The Legislative Council Complex
Greenhouse Gas Accounting Report
For the Period 1 April 2014 - 31 March 2015

Prepared by

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1. Executive Summary

1.1 Key findings from the GHG accounting project

i. The reported greenhouse gases (GHG) emissions of the Legislative Council Complex (the Complex) during the period from 1 April 2014 to 31 March 2015 are 8,052.44 tonnes CO_2 equivalent (CO_2-e), with Scope 2 emissions contributing to 97.0% through purchased energy. Scope 1 direct GHG emissions which include fuel combustions by vehicles, generators, Towngas equipment and fugitive emissions from refrigerant and fire suppression system take 1.8% while Scope 3 other indirect emissions, including fresh water processing, sewage processing, waste paper and general waste sent to landfill, account for 1.2% of reported emissions.

ii. The GHG emission intensity of the Complex is calculated at 153.95 kg CO_2-e/m^2, based on the included construction floor area at 52,304 m^2.

iii. The GHG performance in terms of absolute emissions and construction floor area both show a 2.3% reduction compared to the base year (1 April 2013 - 31 March 2014).

1.2 Recommendations on carbon reduction and information management

i. Carbon Road Map: Setting GHG reduction targets and review of the performance over time is an internationally best practice for carbon management. As the outcome of 2015 United Nations Climate Change Conference-COP21, Paris Agreement on climate change has delivered a strong and clear message for cutting carbon emissions. It is recommended to engage different stakeholders to develop the carbon reduction targets for the Complex. A strategic planned roadmap will also help the follow up actions on carbon reduction in a more systematic way.

ii. GHG information management system: It is recommended to establish an internal instruction for data collection procedure which will be helpful and make the team well-prepared.

iii. Waste Management: Since the paper waste sent to landfill has been significantly decreased and the general waste increased by 24.3% during the reporting period, the general waste becomes the main contributor of the Scope 3 GHG emissions. It is recommended to review the waste composition and recycling rate of the total recyclables. Source reduction is also important, thus to engage suppliers to reduce packaging materials could be considered.

iv. Communication and engagement: The Complex is the centre of public attention. It can play a leadership role in championing the cause of combating climate change in carbon management.
- Setting up and announcing a long term carbon reduction target;
- Sharing best practices to the stakeholders for both GHG information management and GHG reduction measures;
- Engaging suppliers: The Commission may also lead and influence its service

providers to take actions for the environment, which could provide strong support to the Commission for introducing more innovative and efficient carbon reduction measures;

- Engaging the Complex users: In addition to the recommendations embedded in the base year GHG accounting report, more interactive engagement programme can be explored, for instance, gamification is an emerging approach to encourage involvement. It is recommended to launch the engagement programme to demonstrate a few more innovative and interactive elements in carbon management; and
- Engaging the employees: Internal communication platform could be established to engage staff with environmental information by the environmental team, and this can encourage the sharing of innovative initiatives among the staff on sustainability and carbon reduction.

2. BACKGROUND

2.1 Name of the reporting entity

The Legislative Council Commission (the Commission)

2.2 Description of the reporting entity

The Commission is a statutory body established under The Legislative Council Commission Ordinance (Cap. 443).

2.3 Reporting period

1 April 2014 - 31 March 2015[1]

2.4 Scope of physical boundary

(a) Location of the building

1 Legislative Council Road, Central, Hong Kong

(b) Description of the purpose of the building

The Legislative Council Complex (the Complex) is the first purpose-built building to house the Legislature of Hong Kong.

(c) Description of physical boundary with detailed information

The GHG accounting is compiled from an assessment of facilities under operational control as qualified by the Commission. The Complex has a construction floor area of around 52,528 m^2, comprising the Council Block, the Office Block, and the adjacent open space area namely the Legislative Council Square and the Legislative Council Garden. The Cafeteria with area of 224 m^2 is operated by outsourced contractor.

(d) Description of areas excluded from the GHG accounting

Since the operation of the contractor is not under control of the Commission, the area of Cafeteria, namely 224 m^2, is excluded in this GHG accounting project.

2.5 Scope of operational boundary

(a) Scope 1 Direct GHG emissions from:

- Combustion of fuels in stationary sources – diesel used in electricity generators

[1] 1 April 2013 – 31 March 2014 has been set as the base year for the Legislative Council Complex's GHG accounting in order to compare the GHG emissions over time.

- Combustion of fuels in stationary sources – Towngas used in boilers and room kit
- Combustion of fuels in mobile sources – petrol used in owned vehicles
- Unintentional GHG release from equipment and system (fugitive emissions from fire suppression system and refrigeration/air-conditioning equipment)

(b) Scope 2 Energy indirect GHG emissions from:

- Electricity purchased from The Hongkong Electric Company
- Towngas purchased from The Hong Kong and China Gas Company

(c) Scope 3 Other indirect GHG emissions from:

- Methane gas generation at landfill in Hong Kong due to disposal of paper waste
- GHG emissions due to electricity for fresh water processing by Water Supplies Department (WSD)
- GHG emission due to electricity used for sewage processing by Drainage Services Department (DSD)
- Methane gas generation at landfill in Hong Kong due to general waste disposal

2.6 Methodologies for quantifying GHG emissions

The accounting process follows the Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Buildings (Commercial, Residential or Institutional Purposes) in Hong Kong (2010) (EPD-EMSD Guidelines) in data collection, classification of emission source, quantification methods and the reporting format. The GHG emissions are quantified in terms of CO_2-e, and the types of GHG covered in this report are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluoro-carbons (HFCs), perfluoro-carbons (PFCs) and sulphur hexafluoride (SF_6).

(a) List of activities for which simplified methodologies and conversion factors in the Guidelines are used for quantification:

- Direct emissions from stationary combustion (Scope 1)
  Emission (CO_2) = Σ Amount of fuel consumed × Emission factor of CO_2
  Emission (CH_4 / N_2O) =Σ Amount of fuel consumed × Emission factor of (CH_4 / N_2O) × Relative Global Warming Potential (GWP)
  where
  Emission is summed over all types of fuel used by all generators and Towngas consuming devices; and
  Amount of diesel consumed is in terms of litre and amount of Towngas consumed is in terms of unit.

- Direct emissions from mobile combustion (Scope 1)

Emission (CO_2) = Σ Amount of fuel consumed × Emission factor of CO_2
Emission (CH_4 / N_2O) =Σ Amount of fuel consumed × Emission factor of (CH_4 / N_2O) × GWP
where
Emission is summed over petrol used by all vehicles owned by the Commission; and
Amount of fuel consumed is in terms of litre.

- Indirect emissions from electricity / Towngas purchased (Scope 2)
  Emission (CO_2-e) = Quantity of purchased electricity / Towngas × Emission factor
  where
  Purchased electricity is measured in kilowatt-hours (kWh); and
  Purchased Towngas is measured in unit.

- Other indirect emissions due to electricity used for processing fresh water by WSD (Scope 3)
  Emission (CO_2-e) = Quantity of fresh water consumed × Emission factor
  where
  Water consumed is measured in cubic metre (m^3).

- Other indirect emissions due to electricity used for processing sewage water by DSD (Scope 3)
  Emission (CO_2-e) = Quantity of sewage discharged × Emission factor
  where
  Sewage discharged is measured in cubic metre (m^3).

- Other indirect emissions from paper disposed at landfills (Scope 3)
  In order to simplify the calculations, the default emission factor assumes that the total raw amount of CH_4 emitted throughout the entire decomposition process of the paper waste disposed at landfills will be emitted into the atmosphere within the same reporting period as paper waste collected.

