014–15.

We started saving energy since mid-1990 when green issues were far less prominent. We had the apparent foresight to address the issue and identified sustainability as a major component in CDFO's work portfolio.

Knowing the fact that our works have a huge influence over the energy use, GHG emissions, water use, thermal comfort, pollutions and other sustainability outcomes of campus buildings and grounds, to deliver a more sustainable campus has long been at the forefront of CDFO's work priority.

Throughout the reporting period, we have been helping to establish the University's Sustainability Strategic Plan and 2015 - 2020 Environmental Targets.

While CDFO strives to promote and contribute towards the University's sustainability strategic plan and targets, the key to the success in the sustainability development of the University lies in the University community. By cultivating the correct attitude through a clear policy and management commitment, I am confident that environmental performance of the University can scale to new heights.

Apart from giving an account of CDFO's performance, we wish that our work would arouse interests of the University community for possible collaboration to achieve integrated results and share accountability. Anyway, 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.

Ir K Y Wong
Director of Campus Development and Facilities

City University of Hong Kong
83, Tat Chee Avenue
Kowloon Tong, Kowloon
Email: fmky@cityu.edu.hk

2014 - 2015 Environmental Performance Highlights

Being an ISO14001 certified office for the 14 consecutive years and several environmental awards receiver, CDFO has achieved the following in 2014 - 15 :

Waste Recycling

- Initiated collection of Chinese New Year peach blossoms for recycling.
- Saved over 496 tonnes of solid wastes through recycling.
- Achieved saving of over HK$1.2 million through renew / repair of equipment and salvage of building materials.

Energy Conservation

- Consumed 230,000 kWh less of energy in AC2 and CMC (or reduction of 117 tonnes CO_2-e).

Water Conservation

- Recycled 5,062 m^3 of grey water for irrigation.

Contribution to Teaching

- Conducted more than 12 green talks and green campus tours for over 300 students.

Awards

- Won the Class of Excellence Wastewi$e Label in succession of 13 years and a total of 29 targets achieved.
- Awarded an Honorary Certificate by the HK Environmental Protection Association and EPD for support of the Chinese New Year Peach Blossoms Recycling Campaign.

1. Waste Management

1.1 Solid Waste

In order to uphold the University Charter of Social Responsibility, CDFO endeavours to promote and implement 6 "R" in waste management to conserve resources: reduce, reuse, recycle, replace, renew and responsible use of natural resources.

(a) Reuse

- Used Furniture

Reused 34 used wooden benches and 76 used PVC chairs in common areas of AC2.

Non-rectangular table collected from the reinstatement works of Hong Kong Science Park was re-use in new meeting room of MMW Building

Door closers dismantled from the renovation works of 5/F, CYC Building were re-used in various locations on campus

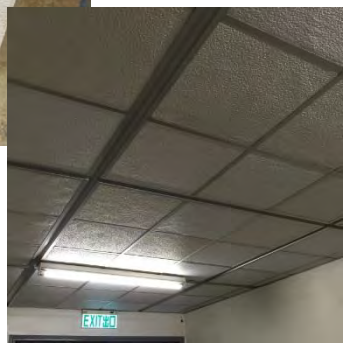
Carpet tiles in good condition dismantled from the renovation works of 5/F, CYC Building were re-used to replace the stained or dirty carpet tiles in various locations on campus

Approximate 50 sets of door locks, door closers, handles, hinges, etc. dismantled from the renovation works of 5/F, CYC Building and FYW Building were re-used at Red Zone corridor of AM Building

False ceiling panels in good condition dismantled from the renovation works of 6/F & 7/F, AC3 were re-used to replace the worn or old ceiling tiles at 5/F, AC3

Office partitions dismantled from the renovation works of TYB were re-used at 7/F-9/F, TYB

Alarm locks dismantled from the reinstatement works of Festival Walk were re-used at CYC Building



False ceiling panels in good condition dismantled from the renovation works of 5/F, CYC Building were re-used to replace the worn or old panels at 3M/F, AM Building

- **Salvaged Building Materials**

The following building services materials were salvaged for reuse, which contributes to not only saving resource and reducing waste but also reduction in cost of about HK$74,100.

Sump pit submersible pumps / control panels / fittings from AC3

300-litre pneumatic pressure vessels from pump room of Student Residence

Motor of electric water control of fan coil units from re-partitioning works of AC1

3 water pumps and non-return valves from fresh water booster pumps of pump room of AC1

A printed circuit board from a defective flow rate sensor of a chiller in Green Zone, AC1.

300-litre pressure vessel diaphragm of pump room of Student Residence

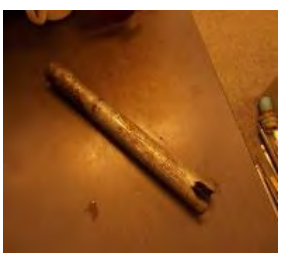
(b) Renew / Repair

We care about the scarcity of our landfill portfolio. Therefore, our scope and scale of repairing defective equipment parts / items and hence conserving resources was extended and a considerable number of building services materials were repaired and put back into service. An estimate of saving is around HK$1,109,100.

Equalizing ball filling valve was overhauled

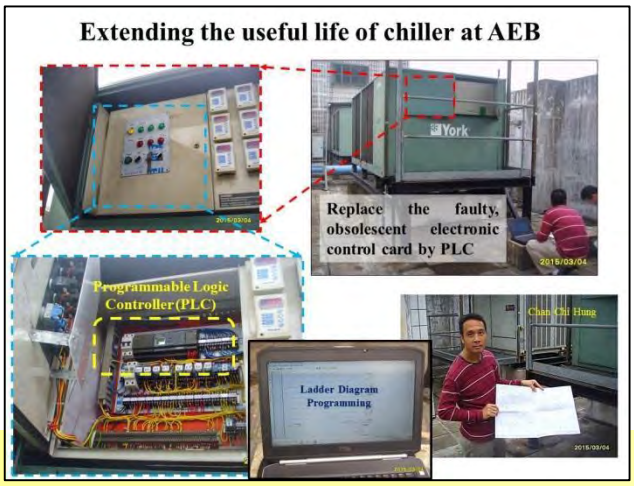
Ball filling valve of roof fresh water tank of AM Building was overhauled

Flush water ball filling valve of the basement flush water tank at SC21, AC1 was re-conditioned



10 aging non-return valves of AC1 pump room were overhauled

The defective electronic control cards of chillers at AEB rooftop, AM Building, CMC & AC2 were retrofitted.



