



Campus Development and Facilities Office Environmental Report 2015 – 16 校園發展及設施管理處 二零一五年至二零一六年度

拾荒者年報

Toward a Sustainable Campus

December 2016

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Welcome to the Campus Development and Facilities Office's Environmental Report for 2015 – 16. This report covers the period from 1 July 2015 to 30 June 2016.

In this report, you will see our 2015 – 16 performance as well as our efforts in striving for sustainable development. This year we continued to follow our passion and keep persevering, challenging and pushing harder on our environmental performance. We have recycled over 213 tonnes of solid wastes and 244 tonnes of food waste. We are also pleased to report that our energy consumption has decreased by 0.82 million kWh.

Please enjoy reading this report. I hope that this report contributes towards educating our key audiences and helps to foster greater environmental awareness.

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2015 – 2016 Environmental Performance

CDFO, being an ISO14001 certified office for the 15 consecutive years and several environmental awards receiver, has achieved the following in 2015 – 16 :

Waste Recycling

- Diverted over 213 tonnes of solid wastes from landfills.
- Recycled over 244 tonnes of food waste.
- Achieved saving of over HK\$0.3 million through renew / repair of equipment and salvage of building materials.

Energy Conservation

Cut electrical energy consumption by 0.82 million kWh or 1.3% reduction.

Water Conservation

• 3,279 m³ of grey water recycled for irrigation, which represents 1.5% of total water consumption.

Contribution to Teaching

• Conducted more than 9 green talks and green campus tours for over 310 students.

<u>Awards</u>

- Won the Class of Excellence Wastewi\$e Label in succession of 14 years.
- Awarded an "Excellence Level" Wastewi\$e Certificate by the Environmental Campaign Committee of HKSAR Government.

1. Waste Management

1.1 Solid Waste

In order to reduce the burden on landfill, CDFO has been doing a great job in adopting the 3 "R" strategy of reduction, reuse and recycling which is evident in the following:

(a) Reuse

Used Furniture





Door closers and locks in good condition dismantled from the renovation works at 7/F, Green Zone of AC1 were reused in various locations on campus.



Carpet tiles in good condition dismantled from the renovation works at 7/F, Green Zone of AC1 were reused in various locations to replace the stained or dirty carpet tiles.



Rockwool ceiling panels in good condition dismantled from the renovation works at 7/F, Lau Ming Wai Academic Building (formerly AC3) was reused to replace damaged or stained panels at 6/F, AC3.





Damaged 660L trolleys were modified and reused for storing recyclables such as papers, plastic cans and aluminum cans.



Used fibre glass false ceiling panels in good condition were reused to put on metal sheet false ceiling panels at 5/F, Yellow Zone of AC1 to improve acoustic effect.



Salvaged Building Materials

Reduction of waste through salvage for reuse, which contributes to not only saving resource and reducing waste but also reduction in cost of about HK\$244,800.

- Usable blower dismantled was reused to replace the faulty blower of FAU in LT3.
- Usable parts dismantled from old gen-sets were reused to replace the faulty panel display of digital fuel level controllers of the gen-sets in Hall 9 of SR and AC3.



Usable air diffusers dismantled from renovation works at 7/F of AC1 were reused in various locations on campus



Condensing unit dismantled from renovation work was reused in Room 307 of TYB.



Usable parts dismantled from 50 mm ball float valves were re-assembled to make a functional valve for reuse at 7/F pump room in Zone 9 of AM Building.



Usable springs, discs, covers dismantled from aged 100 mm non-return valves were assembled to form a spare valve for reuse at G/F pump room in Hall 9 of SR.





A discarded Direct Digital Controller was reconfigured and reused to control chillers in Blue Zone of AC1.



Usable shafts, discs, etc. dismantled from aged check valves were re-assembled as spares for reuse in the pump room at R/F of AC3.

Usable shafts, springs, etc. dismantled from aged float control valves were re-assembled as spares for reuse at G/F in Hall 9 of SR.

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7.5 kW frequency inverter dismantled from MBE construction site at 2/F, Yellow Zone of AC1 was reused in VAU of LT-6.







Usable actuator dismantled from a defective valve was reused to replace defective actuator in another valve in Grey Water Recycling Plant.

(b) Renew / Repair

Reduction of waste through renew / repair has become a practice of CDFO. A considerable number of defective building services equipment parts / items were repaired and put back into service. An estimate of saving is around HK\$63,000.