  Emission (CO_2-e) = (P_s + P_i – P_r – P_e) × Emission factor (estimated at 4.8 kg CO_2-e/kg)
  where
  P_s = Paper inventory at the beginning of the reporting period (in storage) (kg)
  P_i = Paper added to the inventory during the reporting period (kg)
  P_r = Paper collected for recycling purpose (kg)
  P_e = Paper inventory at the end of the reporting period (in storage) (kg)

(b) Details (including necessary reference) of other methodologies and conversion factors used for quantification:

- Fugitive emissions from fire suppression system – portable extinguishers (Scope 1)

2006 IPCC Guidelines for National Greenhouse Gas Inventories[2] is referred, as below:

Emissions (CO_2-e) = Σ Amount of extinguishing agent leakage × GWP of extinguishing agent

where

Amount of extinguishing agent leakage = Amount of extinguishing agent × leakage rate

The IPCC default leakage rate is 4% ± 2% and midpoint of the interval, 4%, is adopted.

- Fugitive emissions from fire suppression system – FM 200 system (Scope 1)

  2006 IPCC Guidelines for National Greenhouse Gas Inventories is referred, as below:

  Emissions (CO_2-e) = Σ Amount of HFC-227ea[3] leakage × $GWP_{HFC-227ea}$

  where

  Amount of extinguishing agent leakage = Amount of HFC-227ea × leakage rate

  The IPCC default leakage rate is 2% ± 1%. In consideration of the periodical pressure tests have been conducted during the reporting period, the lower value 1% is selected.

- Fugitive emissions from refrigeration / air-conditioning systems – refrigerators / air conditioning equipment (Scope 1)

  2006 IPCC Guidelines for National Greenhouse Gas Inventories is referred, as below:

  Emissions (CO_2-e) = Σ Amount of refrigerant leakage × GWP of refrigerant

  where

  Amount of refrigerant leakage = Amount of refrigerant charge × operation emission factor

  The IPCC default operation emission factor for domestic refrigeration is 0.1% - 0.5% of initial charge per year and for chiller is 2% - 15% of initial charge per year. The lower end of the emission factors are intended to specify the status in developed region, thus, 0.1% and 2% are selected accordingly.

- Other indirect GHG emissions from general waste disposal (Scope 3)

  The Guidelines of Carbon Audit Toolkit for Small and Medium Enterprises in Hong Kong is referred, as below:

  The general waste sent to landfill will be decomposed through anaerobic digestion and CH_4 will be emitted. It is estimated that anaerobic digestion of one kg of the general waste is equivalent to 1.5 kg CO_2-e, then

  Emission (CO_2-e) =Amount of general waste disposal × Emission factor (estimated at 1.5 kg CO_2-e/kg).

[2] Source: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_7_Ch7_ODS_Substitutes.pdf

[3] HFC-227ea is the fire suppression agent used in FM 200 system.

(c) Details of any changes in methodologies and conversion factors since the last GHG report by the Entity:

- The GHG Emission Factor for purchased electricity within Scope 2 has been updated from 0.78 kg CO_2-e/kWh (2013) to 0.79 kg CO_2-e/kWh (2014) according to the recent Hong Kong Electric Investments Sustainability Report 2014.

- The GHG Emission Factor of Towngas purchased within Scope 2 has been updated from 0.62 kg CO_2-e/unit (2013) to 0.60 kg CO_2-e/unit (2014) according to the recent Towngas Sustainability Report 2014.

- The GHG Emission Factor for fresh water processing by WSD within Scope 3 has been updated from 0.414 kg CO_2-e/m^3 (2013) to 0.398 kg CO_2-e/m^3 (2014) according to the recent WSD Annual Report 2013-2014.

- The GHG Emission Factor (in) for Sewage Processing by DSD within Scope 3 has been updated from 0.167 kg CO_2-e/m^3 (2013) to 0.169 kg CO_2-e/m^3 (2014) according to the recent DSD Sustainability Report 2013-2014.

(d) Details on any re-calculation of previously reported emissions and removals because of changes in methodologies and conversion factors

Not applicable.

2.7 Contact person of the reporting entity

The Administration Division, Legislative Council Secretariat (the Secretariat)

2.8 References

The following guidelines are taken as references in this *Report*:

- *Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Buildings (Commercial, Residential or Institutional Purposes) in Hong Kong (2010)*. Environmental Protection Department and Electrical and Mechanical Services Department of the Government of the Hong Kong Special Administrative Region
- *ISO14064-1 (2006): International Standard on Greenhouse Gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*. ISO
- *2006 IPCC Guidelines for National Greenhouse Gas Inventories - Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances*. IPCC
- *Carbon Audit Toolkit for Small and Medium Enterprises in Hong Kong (2010)*. Published in February 2010 by The University of Hong Kong
- Other references, where appropriate (e.g. emission factors), have also been taken into consideration and are quoted under corresponding sessions in this report.

3. GHG EMISSIONS DATA

3.1 Information on GHG emissions and removals

Summary of Results

Scope 1 Emissions:	141.81	tonnes of CO_2-e
Scope 1 Removals:	Nil	tonnes of CO_2-e
Scope 2 Emissions:	7,813.20	tonnes of CO_2-e
Scope 3 Emissions:	97.43	tonnes of CO_2-e
Other GHG Offsets / Removals:	Nil	tonnes of CO_2-e
Accounted GHG Emissions in total:	8,052.44	**tonnes of CO_2-e**

In terms of absolute GHG emission, the reported emissions of the Complex in current reporting period achieves a 2.3% reduction versus the base year's 8,243.16[4] tonnes CO_2-e, indicating a decrease of 190.72 tonnes CO_2-e.

GHG Performance in Ratio Indicator: Based on the included construction floor area of 52,304 m^2, the GHG emission intensity of the Complex in terms of construction floor area is 153.95 kg CO_2-e/m^2, also indicating a 2.3% reduction compared to the base year's 157.60 kg CO_2-e/m^2.

3.2 Total and breakdown of the GHG emissions

The GHG emissions of the Complex accounted for reporting period: 1 April 2014 to 31 March 2015, are 8,052.44 tonnes CO_2-e. Table 1 summarizes the GHG emissions of the Complex from different emission sources. The summary of activity data and calculation details are shown in APPENDIX 1 and APPENDIX 3 respectively. The GHG emissions summary for the base year is attached in APPENDIX 4.

Table 1: Summary of GHG emissions accounted for the Complex during the reporting period

Emission source	in tonnes of CO_2-e						
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Sub-total
Scope 1 Direct Emissions							
Combustion of fuels in stationary sources – diesel used in generators	0.52	0.00	0.00	N/A	N/A	N/A	0.52
Combustion of fuels in stationary sources – Towngas consumption	12.10	0.00	0.01	N/A	N/A	N/A	12.11

[4] This figure in the *The Legislative Council Complex Greenhouse Gas Accounting Report For the Period 1 April 2013 - 31 March 2014* was 8,243.17 and updated to 8,243.16 due to the rules for rounding off in the current reporting period.