Failed LED light stripes of 285 nos. of EXIT light boxes at AC1, CYC Building, FYW Building, MMW Building public corridors were replaced, instead of replacing the whole EXT light boxes

8 wall-mounted ventilation fans of changing rooms and washrooms were repaired

Defective electronic control cards instead of replacement by OEM were repaired

(c) Recycle

- **Recovery of Solid Wastes**

CDFO is responsive to opportunities. In addition to collection of paper, aluminum cans, plastic bottles, printer cartridges, plastic bags, batteries, CDs, foams, mercury-containing florescent tubes and lamps, glass bottles, Lai See packets for recycling, peach blossom tree are the latest recyclable identified for recycling.

To echo the affirmation of the introduction of quantity-based municipal solid waste (MSW) charging in HKSAR, CDFO plans to carry out a MSW charging pilot trial on CityU Campus not only to prepare for the implementation of quantity-based MSW charging but more importantly to drive the behavioural changes of the University community in waste reduction and recycling.

Summary of Solid Wastes Recycled in CityU :

Reduced
216
tonnes
Solid wastes

	Year 2013 - 14	Year 2014 - 15
Waste paper recycled (kg)	173,770	182,637
Aluminum cans recycled (kg)	2063	1,654
Plastic bottles recycled (kg)	2714	2,427
Printer cartridges recycled (kg)	928	858
Compact discs recycled (kg)	57	11
Mercury-containing fluorescent tubes and lamps recycled (kg)	19,800	17,600
Green waste and plant trimmings reused (kg)	156	132
Glass bottles recycled (kg)	10,070	10,575
Rechargeable batteries recycled	360	370
Used Lai See Packets	70	80

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

- **Collection and Treatment of Hazardous Wastes**

As a tertiary institution equipped with various laboratories, workshops and clinics, it is unavoidable that hazardous wastes including chemical, clinical and radioactive wastes are generated from our daily teaching, research and operational activities on campus and off-campus.

Radioactive Waste Store

Chemical Waste and Clinical Waste Stores

To safeguard health and safety of the University community and prevent contamination of the environment, CDFO continues to coordinate the handling of these hazardous wastes. Relevant management plans and procedures have been formulated to facilitate staff and students to handle wastes in compliance with relevant statutory regulations and requirements.

The quantities of hazardous wastes responsibly disposed of in Year 2013 - 14 and Year 2014 - 15 are listed in the table below :

	Year 2013 - 14	Year 2014 - 15
Liquid Chemical Waste # (L)	11,920	13,405
Solid Chemical Waste # (kg)	20,340	18,260
Clinical Waste * (kg)	1,919	2,489
Liquid Radioactive Waste + (L)	27	35.5
Solid Radioactive Waste + (kg)	18.8	16.5

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).*

- **Recycling of Food Waste**

  Before 1 July 2014, food waste generated from catering outlets on campus was centrally organized and paid for by the University for recycling into fish feed. Since CDFO always makes use of each opportunity in applying green measures on campus, we initiated to include the requirements of sorting, collection and recycling of food waste in the catering services contract.

  Starting from 1 July 2015, all caterers on campus are required to collect food waste generated from their respective catering outlets and recycle it into fish / animal feed or fertilizer. CDFO now plays the role of monitoring. During the reporting period, CDFO inspected all the catering outlets to ensure that proper separation, collection and recording are carried out. In addition, site inspection was also conducted on all the food waste collection contractors who carry out food waste treatment for our caterers to ascertain that food waste collected from CityU is actually processed and recycled into fish / animal fed or fertilizer.

Trolleys of food waste

Food waste collected in a trolley

Prehandling of collected food waste

Fermentation tanks for treatment of food waste

Drying of fermented food waste

Dried food waste product

Pig feed in 25 kg packing ready for delivery

Summary of Food Waste Recycled :

	Year 2013 - 14	Year 2014 - 15
Food waste collected and recycled for making fish / animal feed or fertilizer (kg)	325,123	280,740

2. Air Quality Management

2.1 Outdoor Air Quality

(a) Vehicle Exhaust

CityU continues to replace vehicles of the University fleet with environmentally friendly / hybrid ones and those using Euro 5 fuels for vehicle emissions control.

Adequate maintenance service is provided in order to maintain high efficiency of the University fleet.

2.2 Indoor Air Quality (IAQ)

CDFO endeavors to maintain good IAQ by means of facility design and maintenance procedure to provide a hygienic, healthy and comfortable indoor environment to University building occupants. With our continuous efforts in improving the IAQ, air quality of the campus achieved requirements of Good Class of the IAQ Objectives recommended by the HKSAR Government including temperature, humidity, air movement, concentration of various air contaminants, etc. To further enhance IAQ, the following measures are emphasized:

(a) Maintenance of Hygienic and Pleasant Campus Environment

CDFO continues to work closely with the cleaning contractor to deliver a quality cleaning service to uphold the University's hygiene standards to support IAQ and minimize the potential effects of infectious disease.

(b) Maintenance of the Mechanical, Ventilation and Air Conditioning System

In order to maintain the operating efficiency of the ventilation system on campus, hygienic cleaning and drain pipe purging are regularly provided to all PAUs / AHUs, FCUs and their fans with air filters regularly cleaned or replaced.