Gate valves and non-return valves in AC1 and AEB were re-conditioned.



Before



After





6" ball float valve of the in fresh water tank in basement, SC21 of AC1 was overhauled.



Ball float valve, gate valve, pump packing glands and stuffing boxes in pump rooms of AEB, AM Building and AC3 were reconditioned.

(c) Recycle

Reduced

Summary of solid wastes diverted from landfills : •

Reduced		Year 2014 – 15	Year 2015 – 16
ZI3 tonnes	Waste paper recycled (kg)	182,637	178,722
Solid wastes	Aluminum cans recycled (kg)	1,654	815
	Plastic bottles recycled (kg)	2,427	1,591
	Printer cartridges recycled (kg)	858	1,055
	Compact discs recycled (kg)	11	13.7
	Mercury-containing fluorescent tubes and lamps recycled (kg)	17,600	20,600
	Green waste and plant trimmings reused (kg)	132	195
	Glass bottles recycled (kg)	10,575	9,474
	Rechargeable batteries recycled (kg)	370	337
	Used Lai See packets (kg)	80	100

Collection and Treatment of Hazardous Wastes

To prevent contamination of the environment and safeguard health and safety of the University community due to improper hazardous waste disposal and treatment, CDFO, as the central agent of the University, manages hazardous wastes to ensure their disposal and treatment are carried out in accordance with relevant statutory regulations and requirements.



Hazardous wastes responsibly disposed of in Year 2014 - 15 and Year 2015 – 16 are listed in the table below :

	Year 2014 – 15	Year 2015 – 16
Liquid Chemical Waste [#] (L)	13,405	16,045.5
Solid Chemical Waste [#] (kg)	18,260	21,000
Clinical Waste * (kg)	2,489	2,338
Liquid Radioactive Waste (L)	35.5	45.5
Solid Radioactive Waste (kg)	16.5	12

Remark:

- C # 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 and dead animals from laboratories.

Recycling of Food Waste by Caterers

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.

All caterers on campus collect food waste generated from their respective catering outlets and recycle it into fish / animal feed or fertilizer according to requirements laid down in their catering services contracts. CDFO continues to play the role of monitoring. From time to time, CDFO inspected catering outlets to check that proper separation, collection and recycling are carried out. Also, site inspection was conducted to the manufacture site of the food waste collection contractors who carry out food waste treatment for our caterers to check that food waste collected from CityU is actually processed and recycled into fish / animal feed or fertilizer.

Summary of Food Waste Recycled :

	Year 2014 – 15	Year 2015 – 16
Food waste collected and recycled for making fish / animal feed or fertilizer (kg)	280,740	244,507

2. Air Quality Management

CDFO is committed to maintaining good indoor air quality to provide a pleasant working environment. The ventilation system of all academic and administrative buildings is properly maintained to ensure its effectiveness.

Regular university-wide IAQ monitoring for the University buildings are carried out to assess IAQ conditions and help to identify any potential problems. It was found that the IAQ of CityU offices and buildings is mainly classified as "Good" and "Excellent" level stated in "Guidance Notes for the Management of IAQ in Offices and Public Places".

CDFO also carries out IAQ investigation on an as required basis. The following improvement works were done:

(a) SCM Offices

An inspection to the said offices identified the causes of inadequate IAQ. Ceiling mounted ventilation fans were installed, user-friendly thermostats retrofitted and fresh air supply ducts extended to concerned offices.

(b) Lecture Theatre 18

Unbalanced fresh air distribution was found between LTs 18 and 16 resulting in inadequate ventilation in LT 18. Air dampers and fan speed were adjusted to enable air flow rate was within normal operation range.

(c) Lecture Theatres 1, 2, 3 and 4

The aged air handling units serving LTs 1, 2, 3 and 4 will soon be replaced. In this retrofitting work, the air conditioning system will be upgraded to provide a higher ventilation rate of 8 litres per second per person so as to enhance the indoor air quality.

3. Water Conservation, Consumption and Management

In 2015 – 16, the University has consumed 14.08% more water. It is due to the fact that the consumption of cleansing and irrigation increased by 37.62% whilst 18.22% for that of potable water. Nearly half (at 45.72%) of the water consumption was used in water cooled chillers for air-conditioning. Water consumption other than cooling of air-conditioning 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 2015 - 16 is depicted in the following table and pie chart.