Combustion of fuels in mobile sources – petrol used in the Commission owned vehicles	10.37	0.02	1.51	N/A	N/A	N/A	11.90
Unintentional GHG release from equipment and system	0.05	N/A	N/A	117.23	N/A	N/A	117.28
Scope 2 Energy Indirect Emissions (To be reported in general without being classified into specific gas type)							
Electricity purchased from The Hongkong Electric Company							7,810.35
Towngas purchased from The Hong Kong and China Gas Company							2.85
Scope 3 Other Indirect Emissions (GHG emission from fresh water processing and sewage discharge disposal to be reported in general without being classified into specific gas type)							
Methane gas generation at landfill in Hong Kong due to disposal of paper waste	N/A	45.26	N/A	N/A	N/A	N/A	45.26
GHG emissions due to electricity for fresh water processing by WSD							1.47
GHG emissions due to electricity used for sewage processing by DSD							0.59
Methane gas generation at landfill in Hong Kong due to general waste disposal	N/A	50.11	N/A	N/A	N/A	N/A	50.11

3.3 Data collection

i. Scope 1 - Stationary fuel combustion

The data of diesel consumption for three generators controlled by the Complex are extracted from the monthly maintenance records.

Towngas consumption is based on the bills issued by The Hong Kong and China Gas Company.

ii. Scope 1 - Mobile fuel combustion

The vehicle type of the three cars owned by the Commission has been specified as "Private Car" in the licenses. Fuel consumption records are summerised from the invoices issued by the suppliers. The type of fuel used is petrol, and quantities for each of these vehicles are listed.

iii. Scope 1 - Fugitive emissions

The amounts and specifications of CO_2 portable extinguishers and FM 200 have been summarised by the Secretariat. The types and amounts of refrigerant used in refrigerators and air-conditioning equipment solely controlled by the Complex are also provided. No allocation is made for the refrigerant used in the central chiller plant (CCP) which is shared use with the Chief Executive's Office and Central Government Offices.

iv. Scope 2 - Electricity

The electricity used by the Complex contains the part solely controlled by the Complex and the shared usage with the Chief Executive's Office and Central Government Offices. The shared facilities include CCP and seawater pump house (SWP) and the portion of electricity consumption by the Complex is calculated based on measured water consumption of each building in CCP and SWP.

v. Scope 3 - Water

The fresh water consumption of the Complex is based on the monthly records of the water metres' readings instead of water bills. And the sewage generated is calculated on the basis of the default conversion from fresh water amount, as identified in the EPD-EMSD Guidelines.

vi. Scope 3 - Paper

The data of paper inventory opening stocks for both the Secretariat and Legislative Council Members' Offices are available, which equal to the paper storage at the end of last reporting period. Following the previous practice, the paper purchased and closing stocks are recorded for both, through monthly records and survey.

One ream of 75gsm A4 paper weighs 2.34 kg, while one ream of 75gsm A3 paper weighs 4.68 kg.

The practice of paper collection and recycling in the Complex had contained a mix of the newspaper and office paper (including recyclable confidential paper). Sampling was conducted separately to measure the daily newspaper recycling. Newspaper is not generated for the operation of the Complex, and is therefore out of the operational boundary. Projection was applied to calculate the newspaper recycling for the year.

vii. Scope 3 - General waste

The data of general waste disposal are calculated based on projection of the sample data. While the sampling process and projection method for both newspaper and general waste is consistent with the practice in the base year.

3.4 Data analysis

i. GHG emissions breakdown

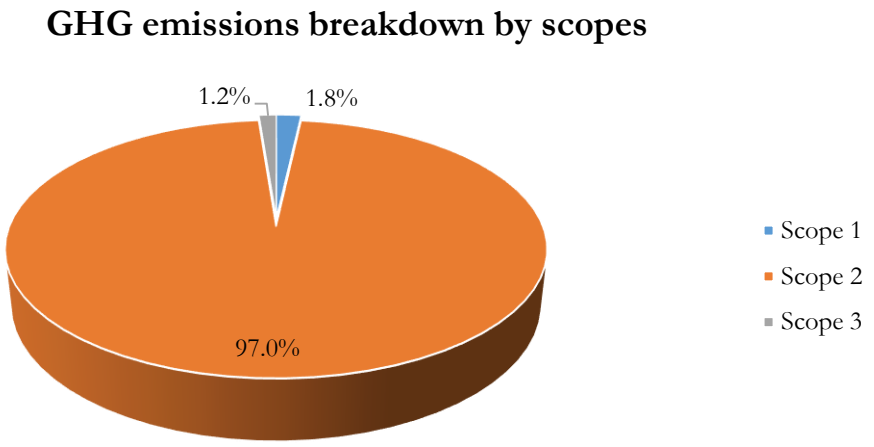

Figure 1. 2014-2015 GHG emission profile by scopes

Figure 1 breakdowns the 2014-2015 GHG emission profile by scopes. The Scope 2 indirect GHG emissions from purchased energy contributed the most, 97.0% (7,813.2 tonnes), to the total GHG emissions (8,052.44 tonnes). It is followed by Scope 1 direct GHG emissions, 1.8% (141.81 tonnes) and lastly, Scope 3 other indirect GHG emissions account for the least of the total, 1.2% (97.43 tonnes).

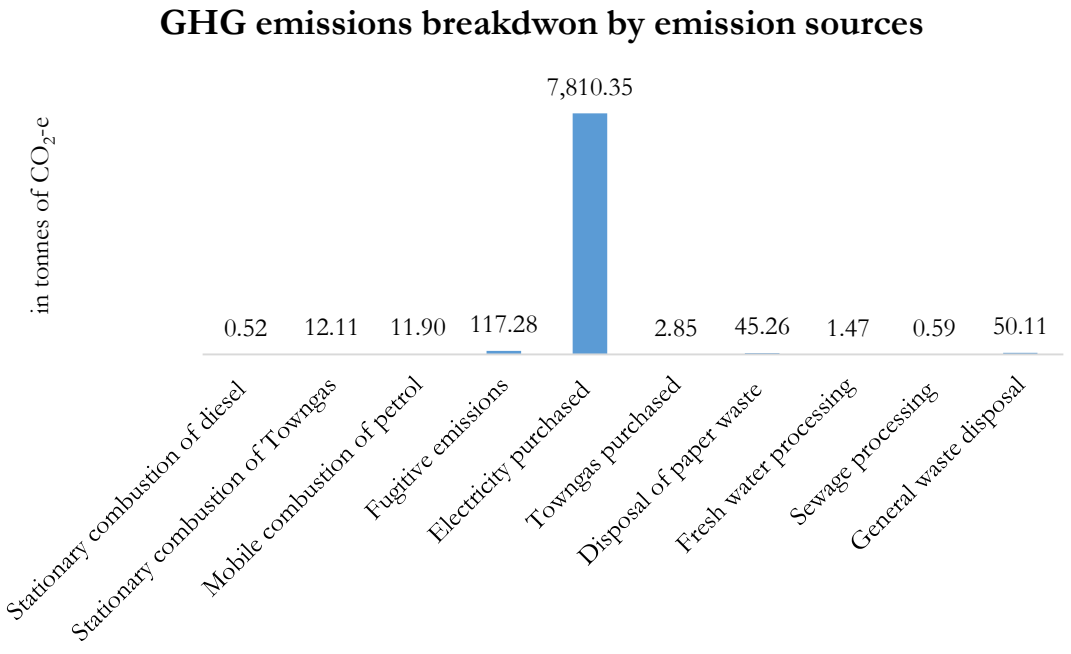

Figure 2. 2014-2015 GHG emission profile by emission sources

Figure 2 presents the distribution of different emission sources. Electricity consumption is the dominant carbon emitter of the Complex, accounting for 7,810.35 tonne CO_2-e, equavlent to 97.0% of the reported emissions, followed by fugitive emissions, 117.28 tonnes, general waste disposal, 50.11 tonnes and disposal of paper waste, 45.26 tonnes. The rest represent less than 1.0% of the total emission profile.