3. Water Conservation, Consumption and Management

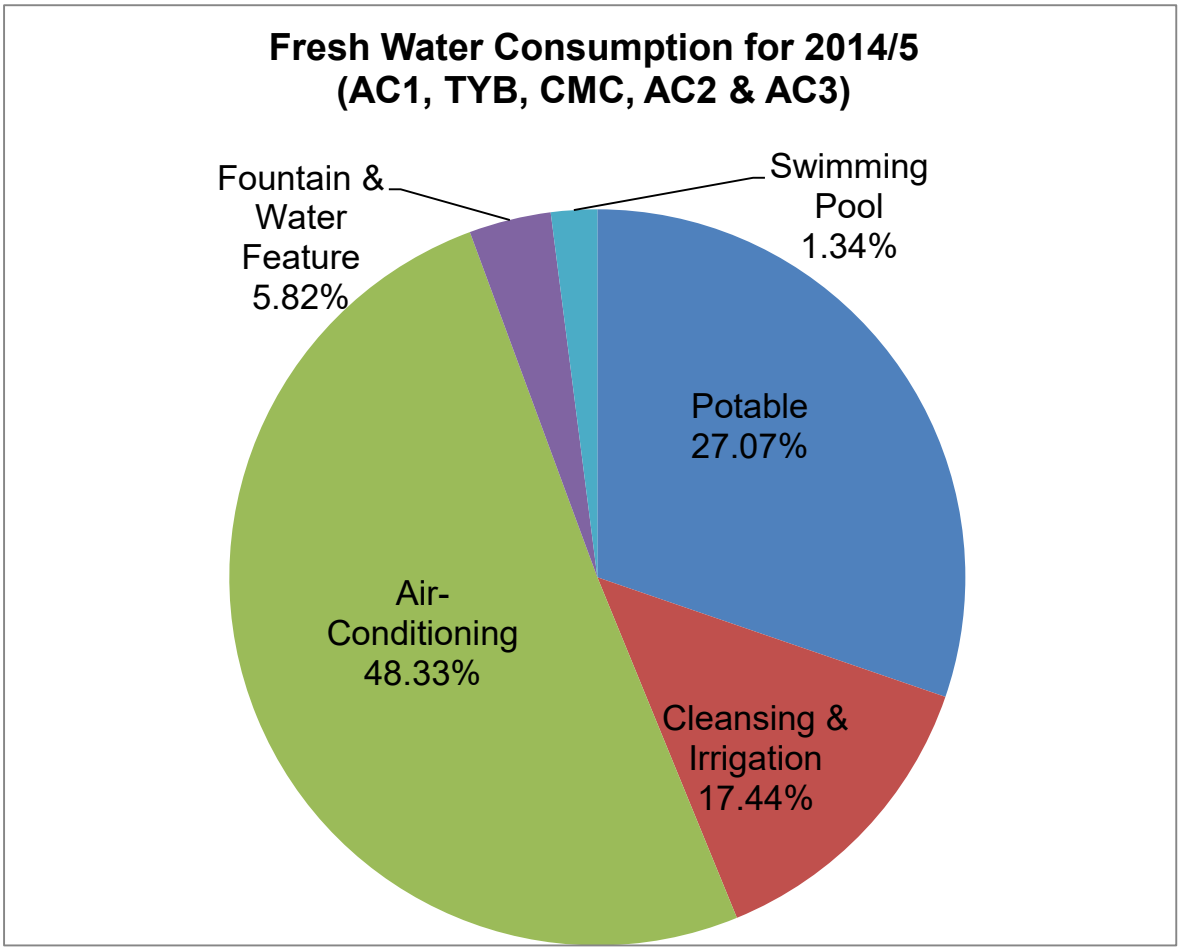
In 2014-15, the University has consumed 9.64% more water even though the number of students has decreased by 2.06% when compared with 2013-14. Almost half of the water consumed (48.33%) was used in water cooled chillers for air-conditioning. Water consumption in descending order was potable water, cleansing & irrigation, fountain and water features, and swimming pool.

3.1 Water Consumption and Management

The fresh water consumption on campus for various purposes in year 2014-15 is depicted in the following table and pie chart.

		2013-14		2014-15	
		m^3 (x1000)	%	m^3 (x1000)	%
1	Potable Water				
	Amenities Building & Sports Centre	12.14	6.82	13.21	6.76
	Academic 1 (AC1) & Administration Buildings	33.34	18.72	35.33	18.09
	To Yuen Building (TYB)	0.55	0.31	0.62	0.32
	Run Run Shaw Creative Media Centre (CMC)	0.87	0.49	0.72	0.37
	Academic 2 (AC2)	1.68	0.94	1.66	0.85
	Academic 3 (AC3)	1.21	0.68	1.31	0.67
	Subtotal	**49.79**	**27.96**	**52.85**	**27.07**
2	Cleansing & Irrigation				
	Amenities Building & Sports Centre	13.86	7.78	11.25	5.76
	AC1 & Administration Buildings	12.04	6.76	20.55	10.52
	TYB	0.09	0.05	0.09	0.05
	CMC	1.03	0.58	1.09	0.56
	AC2	0.37	0.21	0.37	0.19
	AC3	2.16	1.21	0.7	0.36
	Subtotal	**29.55**	**16.59**	**34.05**	**17.44**
3	Air-conditioning				
	AC1	61.84	34.72	65.36	33.47
	AC2	12.99	7.29	14.66	7.51
	AC3	7.71	4.33	14.35	7.35
	Subtotal	**82.54**	**46.34**	**94.37**	**48.33**
4	Fountain & Water Feature	**12.21**	**6.86**	**11.39**	**5.82**
5	Swimming Pool	**4.01**	**2.25**	**2.61**	**1.34**
	Yearly Total (x1000m^3)	**178.10**		**195.27**	
	Consumption / month (x1000m^3)	**14.84**		**16.27**	
	Consumption / day / person⁺ (litre)	**17.27**		**19.33**	

⁺ Note : The total number of staff and students in 2013-14 and 2014-15 are 28,261 and 27,679 respectively.



3.2 Water Usage Performance

Compared with that of year 2013-14, the annual fresh water consumption in year 2014-15 increased by 9.64% and the following particulars were observed :

(a) Potable water consumption increased by 6.15% due to increase of wet laboratory facilities.

(b) Cleansing and irrigation water consumption increased by 15.22% because more greening and roof garden areas have been built under UGC AA&I and Capital Works.

(c) Water consumption for the evaporative cooling tower of air-conditioning plant increased by 14.33% because some air-cooled chillers have been converted to water-cooled chillers, which had the added benefit of saving campus space.

(d) Water consumption of fountain & water features decreased by 6.72% due to suspension of fountain and water features for maintenance.

(e) Water consumption for water replenishment for swimming pool decreased by 34.91% due to defective water meter which had been replaced by Water Supplies Department of HKSAR Government.

3.3 Use of Waterless Urinal System

Despite the 'Desert Cube Waterless Urinal System' used in the urinals of heavily used male toilets has been converted back to sensor flushing during the reporting period due to their unsatisfactory performance for such situation, there were still more than 150 urinals in male toilets on campus still run on the System and a saving of over 7,776 m^3 of flushing water was achieved in 2014-15, representing an annual reduction in carbon emission of about 1.34 tonnes CO_2-e.

3.4 Potable Water Saving Measures

A total of 300 water saving aerators were installed for washbasin taps in toilets on the campus. An annual saving of about 9,720 m^3 of potable water was achieved, which is equivalent to an annual reduction in carbon emission of about 4.2 tonnes CO_2-e.

Before

After

3.5 Recycling of Grey Water

During 2014-15, we have recycled 5,062 m^3 grey water from water basin and condensate water from air-conditioning on the campus for irrigation. An annual saving of this volume of potable water is equivalent to an annual reduction in carbon emission of about 1.67 tonnes CO_2-e.

3.6 Reuse of Spent Swimming Pool Water

After closure of the Swimming Pool, in order to save valuable water resources, spent pool water of 1,800 m^3 was reused for cleansing of floor and ground, and flushing of toilets.