		2014	– 15	2015	– 16	
		m ³ (x1000)	%	m ³ (x1000)	%	
1	Potable Water					
	Amenities Building & Sports Centre	13.21	6.76	16.72	7.51	
	Academic 1 (AC1) & Administration Buildings	35.33	18.09	41.13	18.46	
	To Yuen Building (TYB)	0.62	0.32	0.54	0.24	
	Run Run Shaw Creative Media Centre (CMC)	0.72	0.37	0.93	0.42	
	Academic 2 (AC2)	1.66	0.85	1.69	0.76	
	Academic 3 (AC3)	1.31	0.67	1.47	0.66	
	Subtotal	52.85	27.07	62.48	28.05	
2	Cleansing & Irrigation					
	Amenities Building & Sports Centre	11.25	5.76	11.25	5.05	
	AC1 & Administration Buildings	20.55	10.52	16.63	7.46	
	ТҮВ	0.09	0.05	0.13	0.06	
	CMC	1.09	0.56	1.53	0.69	
	AC2	0.37	0.19	0.63	0.28	
	AC3	0.7	0.36	16.69	7.49	
	Subtotal	34.05	17.44	46.86	21.03	
3	Air-conditioning					
	AC1	65.36	33.47	72.98	32.76	
	AC2	14.66	7.51	14.20	6.37	
	AC3	14.35	7.35	14.67	6.58	
	Subtotal	94.37	48.33	101.85	45.72	
4	Fountain & Water Feature	11.39	5.83	9.05	4.06	
5	Swimming Pool	2.61	1.34	2.54	1.14	
	Yearly Total (x1000m ³)	195.27		222.78		
Consumption / month (x1000m ³)		16.	16.27		18.57	
Consumption / day / person+ (litre)			19.33		22.12	

* Note : The total number of staff and students in 2014 – 15 and 2015 – 16 are 27,679 and 27,596 respectively.



3.2 <u>Water Usage Performance</u>

Compared with that of year 2014 – 15, the annual fresh water consumption in year 2015 – 16 increased by 14.08% and the following particulars were observed :

- (a) Potable water consumption increased by 18.22% due to increase of wet laboratory facilities.
- (b) The cleansing and irrigation water consumption increased by 37.60% because more greening and roof garden areas have been built under UGC AA&I and Capital works.
- (c) The water consumption of fountain & water features decreased by 20.54% due to suspension of fountain and water features for maintenance.
- (d) The water consumption due to water replenishment for swimming pool decreased slightly by 2.68%.

3.3 Use of Waterless Urinal System

There were more than 151 urinals adopting 'Desert Cube Waterless Urinal System' in male toilets on campus for To Yuen Building and some small usage male toilets. The total saving of flushing water was over $2,857 \text{ m}^3$.

3.4 Potable Water Saving Measures

The existing 300 water saving aerators installed for washbasin taps in toilets on the campus achieved an annual saving of about 9,720 m³ of potable water, 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 the year 2015 - 16, we have recycled 3,279 m³ grey water from water basin and condensate water from air-conditioning on the campus for irrigation, which represents 1.47% of the total water consumption. Furthermore, we collected 1,524 m³ rain water and 1,736 m³ of underground water for irrigation.

An annual saving of total volume of potable water is equivalent to an annual reduction in carbon emission of about 2.18 tonnes CO₂-e.

3.6 Reuse of Spent Swimming Pool Water

In order to save valuable water resources, after closure of the Swimming Pool, spent pool water of approx. 1,800 m³ was redirected using pumps and pipes (Photo 1) to Nam Shan Chuen Refuse Chamber (Photo 2) for cleansing purpose and to the flushing water sump tank (photo 3) for toilet flushing purpose.



4. Energy Conservation

4.1 Annual Performance

The total energy consumption of the main buildings on campus for 2015 - 16 is 62.1 million kWh which is 1.3% lower than 2014 - 15. The energy consumption of each building is tabulated as follows.

Bldg	Mil kWh	GFA (000' m ²)	kWh/m ²	Bldg	2014 – 15 (mil kWh)	2015 – 16 (mil kWh)	Saving (mil kWh)	Saving (%)
AC1	45.4	159.3	285	AC1	45.8	45.4	0.39	0.8
AC2	5.8	40.0	145	AC2	5.9	5.8	0.16	2.7
AC3	6.4	42.1	152	AC3	6.2	6.4	-0.13	-2.1
CMC	4.6	23.6	195	CMC	5.0	4.6	0.40	8.1
Total	62.1	265.0	234	Total	63.0	62.1	0.82	1.3

The energy performance trends over past few years are shown in the following figures.