ii. GHG emissions comparison with the base year

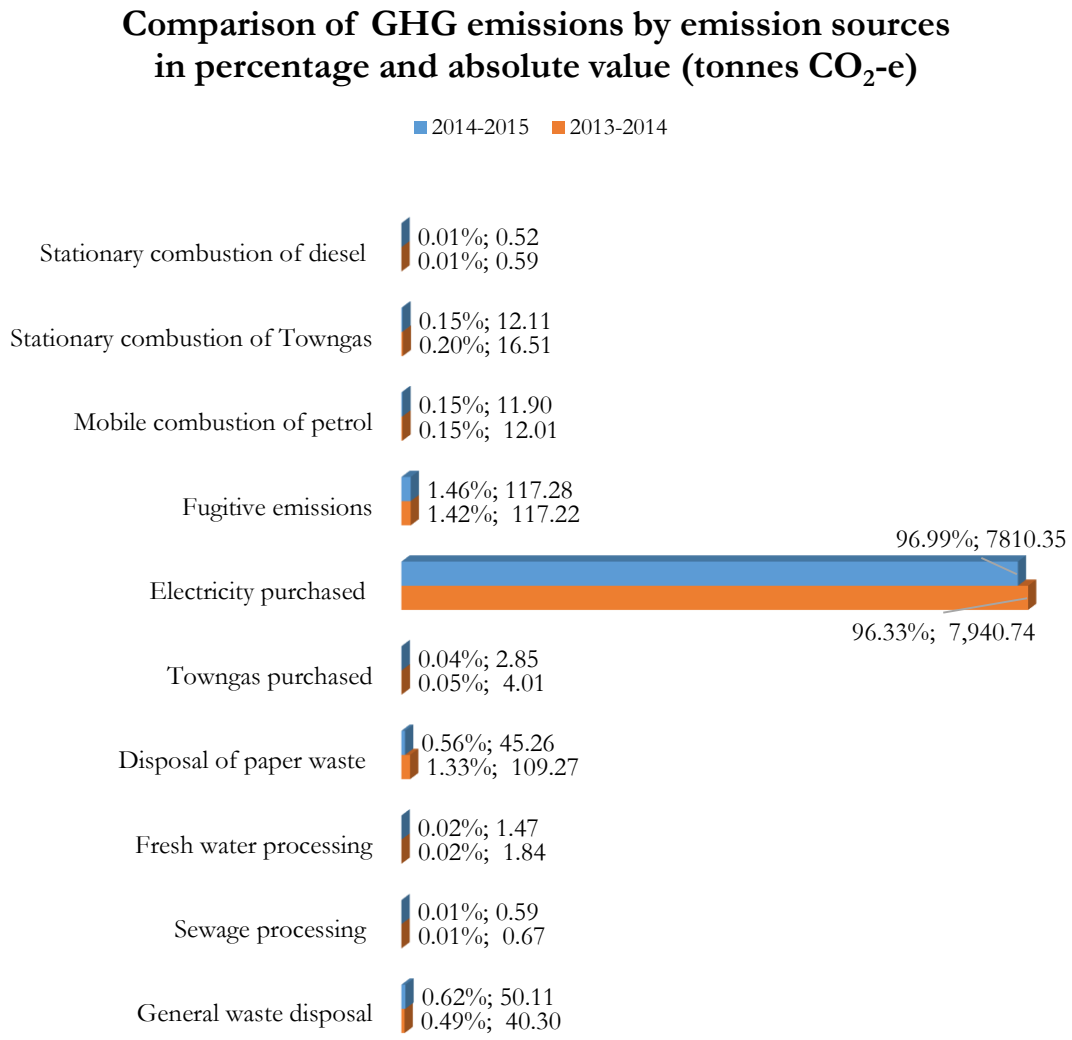

Figure 3. Comparison of GHG emissions between 2014-2015 and 2013-2014

Figure 3 compares the distribution of different emission sources in tonnes of CO_2-e and in percentage terms between the current reporting year and the base year. In both years, electricity consumption remained the largest contributor to total GHG emissions, where made up of 7,940.74 tonnes CO_2-e and equals to 96.3% of total in 2013-2014 while the contribution from electricity purchase in 2014-2015 is 7,810.35 tonnes CO_2-e, which

accounts for 97.0% of the inventory. At the same time, GHG emissions attributable to stationary combustion of diesel and sewage processing in both years continued to be the smallest and an insignificant contributor to total GHG emissions of the Complex. Compared to relatively stable performance of the other emissions sources, general waste disposal has been more significant from 40.30 tonnes CO_2-e to 50.11 tonnes CO_2-e while the paper waste disposal's impact decrease from 109.27 tonnes CO_2-e to 45.26 tonnes CO_2-e.

Table 2 summarises the differences of the accounted GHG emissions between the current reporting period (1 April 2014 – 31 March 2015) and the base year (1 April 2013 – 31 March 2014). It can be observed that except fugitive emissions and general waste sent to landfill, the other emission sources all show different levels of reduction. In terms of absolute reduction, the GHG emissions from eletricity purchased has reduced 130.39 tonnes CO_2-e, which contributes 68.4% of the total reduction of 190.72 tonnes, while the amount of paper waste sent to landfill decreased with 64.01 tonnes fewer emissions than the base year. Also, the significant reduction of paper waste takes the largest negative change in terms of percentage, 58.6% less.

Table 2: Summary of GHG emissions differences between the reporting period (2014-2015) and the base year (2013-2014)

Emission Source	Accounted GHG emissions in tonnes of CO_2-e		Differences in tonnes of CO_2-e	Differences in percentage
	2014-2015	2013-2014	2014-2015 versus 2013-2014	2014-2015 versus 2013-2014
Scope 1 Direct Emissions	**141.81**	**146.33**	**-4.52**	**-3.1%**
Combustion of fuels in stationary sources – diesel used in generators	0.52	0.59	-0.07	-11.9%
Combustion of fuels in stationary sources – Towngas consumption	12.11	16.51	-4.40	-26.7%
Combustion of fuels in mobile sources – petrol used in the Commission owned vehicles	11.90	12.01[5]	-0.11	-0.9%
Unintentional GHG release from equipment and system	117.28	117.22	0.06	0.1%

[5] This figure in the *The Legislative Council Complex Greenhouse Gas Accounting Report For the Period 1 April 2013 - 31 March 2014* was 12.02 and updated to 12.01 due to the rules for rounding off in the current reporting period.

Scope 2 Energy Indirect Emissions	**7,813.20**	**7,944.75**	**-131.55**	**-1.7%**
Electricity purchased from The Hongkong Electric Company	7,810.35	7,940.74	-130.39	-1.6%
Towngas purchased from The Hong Kong and China Gas Company	2.85	4.01	-1.16	-28.9%
Scope 3 Other Indirect Emissions	**97.43**	**152.08**	**-54.65**	**-35.9%**
Methane gas generation at landfill in Hong Kong due to disposal of paper waste	45.26	109.27	-64.01	-58.6%
GHG emissions due to electricity for fresh water processing by WSD	1.47	1.84[6]	-0.37	-20.1%
GHG emissions due to electricity used for sewage processing by DSD	0.59	0.67	-0.08	-11.9%
Methane gas generation at landfill in Hong Kong due to general waste disposal	50.11	40.30	9.81	24.3%
Sum-total	**8,052.44**	**8,243.16**	**-190.72**	**-2.3%**

3.5 Activity data comparison

Under the context of GHG emissions accounting, the activity data have dominant impact in general. The series of Figure 4a to 4e shows the monthly comparisons of different emission sources, which enable further investigation on emission sources changes between the reporting period and the base year. The presented emissions sources (diesel, electricity, Towngas, fresh water and sewage) all indicate reductions on activity data, though one thing needs to be noticed is that electricity consumption from September 2014 to March 2015 are higher than the same period of the previous reporting period.