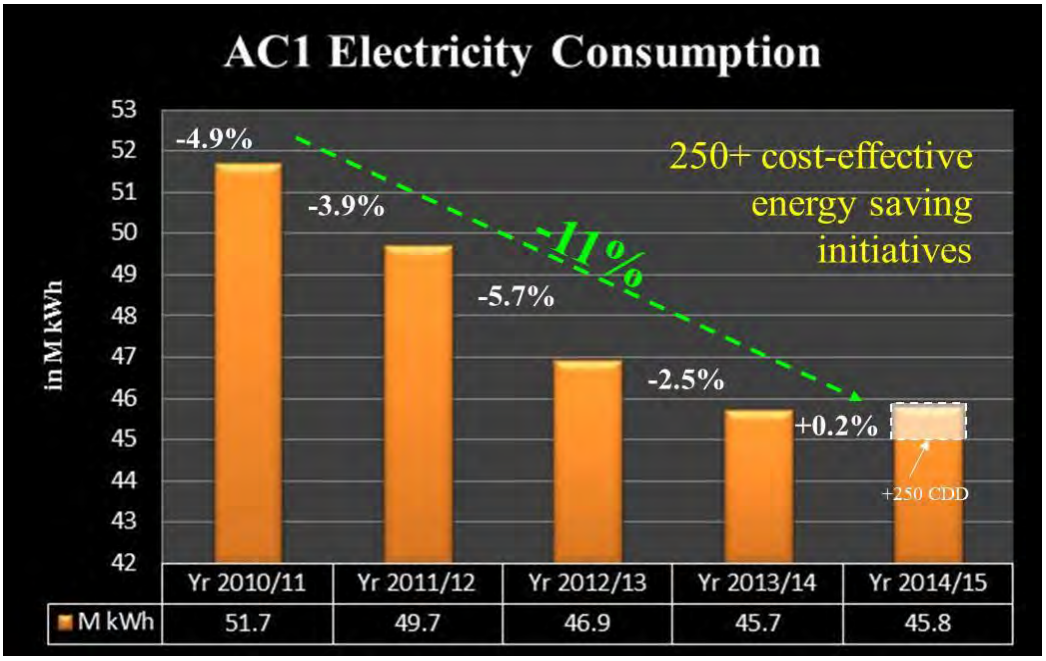
4. Energy Conservation

4.1 Annual Performance

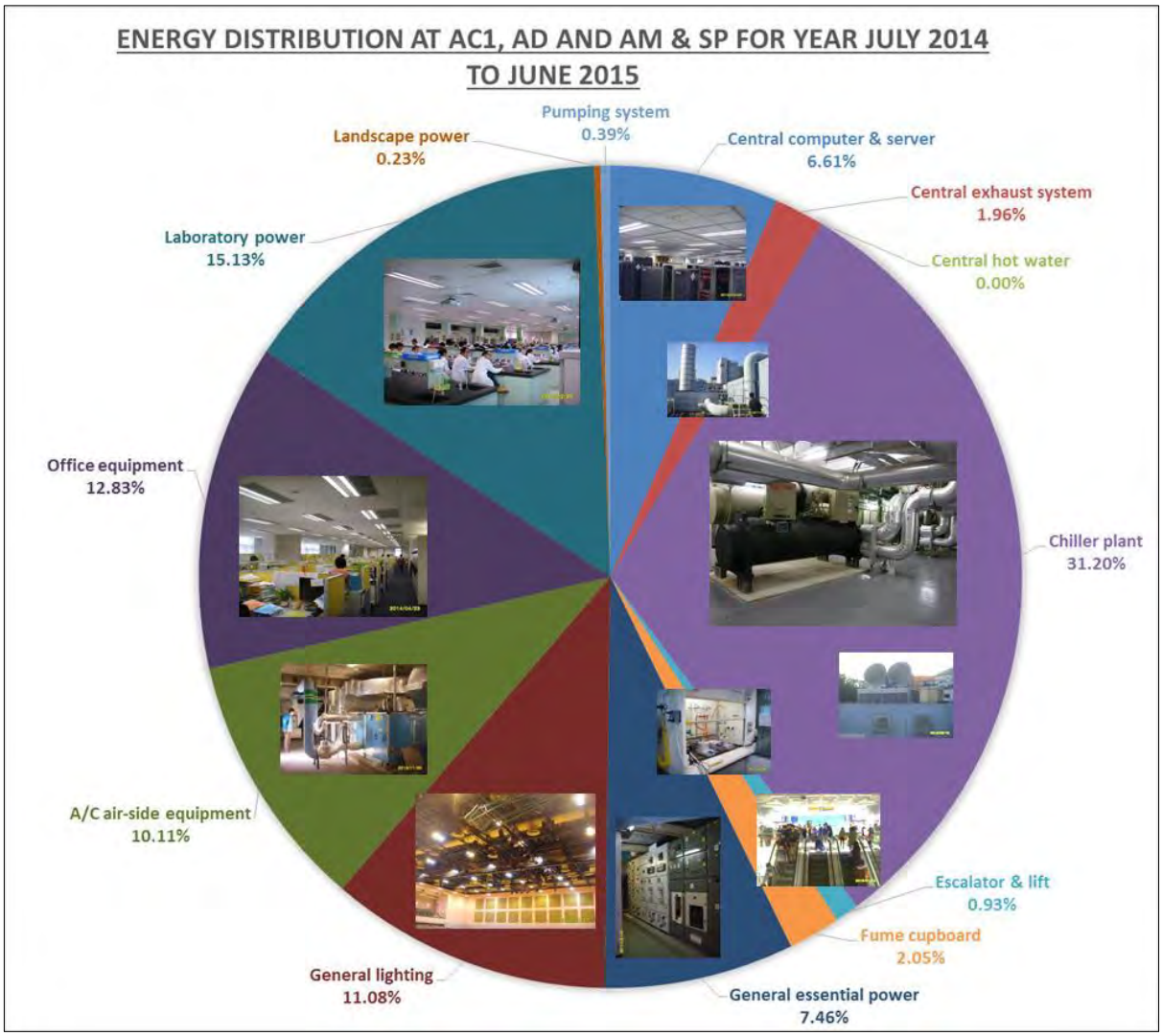
The total energy consumption of the buildings on campus for 2014-15 is 63 MkWh which is 0.8% higher than 2013-14. 2% of energy consumption was accounted for the increase of ambient temperature due to 250 more cooling-degree days. The energy consumption for individual building is tabulated as follows.

Building	MkWh	GFA (000'm²)	kWh/m²
AC1	45.8	159	288
AC2	5.9	40	148
AC3	6.2	42	147
CMC	5.0	24	212
Total	**63.0**	**265**	**238**

The performance of each building is : AC1, 0.2% increase; AC2, 1.5% saving; AC3, 12% increase; CMC, 2.8% saving. The AC1 performance trend over the past 5 years is shown below.



For AC1, the distribution of energy consumption is depicted in the chart below.



The top 5 equipments that consume most energy are :

- Chiller plant: 31.20%
- Laboratory power: 15.13%
- Office equipment: 12.83%
- General lighting: 11.08%
- A/C air-side equipment: 10.11%.