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The distribution of energy utilization in AC1 is :

- General lighting & A/C : 36.3%;
- Chiller plant : 31.2%;
- Laboratory power : 15.2%;
- Essential lighting : 8.1%;
- Central computer & server : 4.0%;
- Fume cupboard : 2.2%;
- Central exhaust system : 2.0%;
- Escalator & lift : 1.0%



4.2 Energy Saving Initiatives

In 2015 - 16, CDFO implemented 85 improvement works (involving 2,360 equipment items) to save energy. The annual energy saving was 1.3 million kWh (702 tonnes CO₂-e). Details are listed in the table below. 50% of the total energy saved was contributed by de-lamping, switching unnecessary air-conditioning and reducing operating time.

Improvement Actions	No.	Saving (MWh/yr)	%
Retrofitting of LED lamps	1,118	107	8
De-lamps & switching-off of air-conditioning	615	364	28
Reduction of operating time	473	283	22
Increase of operating temperature	34	115	9
Combined operation of fan and air- conditioning	115	240	18
Maximization of chiller efficiency	5	189	15
Total	2,360	1,298	100

4.2.1 Retrofitting of LED Lamps

Replaced compact fluorescent tubes (of various types and ratings) by LED lamps at AC1 U-Concourse, TYB staircases, AC3 3/F main entrance, Wei Hing Theatre, corridor outside Bookshop.





4.2.2 De-lamping and Switching-off of Air-conditioning

Lighting intensity was reduced at corridors of all floors of AC3 and TYB, Wei Hing Theatre reception area and AC2 staircases. Central A/C of Sports Centre was switched off at 10 pm instead of 1 am, 50% of central A/C of Sports Halls turned off during non-peak hours and central A/C serving Art Gallery cut off when there was no exhibition.



4.2.3 Reduction of Operating Time

Timers were installed to reduce night time operation of large signage at U-Concourse, air-conditioning services at various premises. Night time operation of primary air units and dehumidification plant of CMC was optimized.



4.2.4 Increase of Operating Temperature

The operating temperature was raised from 22°C to 24/25°C at public corridors of AC1, AMB, AC3, TYB, CMC.





4.2.5 Combined Operation of Fan and Air-conditioning

Ceiling ventilation fans were installed in classrooms of AC1, AC2 and CMC, BMS lab corridors, offices of SEE, FO and SCM. In addition, split-type unit in lift lobbies was replaced by fan at NSB and TYB.





4.2.6 Maximization of Chiller Efficiency

CMC chiller control was retrofitted with OEM proprietary control system of better accuracy and cooling tower was deployed to cool night mode chiller (previously cooled by radiator) at AC3.





4.3 <u>Collaboration with China Light & Power (CLP) to reduce Greenhouse Gas (GHG)</u> <u>Emission</u>

In 2015 – 16, CDFO continued to collaborate with CLP on the Automatic Demand Respond (ADR) scheme. The ADR was implemented at AC2 and AC3 where pre-determined electricity loads were switched off at suitable periods of time. In so doing, not only the energy efficiency of the power generation plant was optimized but the GHG emission was also reduced as well.





Furthermore, CDFO invited CLP to conduct a review on the energy utilization of our Main Server Room (Y2501). The review focused on examining the way of distributing cool air through the raised floor and collecting warm air via the space above server equipment. The ultimate purpose of the study is to explore if it is technically feasible to better utilize the existing air-conditioning (A/C) equipment in the following ways :

- To lower the room temperature without adding more A/C units so that more safety margin for temperature alarm could be attained; and/or
- With the same operating condition, to reduce the number of A/C units so as to provide more standby redundancy capacity.



5. Campus Greening

CDFO realizes the value of greening and always tries every effort in improving and maintaining a green environment for the enjoyment of the University students, faculty, staff and visitors by carrying out regular maintenance and improvement work.

5.1 <u>New Initiatives</u>

- To ensure tree safety, in December 2015, a tree survey of about 350 heavy trees for staff quarters in Tak Chee Yuen and Nam Shan Yuen 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.
- To avoid wastage, 5 unused concrete rubbish bins on campus were reused as plant boxes.