[6] This figure in the *The Legislative Council Complex Greenhouse Gas Accounting Report For the Period 1 April 2013 - 31 March 2014* was 1.83 and updated to 1.84 due to the rules for rounding off in the current reporting period.

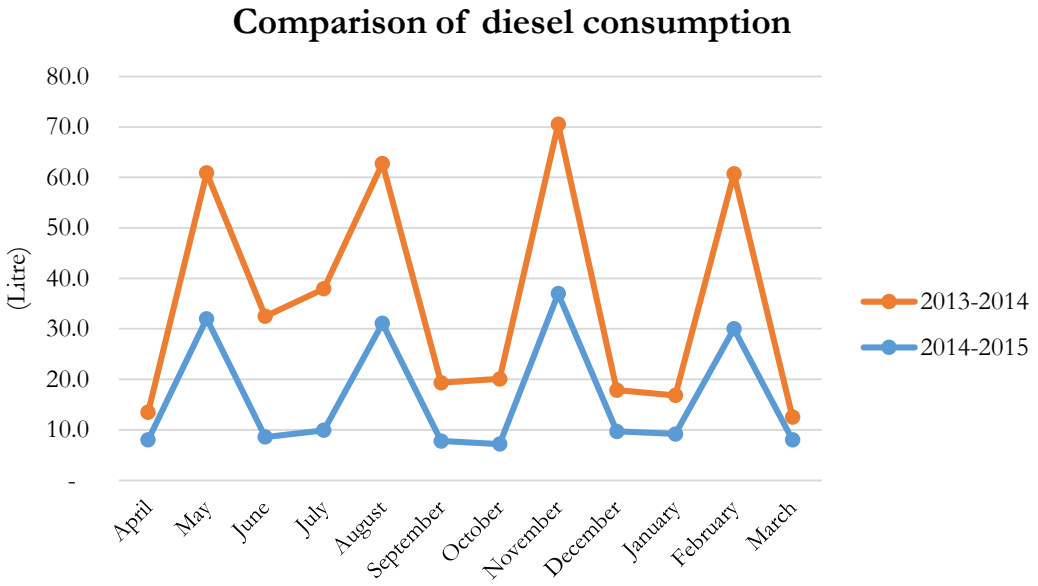

Figure 4a. Diesel consumption

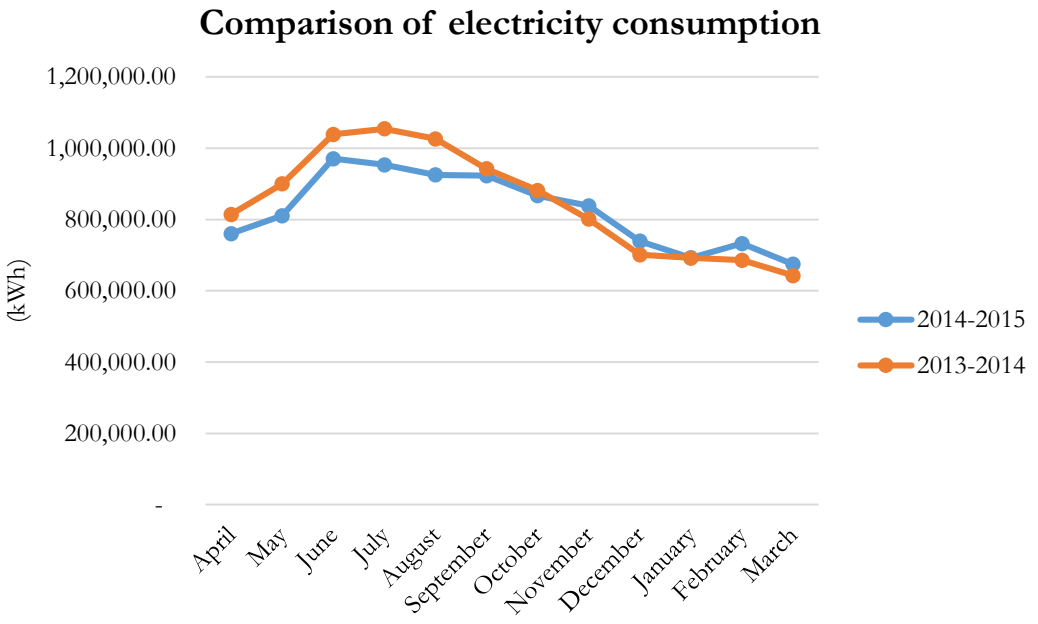

Figure 4b. Electricity consumption

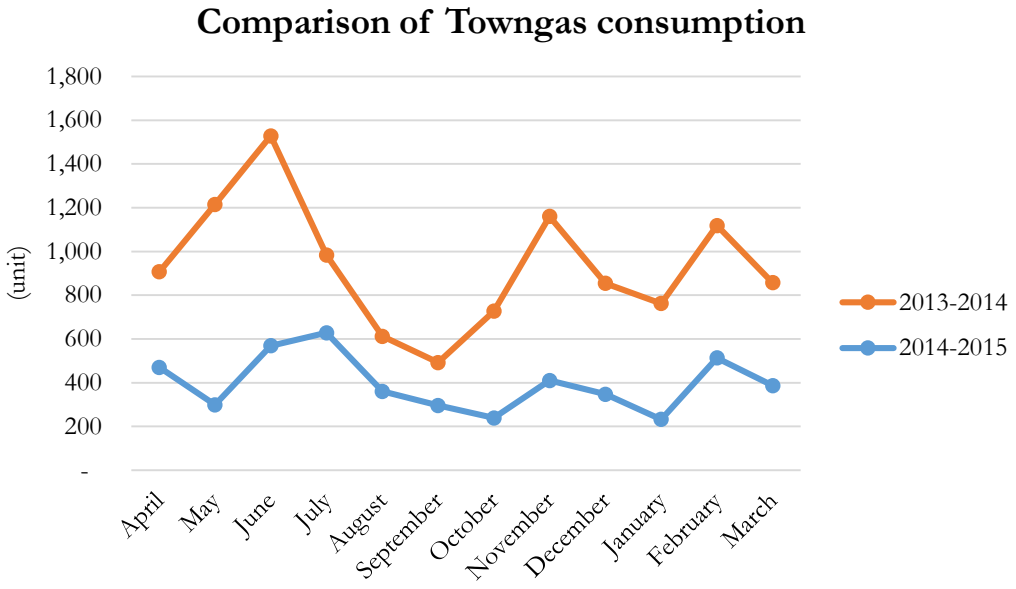

Figure 4c. Towngas consumption

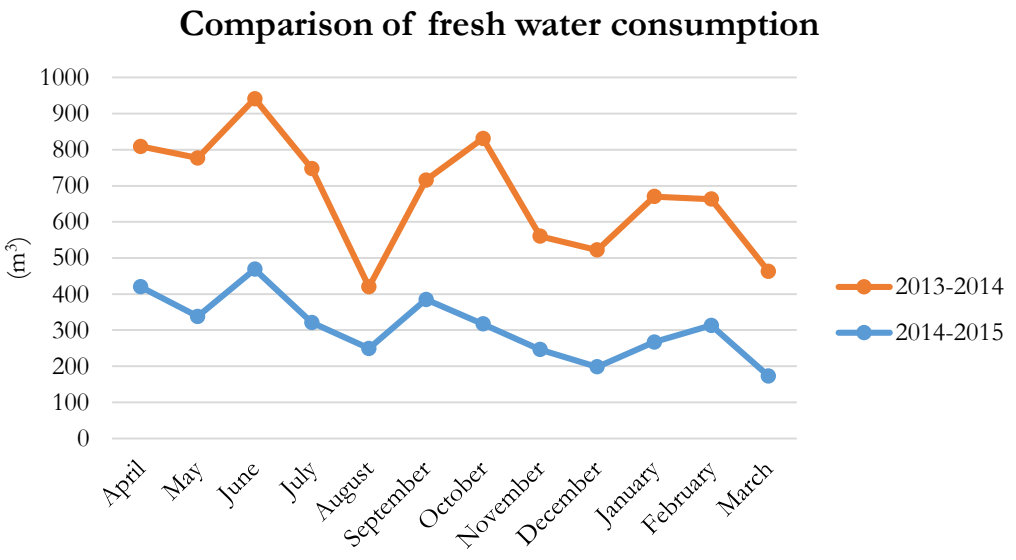

Figure 4d. Fresh water consumption

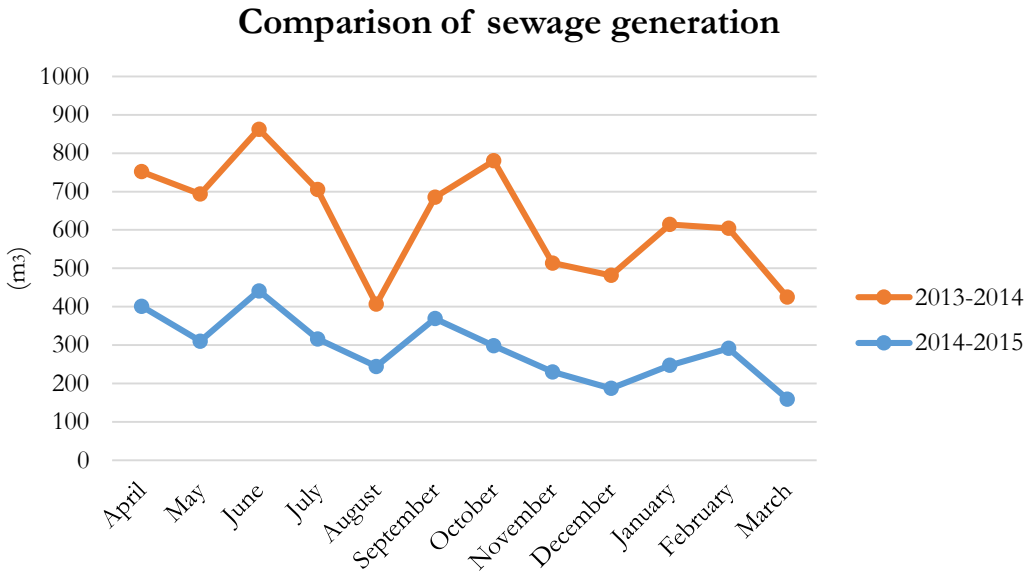

Figure 4e. Sewage generation

3.6 GHG emission reduction measures implemented

This new session of report is to track the new actions to reduce GHG emissions newly adopted during the current reporting period. It can be used for further analysis and discussion regarding continuous improvement of carbon performance in the Complex. As recommended in the base year accounting report, the recording system can be put in place to keep track of improvements and measure the effectiveness of changes implemented. These would also be the basis in which the tangible achievements of the Complex with regard to good environmental practices can be communicated to the stakeholders.

3.6.1 Energy saving

- Lighting: Based on the use pattern of the lights, some lighting sensors have been switched to manual mode, instead of auto mode to balance the needs of the Complex users and needs of energy saving. Some lights at outdoor area are set to be off after office hours as well.

- Server room: Flat metallic sheets have be installed as partition to separate the hot air in front of the server racks which increase the efficiency of air-conditioning system for the server.

3.6.2 Water saving

Water saving controllers have been installed to wash basins in the toilets and shower rooms in January 2015.

3.6.3 Paper

Since 2 March 2015, only softcopy of meeting papers are issued to non-members of all LegCo committees.

3.6.4 Communication and engagement

Upon completion of the GHG accounting for the base year, the Commission has invited the service provider to conduct briefing presentations to the Complex users. There is also a dedicated section on the website of the Legislative Council, for GHG information disclosure to the public. Both are the very fundamental steps to engage stakeholders.