The relatively higher energy consumption (in kWh/m^2) in AC1 is mainly caused by more campus activities and laboratory-related operations at AC1. The laboratory energy consumption (estimated >25%) was attributed to 24-hour operation of fume cupboards and exhaust fans, air-conditioning equipment, and centralized chilled water supply system.

4.2 Energy Saving Initiatives

In 2014-15, CDFO implemented 64 improvement works (involving over 1,100 equipment items) to save energy. The annual energy saving was 1.5 MkWh (or 760 tonnes CO_2-e). Details are listed in the table. 60% energy saving is contributed from 20% equipment items, by fine-tuning operating hours and quantity of equipment to meet service demand.

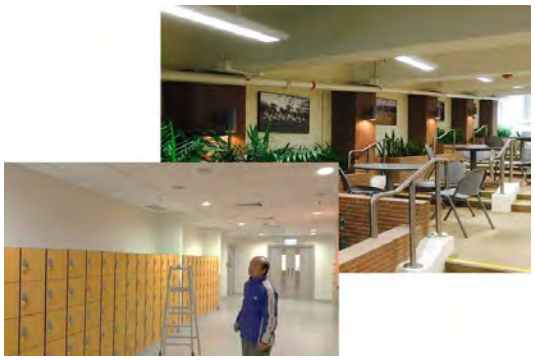
Improvement Actions	No.	Saving (MWh/yr)
Retrofitting of LED lamps	793	94
De-lamping and switching off of air-conditioning	120	217
Reduction of operating time	106	641
Increase of operating temperature	4	59
Combined operation of fan and air-conditioning	106	242
Maximization of chiller efficiency	5	202
Total	**1,134**	**1,455**

4.2.1 Retrofit of LED lamps

Replaced Different types of lamps (filament light bulbs, fluorescent tubes, spot lights, and sodium lamps) at Sports Centre, laboratories, public corridors and lecture theatres was replaced by LED lamps.

4.2.2 De-lamping and switching off of air-conditioning

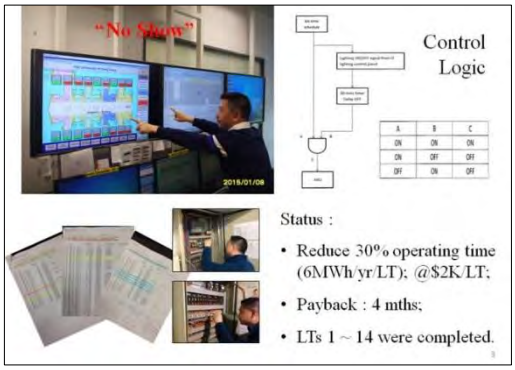
At Chan Tai Ho Multi-purpose Hall, luminance level of public corridors was re-assessed, excessive lighting provisions was reduced and centralized air-conditioning equipment at during non-peak hours was switched off.

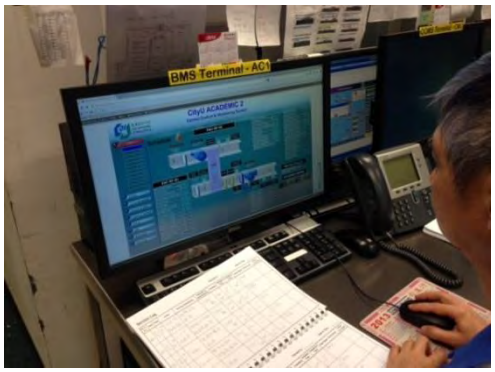


The five air conditioners (CRAC) serving the Main Server Room has been optimized to three after enhancing the supply of chilled water by adding water pumps, which not only saves energy but also improves service reliability and maintenance effectiveness.

4.2.3 Reduction of operating time

Automatic control system was modified to shut down air-conditioning system for booked but “no show” lecture theatres at AC1 while the operating time of fresh air supply system for AC2 was shortened by 2 hours per day.





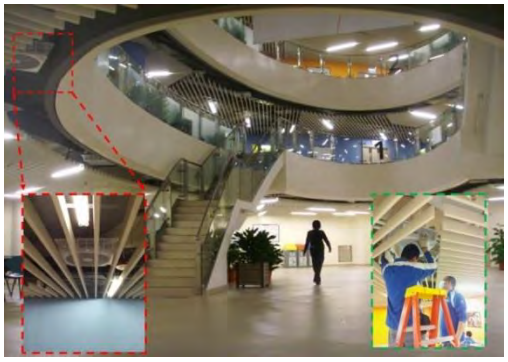
As an ongoing initiative, we continue to put in our best effort to conserve energy through maximization of housekeeping actions by requiring security guards to switch off lighting and air-conditioning where classrooms / lecture theatres are not in use while conducting scheduled security patrols on the campus.

4.2.4 Increase of operating temperature

The operating temperature of lift lobbies at AC2 and AC3 was raised from 24°Cto 26°C and the temperature of AC3 entrances was set at 26°C, which has the additional benefit of minimizing condensation problem due to ingress of hot and humid ambient air.

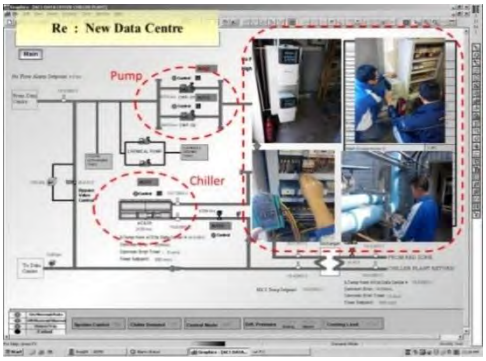
4.2.5 Combined operation of fan & air-conditioning

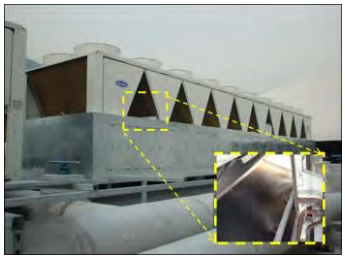
108 fans were installed at public areas and classrooms of AC1 and AC2 to reduce energy consumed by air-conditioning service and provide better air circulation.



4.2.6 Maximization of chiller efficiency

Water mist system was installed for CMC chillers to improve heat dissipation effectiveness of condensers and energy efficient system (chiller operation in accordance with ambient temperature and water return temperature) to optimize CMC chiller efficiency. Central water cooled chiller (as duty) was used instead of designated air-cooled chiller (as standby) for the new Data Centre at AC1.





4.3 Collaboration with China Light & Power (CLP) to Reduce Greenhouse Gas (GHG) Emission

CDFO collaborate with CLP by joining its Automatic Demand Response scheme in which CityU switches off a pre-determined part of the electricity loads at suitable periods so as to enable CLP to optimize the efficiency of their power generation plants. In doing so, CityU not only saves energy but helps to reduce GHG emission and hence mitigate global warming.