5.2 Improvement

• More than 22 landscape improvement works were done throughout the campus.



Environmental Report 2015 – 16

5.3 Event Support

 Potted plants provided to enrich atmosphere in major events such as Yoga Day in Student Residence





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6. Green Measures and Activities in Residential Estates

6.1 <u>Energy Conservation</u>

Reduced 0.2 tonnes CO₂-e

per year

Energy efficiency measure continued to implement in residential quarters. A total of about 1,900 kWh of energy was saved by reducing unnecessary lightings in staircases of Nam Shan Yuen and 0.21 tonnes CO₂-e were reduced.



6.2 <u>Water Conservation</u>

Promoted and supported the 5-minute Shower Challenge 2015 campaign by putting up posters and distributing sandglasses in SSQ to urge staff residents to save water by cutting down shower duration.

6.3 Food Waste Reduction and Recycling

Mini food decomposers were used to recycle food waste generated from residential quarters in TCY and NSY into fertilizer to conserve our limited landfills. Over 4,660 kg of food waste was collected and recycled into 104 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) The University participated in the Lunar Year-end Recycling Scheme (送舊回收迎新歲) organized by Environmental Protection Department of HKSAR Government and invited residents in Tak Chee Yuen, Nam Shan Yuen and Academic Exchange Building to donate their unwanted domestic electrical appliances for reuse. Totally, 19 items were donated by the residents.



(b) With the aim to reduce wastage by reusing some of the materials so as to contribute to a greener Hong Kong, CityU supported and participated in the "Lai See Reuse and Recycling Program" organized by Greeners Action. From 13 February to 3 March 2016, 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 reuse.



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



7. Green Activities and Collaborations

This section covers all the major green activities held or promoted on campus in 2015 – 16.

7.1 Contribution to Student Learning and Teaching

- (a) Green Talks & Tours
 - "GE 2329 Green Buildings : Discovery & Innovations" was conducted for BST on 30 September 2015, serving 110 students and "CA 3137 : No Cost Energy Saving" was conducted on 2 October and 23 October 2015, serving 40 students.



 On 28 January 2016, a green talk on "Quick Win on Energy Saving" and green tour to AC2 chiller plant, pump room, main switch room, central BMS and swimming pool filtration plant were conducted for 50 BST students (CA4750).



• On 18 and 25 February 2016, green tours were conducted for 56 students studying surveying (CA3691) to AC2 chiller plant and central BMS.



• On 16 April 2016, a green talk complied with tour was conducted for 26 MSc students studying SEE 6102 (Energy Efficiency and Conservation Techniques) with visit to AC2 chiller plants, AC1 BMS and solar panels on CTH rooftop.



7.2 Collaboration with Others

(a) Lai See Packets Recycling

CityU continued to support the "Lai See Reuse and Recycling Program" organized by Greeners Action to collect used Lai See packets from AC1, Student Residence, Tak Chee Yuen, Nam Shan Yuen and Academic Exchange Building during the period from 13 February to 3 March 2016. Over 100 kg of Lai See packets were collected for reuse.



(b) Donation of furniture

Used furniture was donated to Man Kiu College.



- (c) Signed the Energy Saving Charter 2016 organized by the Electrical and Mechanical Services Department of HKSAR Government.
- (d) Participated in the FoodEver WasteNever Award Programme organized by the Environmental Protection Department of HKSAR Government.



(e) <u>Water Conservation</u>

Promoted and supported the 5-minute Shower Challenge 2015 campaign by putting up over 70 posters throughout campus and distributing over 400 sandglasses in Sports Complex, SR and SSQ to urge students and staff to save water by cutting down shower duration.

7.3 Enhancing Environmental Awareness and Training

(a) Hong Kong No Air Con Night 2015

The captioned campaign organized by the Green Sense held on 25 September 2015 was a 12-hour-long air-conditioning out action starting from 7:00 p.m. to encourage the whole society to save energy.

CityU actively supported the event by raising the indoor temperature in some communal areas on CityU campus - lecture theatres, Library, Hu Fa Kuang Sports Centre, canteens, Wei Hing Theatre and public areas – to 25°C to lower power consumption.

(b) <u>WWF Earth Hour 2016</u>

CityU supported, as always, the captioned campaign held on 19 March 2016 by turning off non-essential lights in corridors, open / roof gardens, carparks and / or external public areas at AC1, Administration Buildings, Amenities Building, AC2, AC3 and CMC for one hour from 8:30 pm to 9:30 pm.