4. DISCUSSION AND RECOMMENDATIONS

4.1 Discussion

4.1.1 Follow up actions

During the accounting process, the follow up actions to address the recommendations in the accounting report of the base year have been reviewed. It is learned that many of them have been either put in place, or in the process of development. Provision of information on best practices has been in preparation, while the feasibility for sub-metering system and LED lighting has been taken into study along the period.

4.1.2 Fugitive emissions

Although in the data analysis section, the fugitive emissions show a slight increase in 2014-2015 compared to the base year, it could be found the difference lying on the updates of records for FM-200 cylinders and the CO_2 portable extinguishers. This change is not material due to insignificant activity data variance. In most cases, the major contribution of fugitive emissions is accounted for refrigerant refill. It is noted that during the two consecutive reporting periods, there is no refrigerant refill record, which more attention should be paid in coming reporting periods.

4.1.3 Electricity consumption

In Chapter 3, it is mentioned that "electricity consumption from September 2014 to March 2015 are higher than the same period of the previous reporting period", which is different from the rest of the reporting period. It needs particular attention that the emissions does not follow the decreasing trend, although some energy saving measures were already in place. Whether any specific incidents or operation changes lead to this result could be further investigated.

4.1.4 Waste reduction

Paper recycling amount recorded in 2014-2015 has been largely increased by 87.0% as in 2013-2014, at the same time the general waste amount increased by 24.3% which compensate the GHG avoidance by paper recycling. Though the overall GHG emissions from waste category, covering paper waste and general waste has reduced from 149.57 tonnes CO_2-e in 2013-2014 to 95.37 tonnes now. It is worthwhile to review the waste management operations and investigate reverse trends of the two emission sources.