5. Campus Greening

CDFO continues to strive to maintain CityU campus to be a green oasis in the heart of Yau Yat Chuen District and its garden and natural areas on the hillside to contribute to regional biodiversity and habitat for birds and other animals.

5.1 New Initiatives

- To ensure tree safety, in June 2015, a tree survey of about 700 heavy trees mainly in Chinese Garden and along pathways on Campus and Hillside Trail was conducted to identify any trees that have high risk of causing harm to passers-by. Actions have been taken to rectify the trees with immediate danger.

- New natural barriers on roof garden of Academic 2

- New indoor greenery display (花堆) on Ground Floor of Academic 2 using different species of plants

- Composting of over 17kg dry leaves into fertilizer for planting work

- Reuse of unwanted plants by dividing them into smaller pots for use in office

5.2 Improvement

- New plants (簕杜鵑) to beautify the landscape at Chinese Garden of main campus and Student Residence

(Student Residence)

(Chinese Garden)

- Planting of fragrant plants (桂花) in Hillside Trail

- Planting of fragrant trees 白蘭 in Chinese Garden




5.3 Event Support

- Potted plants provided to enrich atmosphere in major events such as CityU Cares For You.

6. Green Measures and Activities in Residential Estates

6.1 Energy Conservation

Reduced
0.2
tonnes CO_2-e per year

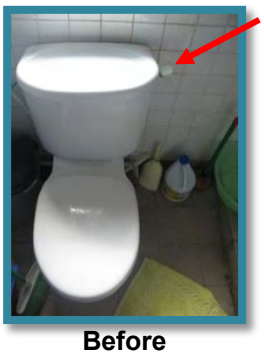
- For visitor quarters in Alice Cheng Hall of Academic Exchange Building, a total of about 1,800 kWh of energy was saved by reducing unnecessary lightings in staircases.

Before

After

6.2 Water Conservation

- Modification of cisterns in Academic Exchange Building to provide flushing buttons with water saving options.



Before

After

6.3 Food Waste Reduction and Recycling

To conserve our limited landfills, mini food decomposers were used to recycle food waste generated from residential quarters in TCY and NSY into fertilizer. About 2,840 kg of food waste was collected and recycled into 124.6 kg of fertilizer which had been applied on campus landscaping areas.

Mini food decomposers used in NSY for recycling into fertilizer

6.4 Waste Reduction and Recycling

(a) Under the Lunar Year-end Recycling Scheme (歲晚回收大行動) organized by Environmental Protection Department, recycling activities were organized to encourage residents in Tak Chee Yuen, Nam Shan Yuen and Academic Exchange Building to donate their unwanted domestic appliances for reuse.

(Tak Chee Yuen)

(Nam Shan Yuen)

(b) CityU participated in the "Lai See Reuse and Recycling Program" organized by Greeners Action with the aim to reduce wastage by reusing some of the materials. From 18 February 2015 to 11 March 2015, Lai See packet collection boxes were placed at Tak Chee Yuen, Nam Shan Yuen and Academic Exchange Building to collect used Lai See packets for re-use.

(c) Dry leaves of 魚尾葵 were reused to make sweepers for efficient sweeping of floor in common areas of staff quarters.

7. Green Activities and Collaborations

We rendered active support to environmental programmes and conducted and / or participated in the following teaching, education, training, show-and-tell, campaign and publicity activities:

7.1 Contribution to Student Learning and Teaching

(a) GROW CityU (Green Roofs over Walls)

CDFO facilitated this cross-disciplinary cultural landscaping project which introduced permaculture to CityU on the rooftop area of AC2. It enables staff and students who might not have ever had the experience of working in a garden to, literally, get their hands dirty and learn how to grow.

(b) Designing Hong Kong Internship Program

CDFO facilitated the captioned Program of the Department of Public Policy. An experimental research was conducted on waste separation and designed simple and effective interventions that successfully increased the recycle rate.

(c) Green Talks & Tours

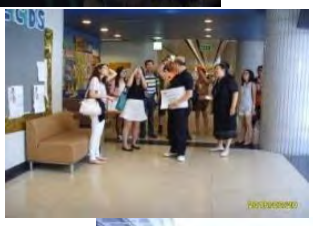
CDFO conducted 12 green forums for over 300 students to introduce green campus facilities and share experience about our “no / low cost” energy saving methods listed below:

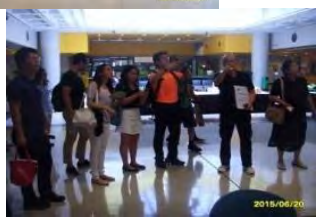
- To monitor and control energy;
- To reduce use of energy inefficient equipment;
- To reduce operating time and equipment; and
- To minimize wastage and maximize efficiency.

Green tours covered visits to chiller plant room, cooling tower, air-conditioning plant room, main switch room, wastewater treatment plant, energy storage plant, and Building Management System / Central Computer Monitoring System.

In addition, we also provided operational support and experience sharing sessions to facilitate university's sustainability events :

- Sustainability Summit;
- Thai's Delegation Visit;
- China Green Campus Conference.





7.2 Collaboration with Others

(a) Exhibition at Sustainability Summit

The captioned Exhibition, which showcases the work of CDFO and its commitment in enhancing the environment and quality of life for the CityU community, was organized and held in AC3 during the Sustainability Summit between 20 and 25 October 2014.

(b) Lai See Packets Recycling

In collaboration with Greeners Action, CityU continued to organize the "Lai See Reuse and Recycling Program" to collect used Lai See packets from AC1, Student Residence, Tak Chee Yuen, Nam Shan Yuen and Academic Exchange Building during the period from 18 February 2015 to 11 March 2015. A total of 80 kg of Lai See packets were collected for re-use.

(c) At the request from HK Productivity Council, a team of technical staff from the HK Housing Society was received to pay a visit to the Grey Water Recycling plant on 23 April 2015.

(d) Collaboration with China Light & Power

With the successful trial at AC2, Automatic Demand Response program was extended to AC3.

In addition, application of computer fluid dynamic technique was explored to look for energy saving opportunities for Main Server Room by having better cooled air distribution.

(e) Donation of furniture

Surplus furniture including bookshelves were donated to Christian Action.

(f) Study on Land Requirement for Supporting the Waste Recycling Industry Feasibility Study (支援回收業的土地需求可行性研究)

Supported the survey of Environmental Protection Department on Study on Land Requirement for Supporting the Waste Recycling Industry Feasibility Study by providing information on the University's waste collection and recycling facilities.