Moreover, City Announcement Portals (CAPs) were issued to all staff and students to encourage them and their families 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.





8. Recognitions and Awards

The following recognitions and awards were received that honoured our efforts in creating a low-carbon campus:

8.1 ISO 14001 Certification

Our Environmental Management System is certified to be in compliance with the requirements of ISO14001 for the 15th year, demonstrating CDFO's commitment in applying internationally recognized green practices at work.

8.2 Quality Water Supply Scheme for Buildings – Fresh Water (Plus) (Basic Plan)

CDFO not only successfully renewed its certificate under the new Quality Water Supply Scheme for Buildings – Fresh Water (Plus) (Basic Plan) of the Water Supplies Department of the HKSAR Government but also maintained its Gold certificate the sixth 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, satisfying the prescribed requirements.



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

To recognize CityU that has demonstrated all-round and outstanding achievements in environmental performance, "Class of Excellence" Wastewi\$e Label was awarded for the fourteenth years.



CityU was awarded the "Excellence Level" Wastewi\$e Certificate by the Environmental Campaign Committee of HKSAR Government in recognition of our outstanding effort in waste management.





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9. Looking Ahead

The CDFO continues to have a strong focus on achieving the environmental commitments made in the report of 2014 - 15 (shown below).

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% ⁺ ■	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

- Represents a total of 2,200 km
- ✤ Represents a total of 3,300 km
- ✤ Represents a total of 5,500 km
- # Excluding food waste

We appreciate your support and involvement as this journey of confronting issues of sustainability on campus continues.

Performance Report

on

Greenhouse Gas (GHG) /

Carbon Reduction

for

City University of Hong Kong Campus

2015 – 16

1. <u>Reporting Entity</u>

This is the Performance Report on Greenhouse Gas (GHG) / Carbon Reduction for City University of Hong Kong (CityU) Campus 2015 – 16 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. <u>Reporting Period</u>

This report covers the period from 1 July 2015 to 30 June 2016.

4. <u>Scope of Physical Boundaries</u>

- (a) The physical boundaries for this report include the Campus of the City University of Hong Kong which comprises the following:
 - Academic 1, Amenities Building, Administration Buildings, Li Dak Sum Yip Yio Chin Academic Building (AC2), Lau Ming Wai Academic Building (AC3) and External Laboratory Facilities 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.
 - Li Dak Sum Yip Yio Chin Academic Building (AC2): offices, lecture theatres, classrooms, computer rooms, plant rooms, canteen and machine rooms.
 - Lau Ming Wai Academic Building (AC3): 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.

Building	Approx. Gross Floor Area (GFA) (m²)
Academic 1, Amenities Building, Administration Buildings and External Laboratory Facilities	151,497
Li Dak Sum Yip Yio Chin Academic Building	40,025
Lau Ming Wai Academic Building	42,101
To Yuen Building	6,017
Run Run Shaw Creative Media Centre	23,648

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

(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
 - 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 CO₂-e/floor area and kg CO₂-e/person will be used as the ratio indicators to measure performance.
- (c) 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.
- (d) 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 <u>fmwork@cityu.edu.hk</u>.

<u>Summary Table on Greenhouse Gas (GHG) Emissions and Removal</u> for Campus of City University of Hong Kong for Year July 2015 - June 2016