4.2 Recommendations

4.2.1 Carbon Roadmap Strategy Assessment

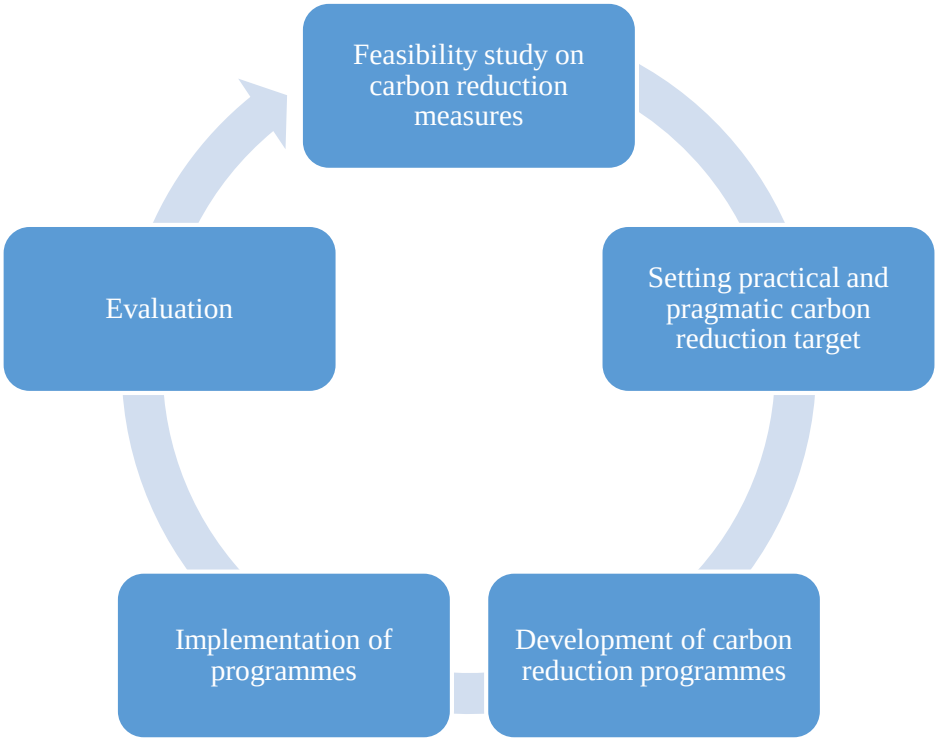

Figure 5. Carbon Roadmap Strategy Assessment

Setting GHG reduction target and review of the performance over time is an internationally best practice for carbon management. As one of the most important event, the 2015 United Nations Climate Change Conference, COP21 was held in Paris *and Paris Agreement* on climate change has been successfully negotiated by 196 parties. This global agreement delivers a strong and clear message for cutting carbon emissions with each country's Intended Nationally Determined Contributions (INDC) and keep temperature rise well below 2 degree Celsius. Hong Kong Special Administrative Region Government also confirms Hong Kong's target of 50%-60% reduction in GHG emission intensity by 2020. It is the time to set a target for the Complex, for instance, the Parliament of the United Kingdom[7] had set to reduce absolute carbon emissions by 34% by 2020-2021 against the base scenario in 2008-2009. The approach of Carbon Roadmap Strategy Assessment is demonstrated in Figure 5 will be a practical step for setting the GHG reduction target. It is recommended that the Commission may engage different stakeholders to develop its reduction targets in the short, medium and long term based on a review of internal capacity and current performance.

[7] Source: http://www.parliament.uk/about/sustainability/targets-and-performance/

4.2.2 GHG information management system

It is recommended to establish an internal instruction for data collection procedure which will be helpful and make the team well-prepared.

4.2.3 Implementation of GHG emission reduction measures

- Refrigerant
  According to the international recognised references[8&9], a checklist/manual for maintenance of refrigeration and air-conditioning system could be considered for operation practice. Table 3 presents the estimates for charge, lifetimes and emission factors data extracted from IPCC, which could be taken as internal reference to check if the leakage rate is within the reasonable range and if there is any defection instead of aging problem.

Table 3 Estimates for charge, lifetime and emission factors for refrigeration and air-conditioning system[10]

Sub-application	Charge (kg)	Lifetimes (year)	Emission Factors (% of initial charge/year)		End-of-Life Emission (%)	
			Initial emission	Operation emission	Recovery efficiency	Initial charge remaining
Chillers	$10 \leq M \leq 2{,}000$	$15 \leq d \leq 30$	$0.2 \leq k \leq 1$	$2 \leq x \leq 15$	$0 < \eta_{rec,d} < 95$	$80 < P < 100$
Residential and commercial A&C, including Heat Pumps	$0.5 \leq M \leq 100$	$10 \leq d \leq 20$	$0.2 \leq k \leq 1$	$1 \leq x \leq 10$	$0 < \eta_{rec,d} < 80$	$0 < P < 80$

- General waste reduction
  Since the paper waste sent to landfill has been significantly decreased and the general waste increased by 24.3% during the reporting period, the general waste becomes the main contributor of the Scope 3 GHG emissions. It is recommended to review the waste composition and recycling rate of the total recyclables. Source reduction is also important, thus to engage suppliers to reduce packaging materials could be considered.

[8] Source: US Environmental Protection Agency(EPA)
http://www2.epa.gov/sites/production/files/2013-12/documents/gc_preventativemaintenance_20130913.pdf
[9] Source: Australian Institute of Refrigeration, Airconditioning and Heating
http://www.airah.org.au/imis15_prod/Content_Files/UsefulDocuments/AIRAH_HFC_RefrigerantLevy_FactSheet3.pdf
[10] Source: Volume 3: Industrial Processes and Product Use - 2006 IPCC Guidelines for National Greenhouse Gas Inventories

4.2.4 Communication and Engagement

Programs for engaging internal and external stakeholders to support and implement the GHG reduction actions should be planned and set up to promote sustainability awareness and support carbon care practices.

- *Engaging suppliers:* The Commission may also lead and influence its service providers to take actions for the environment, which could provide strong support to the Commission for introducing more innovative and efficient carbon reduction measures. For instance, Green Procurement Guidelines could be taken into consideration to provide guidance for suppliers and contractors to fulfill their responsibility in sustainability.

- *Engaging the Complex users:* In addition to the recommendations embedded in the base year GHG accounting report, more interactive engagement programme can be explored, for instance, gamification is an emerging approach to encourage involvement. Direct interaction, such as kinetic energy electricity generation that convert human power to electricity can be fun and clearly deliver the message of alternative energy to reduce the fossil fuel usage. It can be applied in the gym as cycling or running exercise, or even can be communal area pavement to light up the bulb over the head while some innovative technology are in the market. This is an example of the element that can be considered and it is recommended to launch the engagement programme to demonstrate a few more innovative and interactive elements in carbon management.

- *Engagement program for employees*: Best practice can be provided to the staff and users of the Complex through multi channels, which will help them implement GHG emission management in operations of the Complex. It is recommended to deliver the information in series as routine, rather than a one-time action, for instance, tips in email newsletter, et cetera. Internal communication platform could be established to engage staff with environmental information by the environmental team, and this can encourage the sharing of innovative initiatives among the staff on sustainability and carbon reduction.

//end of text//

APPENDIX 1: SUMMARY OF ACTIVITY DATA

Activity	Emission source	Activity data	Unit	Scope (1, 2, 3)
Stationary fuel combustion	Diesel	198.6	litre	1
Stationary fuel combustion	Towngas	4,750	unit	1
Mobile fuel combustion	Unleaded petrol (ULP)	4,394	litre	1
Fugitive emission – Portable extinguishers	CO_2	44	kg	1
Fugitive emission – FM 200	HFC-227ea	40	kg	1
Fugitive emission – Refrigerator	R-134a	0.0022	kg	1
Fugitive emission – Air-conditioning equipment	R-410A	1.2	kg	1
Electricity purchased	GHG emissions from the utility	9,886,515	kWh	2
Towngas purchased	GHG emissions from the utility	4,750	unit	2
Paper waste disposal	Methane gas generation at landfill	9,430	kg	3
Fresh water processing	Electricity used for processing by WSD	3,696	m^3	3
Sewage discharge	Electricity used for processing by DSD	3,496	m^3	3
General waste disposal	Methane gas generation at landfill	33,406	kg	3

APPENDIX 2: CONVERSION FACTORS

A. Emission factors used

Scope	Emission source	Type	Unit	CO_2 (kg/unit)	CH_4 (g/unit)	N_2O (g/unit)	Data source
Scope 1	Stationary combustion	Diesel	litre	2.614	0.0239	0.0074	EPD-EMSD Guidelines
	Stationary combustion	Towngas	unit	2.549	0.0446	0.0099	EPD-EMSD Guidelines
	Mobile combustion	ULP – Passenger car	litre	2.360	0.253	1.105	EPD-EMSD Guidelines

Scope	Emission source	Unit	$kgCO_2$-e /unit	Data source
Scope 2	Electricity purchased from The Hongkong Electric Company	kWh	0.79	HK Electric Investments Sustainability Report 2014
	Towngas purchased from The Hong Kong and China Gas Company	unit	0.60	Towngas Sustainability Report 2014
Scope 3	Methane generation at landfill in Hong Kong due to Disposal of Paper Waste	kg	4.8	EPD-EMSD Guidelines (2010)
	Electricity used for fresh water processing by WSD	m^3	0.398	WSD Annual Report 2013/2014
	Electricity used for sewage processing by DSD	m^3	0.169	DSD Sustainability Report 2013-2014
	General waste disposal	kg	1.5	Carbon Audit Toolkit for Small and Medium Enterprises in Hong Kong

B. GWP values used

Gas or Blend	GWP	Information source
HFC-227ea	2,900	IPCC Second Assessment Report (1995)
R-134a	1,300	IPCC Second Assessment Report (1995)
R-410A	1,725	"World Resources Institute (2005), Calculating HFC and PFC Emissions from the Manufacturing, Installation, Operation and Disposal of Refrigeration & Air-conditioning Equipment (Version 1.0) - Guide to calculation worksheets, World Business Council for Sustainable Development", in which the latter states that the source of reference is from ASHRAE Standard 34.