7.3 Enhancing Environmental Awareness and Training

(a) 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 25 September 2014 was a 12-hour-long air-conditioning out action starting from 7:00 p.m. to encourage the whole society to save energy. Considerable number of 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 Centre, canteens, Wei Hing Theatre and public areas – to 25°C to lower power consumption.

(b) WWF Earth Hour 2015

CityU continued to take part in the “WWF Earth Hour 2015”, an energy saving activity organized by the World Wide Fund for Nature of Hong Kong on 28 March 2015. 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.

(c) To arouse awareness and promote green messages among our staff and contractors, environmental awareness briefings, environmental audits, chemical spillage drills, and EMS-specific meetings were conducted regularly.

8. Recognitions and Awards

A number of environmental awards and certificates including ISO 14001, energy efficiency, waste reduction and quality have been received over the year.

8.1 ISO 14001 : 2004 Certification

Certified to be in compliance with the requirements of ISO14001 EMS for the 13th year, which is a recognition of CDFO's commitment in applying internationally recognized green practices at work.


FUGRO CERTIFICATION SERVICES LIMITED

MANAGEMENT SYSTEM CERTIFICATE

This is to certify that

City University of Hong Kong
Campus Development and Facilities Office

ISO 14001:2004

Signed for and on behalf of
FUGRO CERTIFICATION SERVICES LIMITED

8.2 Power Smart Energy Saving Contest 2014

The CityU was awarded a Certificate of Appreciation for our participation in the "Power Smart Contest" organized by Friends of the Earth, which fostered good habits in energy saving.

8.3 Certificate of Fresh Water Plumbing Quality Maintenance Recognition Scheme

Gold certificate was awarded for the fifth 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.

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

The CDFO was rated "Class of Excellence" Wastewi$e Label of the Hong Kong Awards for Environmental Excellence by the Environmental Campaign Committee for the twelveth years.

8.5 Honorary Certificate

The CityU was awarded a Honorary Certificate for its support to the Chinese New Year Peach Blossom Tree Recycling Campaign 2015 organized by the Hong Kong Environmental Protection Association and Environmental Protection Department of HKSAR Government to promote waste recovery and recycling. Through the Campaign, peach blossom trees were recycled as bitumious wood (a useful type of renewable energy) and composting materials.

8.6 Commendation Scheme on Source Separation of Commercial and Industrial Waste

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

9. Looking Ahead

To ensure continuous improvement in our performance, we have established targets addressing different environmental issues related to our operations.

Environmental Improvement	Target for 2015-17	Target for 2015-18	Target for 2015-20
Energy Consumption Reduction	Save 4%$^{+}$	Save 6%$^{+}$	Save 10%$^{+}$
Water Consumption Reduction	Save 1%$^{+}$	Save 2%$^{+}$	Save 5%$^{+}$
Green Transportation	Reduce 2%$^{+\lozenge}$	Reduce 3%$^{+*}$	Reduce 5%$^{+✠}$
Solid Waste Reduction	Reduce 350 tonnes$^{\#}$	Reduce 550 tonnes$^{\#}$	Reduce 800 tonnes$^{\#}$

Notes :
- $^{+}$ Measured on a "year-to-year" basis using 2014 as the base year
- $^{\lozenge}$ Represents a total of 2,200 km
- * Represents a total of 3,300 km
- ✠ Represents a total of 5,500 km
- $^{\#}$ Excluding food waste

The achievement of these targets requires collective commitment and efforts from every sector of the University community, especially students. CDFO exemplifies the University's commitment and will continue to play a key role in confronting issues of sustainability on campus. We hope our effort is inspirational to students, faculty and staff.

Appendix I

Performance Report

on

Greenhouse Gas (GHG) /

Carbon Reduction

for

City University of Hong Kong Campus

2014-15

1. Reporting Entity

This is the Performance Report on Greenhouse Gas (GHG) / Carbon Reduction for City University of Hong Kong (CityU) Campus 2014-15 prepared by the Campus Development and Facilities Office, City University of Hong Kong.

2. Campus Development and 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 July 2014 to 30 June 2015.

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, Hu Fa Kuang Sports Centre, Amenities Building, Academic 2 and Academic 3 within the Site Lot at 83, Tat Chee Avenue, Kowloon Tong.
- To Yuen Building within the Site Lot at 31, To Yuen Street, Kowloon.
- Run Run Shaw Creative Media Centre within the Site Lot at 18 Tat Hong Avenue, Kowloon Tong.

(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.
- Hu Fa Kuang Sports Centre and Amenities Building: sports halls, student activities rooms, exhibition rooms, health centre, canteen, restaurants, offices and carparks.
- Academic 2: offices, lecture theatres, classrooms, computer rooms, plant rooms, canteen and machine rooms.
- Academic 3: offices, lecture theatres, classrooms, computer rooms, plant rooms, machine rooms, dry laboratories, conference rooms, museum, canteens and carparks.
- To Yuen Building: offices, meeting rooms and conference rooms.
- Run Run Shaw Creative Media Centre: offices, lecture theatres, exhibition areas 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, Hu Fa Kuang Sports Centre and Amenities	159,300
Academic 2	40,025
Academic 3	42,101
To Yuen Building	6,017
Run Run Shaw Creative Media Centre	23,648

(d) The Academic Exchange Building, 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 Water Supplies Department (WSD);
- GHG emissions due to electricity used for sewage processing by Drainage Services Department (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 WSD water bills.

b) In 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, 2010 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 (2012-2014) Plan was formulated to reduce the annual carbon emission by 6% by end of year 2014, using the emissions in year 2011 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 Hu Fa Kuang Sports Centre.

(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. Percy Kong at 3442 6522 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 Year July 2014/June 2015

Updated : 28 August 2015

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	1.87831584	0.00036065	0.00164838	**N/A**	**N/A**	1.880
Towngas used in Lab.	15.416352	0.00566456	0.01856131	**N/A**	**N/A**	15.441
Mobile Combustion Sources						
Vehicle	47.4825322	0.07835263	4.89779807	**N/A**	**N/A**	52.459
Fugitive Emissions						
Refrigerant used in A/C plant	**N/A**	**N/A**	**N/A**	87.67568		87.676
Other Direct Emissions						
NIL						0.000
Scope 1 Emissions Total	64.7772	0.08437783	4.91800776	87.67568		***157.455***
Scope 1 Direct Removals						
Planting of Additional Trees based on year 2013/2014						
Campus	-0.437	**N/A**	**N/A**	**N/A**	**N/A**	-0.437
Other Direct Removals						
Vacuum tube solar panel for shower	19.99					19.990
AC3 PV on-grid system	2.628					2.628
Scope 1 Removals Total	22.618	0	0	0	0	***22.618***
Scope 2 Energy Indirect Emission	(To be reported in general without being classified into specific gas type)					
Electricity Purchased						
Campus						39,198.881
Towngas Purchased						
Campus						3.586
Scope 2 Emission Total						***39,202.468***
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						82.794
Electricity for Processing Sewage (To be reported in general without being classified into specfic gas type)						
Campus						33.586
Others						
NIL						0.000
Scope 3 Emissions Total						***116.381***
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		876.6576				***876.658***
Off-site GHG Reduction Projects outside Hong Kong						
NIL						***0.000***