					U	pdated : 4 Nov 2016
	En	hissions by ga	as type [(in to	nnes of CO ₂ -e	equivalent) (C	О ₂ -е)]
Description (by sources, areas,	Carbon	Methane	Nitrous	Hydrofluoro	Perfluoro-	
etc.)	dioxide	(CH₄)	oxide	-carbons	carbons	Total
	(CO ₂)	、 "	(N ₂ O)	(HFCs)	(PFCs)	
Scope 1 Direct Emissions						
Stationary Combustion Sources						
Standby-generator	2.3792628	0.00045683	0.002088	N/A	N/A	2.382
Towngas used in Lab.	15.171648	0.00557464	0.01826669	N/A	N/A	15.195
Mobile Combustion Sources		-	-			
Vehicle	46.9847838	0.08604088	4.33820432	N/A	N/A	51.409
Fugitive Emissions						
Refrigerant used in A/C plant	N/A	N/A	N/A	()	0.000
Other Direct Emissions						
NIL						0.000
Scope 1 Emissions Total	64.5356946	0.09207235	4.35855901	()	68.986
Scope 1 Direct Removals						
Planting of Additional Trees based of	on year 2013/2	014				
Campus	-1.058	N/A	N/A	N/A	N/A	-1.058
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 repor	ted in general	without being	classified into s	specific gas typ	be)
Electricity Purchased						
Campus						36,962.833
Towngas Purchased						
Campus						3.530
Scope 2 Emission Total						36,966.363
Scope 3 Other Indirect Emissions						
Methane Generation at Landfill due	to Disposal of	f Paper Waste	1	1		
Campus	N/A	No data	N/A	N/A	N/A	No data
Electricity for Processing Fresh Wat	er (To be repo	rted in genera	l without being	classified into	specfic gas ty	pe)
Campus						101.052
Electricity for Processing Sewage (1	o be reported	in general with	out being clas	sified into spec	cfic gas type)	
Campus						40.993
Others						
NIL						0.000
Scope 3 Emissions Total						142.045
Other GHG Offsets / Removals						
On-site Renewable Energy Sources	for Off-site Us	ses		1		
NIL						0.000
Off-site GHG Reduction Projects in	Hong Kong					
Waste paper for recycling		857.8656				857.866
Off-site GHG Reduction Projects out	tside Hong Ko	ong				
NIL						0.000

Summary of Results

Total Scope 1 Emissions :

Total Scope 1 Removals :

Total Scope 2 Emissions :

Total Scope 3 Emissions :

Total other GHG Offsets / Removals :

Total Net GHG Emissions :

GHG Performance in Ratio Indicator :

1011103 01	002-0
22.618 Tonnes of	CO ₂ -e
36,966.363 Tonnes of	CO ₂ -e
142.045 Tonnes of	CO ₂ -e
857.866 Tonnes of	CO ₂ -e
37,154.776 Tonnes of	CO ₂ -e

1.346	Tonnes of CO ₂ -e / person
0.112	Tonnes of CO ₂ -e / m ²

Table 1 : GHG Emissions from Stationary Sources for Year July 2015 - June 2016

Step 1		Step 2		Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
А	В	С	D	E	F	G	н	I	J
Source description with	F	uel Informatio	on						N ₂ O emissions in
location (e.g. boilers,	Fuel	used		CO ₂ emission	CO ₂ emissions in tonnes of CO ₂	CH₄ emission	tonnes of CO_2	N ₂ O emission	tonnes of CO ₂
furnances, ovens, and emergency electricity generator etc.)	Amount	Unit	Fuel type	factor	equivalent ((B x E) / 1000)	factor	equivalent ((B x G) / (1000 x 1000) x GWP)	factor	equivalent ((B x I) / (1000 x 1000) x GWP)
AC1(B) Standby-generator	138	litre	diesel oil	2.614	0.360732	0.0239	6.92622E-05	0.0074	0.000316572
AC1(P) Standby-generator	0	litre	diesel oil	2.614	0	0.0239	0	0.0074	0
SR Phase 1 Standby-generator	116	litre	diesel oil	2.614	0.303224	0.0239	5.82204E-05	0.0074	0.000266104
SR Hall 4 Standby-generator	31.2	litre	diesel oil	2.614	0.0815568	0.0239	1.56593E-05	0.0074	7.15728E-05
SR Hall 6 Standby-generator	31.2	litre	diesel oil	2.614	0.0815568	0.0239	1.56593E-05	0.0074	7.15728E-05
SR Hall 8 Standby-generator	31.2	litre	diesel oil	2.614	0.0815568	0.0239	1.56593E-05	0.0074	7.15728E-05
SR Hall 9 Standby-generator	50.1	litre	diesel oil	2.614	0.1309614	0.0239	2.51452E-05	0.0074	0.000114929
SR Hall 10 Standby-generator	57.8	litre	diesel oil	2.614	0.1510892	0.0239	2.90098E-05	0.0074	0.000132593
CMC Standby-generator	150.7	litre	diesel oil	2.614	0.3939298	0.0239	7.56363E-05	0.0074	0.000345706
AC2 Standby-generator	99.9	litre	diesel oil	2.614	0.2611386	0.0239	5.01398E-05	0.0074	0.000229171
AC3 Standby-generator	198.6	litre	diesel oil	2.614	0.5191404	0.0239	9.96773E-05	0.0074	0.000455588
AM Standby-generator	5.5	litre	diesel oil	2.614	0.014377	0.0239	2.76045E-06	0.0074	0.000012617
Towngas used in Lab	5952	48MJ	Towngas	2.549	15.171648	0.0446	0.005574643	0.0099	0.018266688
Total					17.5509108		0.006031473		0.020354687

Note : The towngas being consumed by commercial sector (caterer) is not included. New CO₂ emission factor 2.549 is applied quoted in EPD's guideline 2010 edition.