APPENDIX 3: DETAILED CALCULATION WORKSHEETS FOR GHG EMISSIONS

A. GHG emissions from stationary combustions

A	B	C	D	E	F	G	H	I
Source description	Amount of fuel used (litre/unit)	Fuel Type	CO_2 emission factor	CO_2 emissions in tonnes of CO_2-e ((B×D)/1000)	CH_4 emission factor	CH_4 emissions in tonnes of CO_2-e ((B × F)/(1000 × 1000) × GWP[Note 1])	N_2O emission factor	N_2O emissions in tonnes of CO_2-e ((B × H)/(1000 × 1000) × GWP[Note 1])
Generators	198.60	Diesel	2.614	0.52	0.0239	0.0001	0.0074	0.0005
Towngas consumption	4,750	Towngas	2.549	12.10	0.045	0.0045	0.0099	0.01
Total				12.62		0.00		0.01

Note 1: GWP of CH_4 is 21 while it is 310 for N_2O.

B. GHG emission from mobile combustions

A	B	C	D	E	F	G	H	I
Source description	Amount of fuel used (litre/unit)	Fuel Type	CO_2 emission factor	CO_2 emissions in tonnes of CO_2-e ((B × D)/1000)	CH_4 emission factor	CH_4 emissions in tonnes of CO_2-e ((B × F)/(1000 × 1000) × GWP[Note 1])	N_2O emission factor	N_2O emissions in tonnes of CO_2-e ((B × H)/(1000 × 1000) × GWP[Note 1])
LC1	1,738	ULP	2.36	4.10	0.253	0.009	1.105	0.60
LC2	1,376	ULP	2.36	3.25	0.253	0.007	1.105	0.47
LC3	1,280	ULP	2.36	3.02	0.253	0.007	1.105	0.44
Total				10.37		0.02		1.51

Note 1: GWP of CH_4 is 21 while it is 310 for N_2O.

C. GHG emission from fugitive emission

A	B	C	D	E
Type of agent	Amount of the agent at the beginning of the reporting period (kg)	IPCC default leakage rate / operation emission factor	GWP of the agent	GHG emissions in tonnes of CO_2-e ((B × C × D) /1000)
CO_2 - portable extinguishers	1,110	4%	1	0.05
HFC-227ea – FM 200 system	3,972	1%	2,900	115.19
R-134a - refrigerators	2.2	0.1%	1,300	0.00
R-410A – air-conditioning equipment	59	2%	1,725	2.04
			Total	117.28

D. GHG emission from purchased energy

a) Electricity

A	B	C	D
Facility / source description	Amount of electricity purchased (kWh)	Emission factor (kg CO_2-e/kWh)	Indirect GHG emissions in tonnes of CO_2-e (B × C/1000)
The Complex solely controlled	7,685,569	0.79	6,071.60
Share usage CCP and SWP	2,200,946	0.79	1,738.75
		Total	7,810.35

b) Towngas

A	B	C	D
Facility / source description	Amount of towngas purchased (unit)	Emission factor (kg CO_2-e/unit)	Indirect GHG emissions in tonnes of CO_2-e (B × C/1000)
Towngas consumption	4,750	0.60	2.85
		Total	2.85

E. GHG Emission from paper waste disposal sent to landfill

A	B	C	D	E	F	G
Source description	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)	Indirect emissions in tonnes of CO_2-e ((B+C-D-E) × F/1000)
Waste paper disposal	6,677	53,229	42,711	7,765	4.8	45.26
					Total	45.26

F. GHG emissions due to electricity used for fresh water processing by WSD

A	B	C	D
Source description	Amount of water consumed (m^3)	Emission factor (kg CO_2-e/m^3)	Emission in tonnes of CO_2-e (B × C/1000)
Fresh water usage	3,696	0.398	1.47
		Total	1.47

G. GHG emissions due to electricity used for sewage processing by DSD

A	B	C	D
Source description	Amount of water consumed (m^3)	Default Emission factor [Note 1] (kg CO_2-e/m^3)	Emission in tonnes of CO_2-e (B × C /1000)
Sewage generation - General	3,031	0.169	0.51
Sewage generation - 1/F kitchen[Note 2]	665	0.118	0.08
		Total	0.59

Notes for GHG Emissions due to electricity used for sewage processing by DSD

Note 1: The default emission factor is determined according to the purpose of water used as follows:

Source description	Default emission factor (kg CO_2-e/m^3)
Restaurants and catering services	(0.7 × Emission factor) assuming 70% of the fresh water consumed will enter the sewage system.
Other commercial, residential and institutional purposes	(1.0 × Emission factor) assuming 100% of the fresh water consumed will enter the sewage system.

Note 2: "Restaurants and catering services" category is applied to the sewage generation in 1/F kitchen.

H. GHG emissions from general waste disposal

A	B	C	D
Source description	Amount of general waste sent to landfill (kg)	Emission factor (kg CO_2-e/kg)	Emissions in tonnes of CO_2-e (B × C /1000)
General waste disposal	33,406	1.5	50.11
		Total	50.11

APPENDIX 4: GHG EMISSIONS SUMMARY IN THE BASE YEAR

Summary of GHG emissions accounted for the Complex from 1 April 2013 to 31 March 2014

Emission source	in tonnes of CO_2-e						
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Sub-total
Scope 1 Direct Emissions							
Combustion of fuels in stationary sources – diesel used in generators	0.59	0.00	0.00	N/A	N/A	N/A	0.59
Combustion of fuels in stationary sources – Towngas consumption	16.48	0.01	0.02	N/A	N/A	N/A	16.51
Combustion of fuels in mobile sources – petrol used in the Commission owned vehicles	10.47	0.02	1.52	N/A	N/A	N/A	12.01
Unintentional GHG release from equipment and system	0.05	N/A	N/A	117.17	N/A	N/A	117.22
Scope 2 Energy Indirect Emissions (To be reported in general without being classified into specific gas type)							
Electricity purchased from The Hongkong Electric Company							7,940.74
Towngas purchased from The Hong Kong and China Gas Company							4.01
Scope 3 Other Indirect Emissions (GHG emission from fresh water processing and sewage discharge disposal to be reported in general without being classified into specific gas type)							
Methane gas generation at landfill in Hong Kong due to disposal of paper waste	N/A	109.27	N/A	N/A	N/A	N/A	109.27
GHG emissions due to electricity for fresh water processing by WSD							1.84
GHG emissions due to electricity used for sewage processing by DSD							0.67
Methane gas generation at landfill in Hong Kong due to general waste disposal	N/A	40.30	N/A	N/A	N/A	N/A	40.30