Summary of Results

Total Scope 1 Emissions :	**157.455**	Tonnes of CO_2-e
Total Scope 1 Removals :	**22.618**	Tonnes of CO_2-e
Total Scope 2 Emissions :	**39,202.468**	Tonnes of CO_2-e
Total Scope 3 Emissions :	**116.381**	Tonnes of CO_2-e
Total other GHG Offsets / Removals :	**876.658**	Tonnes of CO_2-e
Total Net GHG Emissions :	**39,453.686**	Tonnes of CO_2-e

GHG Performance in Ratio Indicator :	**1.425**	Tonnes of CO_2-e / person
	0.150	Tonnes of CO_2-e / m^2

Table 1 : GHG Emissions from Stationary Sources for Year July 2014/June 2015

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_2O emission factor	N_2O emissions in tonnes of CO_2 equivalent ((B x I) / (1000 x 1000) x GWP)
	Fuel used								
	Amount	Unit	Fuel type						
AC1(B) Standby-generator	156	litre	diesel oil	2.614	0.407784	0.0239	7.82964E-05	0.0074	0.000357864
AC1(P) Standby-generator	60	litre	diesel oil	2.614	0.15684	0.0239	0.000030114	0.0074	0.00013764
CMC Standby-generator	179.5	litre	diesel oil	2.614	0.469213	0.0239	9.00911E-05	0.0074	0.000411773
AC2 Standby-generator	92.16	litre	diesel oil	2.614	0.24090624	0.0239	4.62551E-05	0.0074	0.000211415
AC3 Standby-generator	230.9	litre	diesel oil	2.614	0.6035726	0.0239	0.000115889	0.0074	0.000529685
Towngas used in Lab	6048	48MJ	Towngas	2.549	15.416352	0.0446	0.005664557	0.0099	0.018561312
Total					**17.29466784**		**0.006025202**		**0.020209689**

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

New CO_2 emission factor 2.549 is applied quoted in EPD's guideline 2010 edition.

Table 2 : GHG Emissions from the Mobile Sources for Year July 2014/June 2015

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 types)	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	2,255.03	petrol	2.36	5.322	0.253	0.012	1.105	0.772
LY7643 passenger car	1,742.19	petrol	2.36	4.112	0.253	0.009	1.105	0.597
FL8988 passenger car	1,782.85	petrol	2.36	4.208	0.253	0.009	1.105	0.611
MU6235 passenger car	2,024.79	petrol	2.36	4.779	0.253	0.011	1.105	0.694
KP8936 passenger car	1,706.94	petrol	2.36	4.028	0.253	0.009	1.105	0.585
FY880 passenger car	1,584.42	petrol	2.36	3.739	0.253	0.008	1.105	0.543
JW7858 passenger car	804.35	petrol	2.36	1.898	0.253	0.004	1.105	0.276
GG7750 medium goods vehicle	2547.36	diesel oil	2.614	6.659	0.145	0.008	0.072	0.057
HS783 (Nissan) van	1542.61	diesel oil	2.614	4.032	0.072	0.002	0.506	0.242
EK1983(Hiace) van	1281.34	diesel oil	2.614	3.349	0.072	0.002	0.506	0.201
RU5133 van	2049.19	diesel oil	2.614	5.357	0.072	0.003	0.506	0.321
Navigation								
NIL								
Aviation								
NIL								
Total				**47.483**		**0.078**		**4.898**

Table 3 : HFC and PFC Emissions from Refrigeration / Air-conditioning Equipment (Operation Process) for Year July 2014/June 2015

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	0	45.36	0	0	0	0
R407C	0	0	0	0	1526	0
R410A	0	0	0	0	1725	0
R134a	0	40.82	0	0	1300	53.066
R407C	0	22.68	0	0	1526	34.60968
Total						**87.67568**

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 Year July 2014/June 2015

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	10	29	23	-0.437
Total				**-0.437**

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 July 2013/June 2014

Table 5 : GHG Emissions from Electricity Purchased from Power Companies for year July 2014/June 2015

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 of CO_2 equivalent	
		Power company - specific	Territory-wide default value	Power company - specific	Territory-wide default value
Academic 1, Administration Building, Amenities Building and Sport Complex	43,271,012	0.64	0.7	27,693.448	30289.7084
To Yuen Building	855,276	0.64	0.7	547.377	598.6932
Academic 2 & 3	11,205,948	0.64	0.7	7,171.807	7844.1636
Academic 3	956,606	0.64	0.7	612.228	669.6242
Creative Multimedia Centre	4,959,410	0.64	0.7	3,174.022	3471.587
Total				**39,198.881**	**42873.7764**

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

The Power company specific emission factor 0.64 is extracted from CLP Substantiability Report 2014.

Table 6 : GHG Emissions from Towngas Purchased from the Hong Kong and China Gas Company for Year July 2014/June 2015

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)
Towngas used in Lab	6048	0.593	3.586
Total			**3.586**

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.
New GHG emission factor 0.593 based on year2008 is applied quoted in EPD's guideline 2010 edition.

Table 7 : Methane Generation at Landfill in Hong Kong due to Disposal of Paper Waste for Year July 2014/June 2015

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	182637 Note 2		0	4.8	-876.6576
Total						**-876.6576**

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 Year July 2014/June 2015

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 / m3) Note	Emission in tonnes of CO_2 equivalent (B x C / 1000)
Academic 1, Administration Building, Amenities Building and Sport Complex	159700	0.424	67.713
To Yuen Building	710	0.424	0.301
Creative Multimedia Centre	1810	0.424	0.767
Academic 2	16690	0.424	7.077
Academic 3	16360	0.424	6.937
Total			**82.794**

Note : 1. New emission factor 0.424kg CO_2-e /m^3 based on year 2008 is applied quoted in EPD's guideline 2010 edition
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 Year July 2014/June 2015

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 1, Administration Building, Amenities Building and Sport Complex	159700	0.172	27.468
To Yuen Building	710	0.172	0.122
Creative Multimedia Centre	1810	0.172	0.311
Academic 2	16690	0.172	2.871
Academic 3	16360	0.172	2.814
Total			**33.586**

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.
New emission factor 0.172 kg CO_2-e / m^3 based on year 2008 is applied quoted in EPD's guideline 2010 edition.

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