Table 2 : GHG Emissions from the Mobile Sources for Year July 2015 - June 2016

Step 1	Ste	ep 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
А	В	С	D	E	F	G	н	I.
	Fuel Info	ormation				CLL emissions in tennes of		N O omissions in tennos of
Source description (by different vehicle and fuel types)	Amount of fuel used (in litres)	Fuel type	CO ₂ emission factor ^{Note 1}	tonnes of CO ₂ equivalent ((B x D) / 1000)	CH₄ emis sion factor ^{Note 2}	CO ₂ equivalent ((B x F) / (1000 x 1000) x GWP ^{Note 4})	N ₂ O emission factor ^{Note 3}	CO ₂ equivalent ((B x H) / (1000 x 1000) x GWP ^{Note 4})
Road Transport(vehicle no.)								
Petrol Car	12,211.64	petrol	2.36	28.819	0.253	0.065	1.105	4.183
Diesel Car	6949.24	diesel oil	2.614	18.165	0.145	0.021	0.072	0.155
	Navigation							
NIL								
Aviation								
NIL								
Total				46.985		0.086		4.338

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Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
А	В	С	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	0	0	0	0	0
R407C	0	0	0	0	1526	0
R410A	0	0	0	0	1725	0
R134a	0	0	0	0	1300	0
R407C	0	0	0	0	1526	0
Total						0

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 2015 - June 2016

Step 1	Step 2	Step 3	Step 4	Step 5
А	В	С	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	56	23	-1.058
Total				-1.058

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 2015 - June 2016

Step 1	Step 2	Step 3		Step 4	
А	ВС		ſ	0	
Facility / source description (i.e. Area /	Amount of electricity	Emission factor (kg / kWh)		Indirect GHG emissions in tonnes of CO ₂ equivalent	
facilities the electricity bill is reporting)	purchased (in kWh)	Power company - specific	Territory-wide default value	Power company - specific	Territory-wide default value
Academic 1, Administration Building, Amenities Building and Sports Centre	42,941,003	0.54	0.7	23,188.141	30058.70189
To Yuen Building	670,996	0.54	0.7	362.338	469.6972
Academic 2 & 3	11,164,813	0.54	0.7	6,028.999	7815.3691
Academic 3	968,362	0.54	0.7	522.915	677.8534
Creative Multimedia Centre	4,556,191	0.54	0.7	2,460.343	3189.3337
Student Residence	8,148,326	0.54	0.7	4,400.096	5703.8282
Total				36,962.833	47914.78349

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

The Power company specific emission factor 0.54 is extracted from CLP Substantiability Report 2015.

Table 6 : GHG Emissions from Towngas Purchased from the Hong Kong and China Gas Company for Year July 2015 - June 2016

Step 1	Step 2	Step 3	Step 4
А	В	С	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	5952	0.593	3.530
Total			3.530

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 2015 - June 2016

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
A	В	С	D	E	F	С
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	178722	Note 2	0	4.8	-857.8656
Total				•		-857.8656

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 2015 - June 2016

Step 1	Step 2	Step 3	Step 4
А	В	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, 2 & 3, Administration Building, Amenities Building & Sports Centre, To Yuen Building and Creative Multimedia Centre	222780	0.424	94.459
Student Residence	15551	0.424	6.594
Total	238331		101.052

Note : 1. New emission factor 0.424kg CO_2 -e /m³ 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 2015 - June 2016

Step 1	Step 2	Step 3	Step 4
A	В	С	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, 2 & 3, Administration Building, Amenities Building & Sports Centre, To Yuen Building and Creative Multimedia Centre	222780	0.172	38.318
Student Residence	15551	0.172	2.675
Total			40.993

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

Source description	Default Emission Factor (kg / m³)
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 CO₂-e / m³ 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.