The Legislative Council Complex
Greenhouse Gas Accounting Report
For the Period 1 April 2013 - 31 March 2014

Prepared by

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1. Executive Summary

1.1 Key findings from the GHG accounting project

i. The reported GHG emissions of the Legislative Council Complex (the Complex) during the period from 1 April 2013 to 31 March 2014 are 8,243.17 tonnes CO_2 equivalent (CO_2-e), with Scope 2 emissions contributing to 96.38% through purchased energy. Scope 1 direct GHG emissions (fuel combustions by vehicles, generators, Towngas equipment and fugitive emissions from refrigerant and fire suppression system) take 1.78% while Scope 3 other indirect emission, including fresh water processing, sewage processing, waste paper and general waste sent to landfill, account for 1.84% of reported emissions.

ii. The GHG emission intensity of the Complex is calculated at 157.60 kg CO_2-e/m^2, based on the included construction floor area at 52,304 m^2.

1.2 Recommendations on carbon reduction and information management

i. GHG information management system: It is recommended that a GHG report of the Complex be compiled on an annual basis with the 2013-14 as the base-year and disclosed to the public. Multi-year comparison serves as a basis for monitoring of improvement.

- A comprehensive GHG information management system requires a carbon management team, data centralisation, periodic review and update, data input and internal checking. Establishment of the system will enable the Commission to measure carbon performances of the Complex, to identify and implement improvements, to monitor progress, to conduct internal checking in an efficient and systematic way, and to analyse the data on a more enhanced level; and
- Sub-metering system and power monitor panel for visualisation of electricity usage, reviewing the possible impacts of key events and periodic review of GHG data will enable an enhanced level of data analysis.

ii. GHG emission reduction best practice guidelines: Best practice guidelines can be compiled for the staff and users of the Complex to help them implement GHG emission management in operations of the Complex. The guidelines should be in both English and Chinese.

iii. Energy saving: As electricity is responsible for 96.33% of GHG emissions generated from the Complex, renewable energy, LED lighting and optimisation of airflow in server rooms are recommended. Both solar power and LED Lights have improved in efficiency and it is recommended that

options in energy saving be actively explored.

iv. Waste Management: In order to reduce the amount of waste, it is recommended to conduct internal audit and supplier engagement, as emissions due to waste generated is the key contributor of Scope 3 emissions.

v. Carbon reduction roadmap: A Strategic Assessment for the Carbon Roadmap of the Complex is recommended, including: feasibility study on carbon reduction measures; setting practical and pragmatic carbon reduction target; development of carbon reduction programmes; implementation programmes and evaluation. As the Government has adopted a carbon reduction target for Hong Kong in 2020[1], it is recommended that the Commission adopts a target with reference to the same year.

vi. Reporting and disclosure: Reporting in accordance with international and local standards will ensure the quality of the reporting and publishing the data in public platforms will bring benefits in drawing more public's attention on climate change and support for mitigation.

vii. 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;
- When appropriate, apply for labels or joining award scheme for carbon reduction achievement;
- Organizing educational programs for engaging internal and external stakeholders, including the Complex users, suppliers and employees, to uphold the GHG reduction actions, should be planned and set up to promote sustainability awareness and support carbon care practices; and
- An efficient recording system will help to evaluate improvements and measure the effectiveness of changes implemented.

[1] Source: http://www.legco.gov.hk/yr13-14/english/panels/ea/papers/ea0428cb1-1292-6-e.pdf

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 2013 - 31 March 2014

It shall be set as the base year to assess GHG emission performances of the Legislative Council Complex (the Complex).

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 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
- 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; 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 term 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.

[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.

- 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).

(c) Details of any changes in methodologies and conversion factors since the last GHG report by the Entity:
This is the first GHG report for the Complex.

(d) Details on any re-calculation of previously reported emissions and removals because of changes in methodologies and conversion factors
This the first GHG report for the Complex.

2.7 Contact person of the reporting entity

The 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:	146.34	tonnes of CO_2-e
Scope 1 Removals:	Nil	tonnes of CO_2-e
Scope 2 Emissions:	7,944.75	tonnes of CO_2-e
Scope 3 Emissions:	152.08	tonnes of CO_2-e
Other GHG Offsets / Removals:	Nil	tonnes of CO_2-e
Accounted GHG Emissions in total:	8,243.17	**tonnes of 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 floor area is 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 2013 to 31 March 2014, are 8,243.17 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.

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	0.59	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	0.03	1.52	N/A	N/A	N/A	12.02
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							1.83
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

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 8,054 kg refrigerant used in the central chiller plant (CCP) which is shared use with the Chief Executive's Office and Central Government Complex.

iv. Scope 2 - Electricity

The electricity used by the Complex contain the part solely controlled by the Complex and the shared usage with the Chief Executive's Office and Central Government

Complex. 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 usage data of the Complex are based on the monthly records of the water metres' readings, as the water bills are not applicable.

vi. Scope 3 - Paper

The data of paper inventory opening stocks for both the Secretariat and Legislative Council Members' Offices are not available for this reporting period, but paper purchase and closing stocks are recorded for both, through monthly records and survey. The calculations of the waste paper have been simplified to subtract the amount of paper recycled from the amount of paper purchased, and then subtract closing stock. Since normally the opening stock is not 0, an error exists in that the actual paper consumed should be bigger than the calculated result. However, this is not material and remains insignificant.

One ream of 75 gsm 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. 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.

3.4 Data analysis

i. GHG emissions breakdown

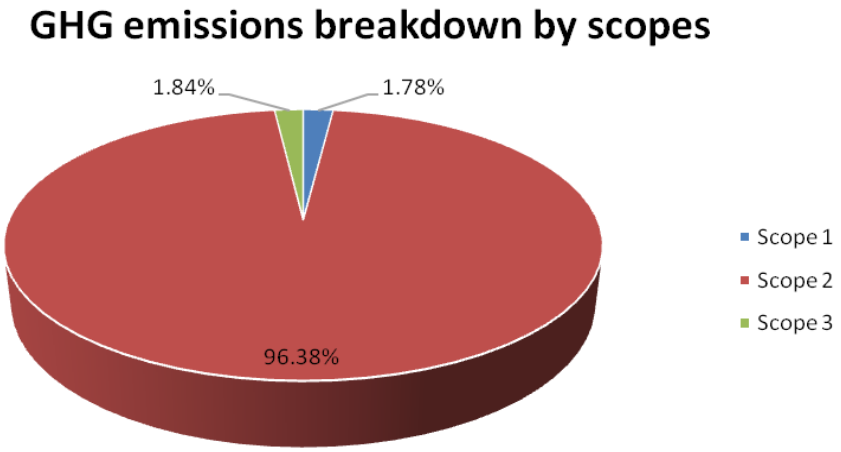

Figure 1. GHG emission profile by scopes

Figure 1 demonstrates that Scope 2 indirect GHG emissions from purchased energy account for a large majority (96.38%) of the accounted GHG emissions, followed by Scope 3 other indirect GHG emissions (1.84%). Scope 1 direct GHG has the least impact (1.78%) of the accounted emissions.

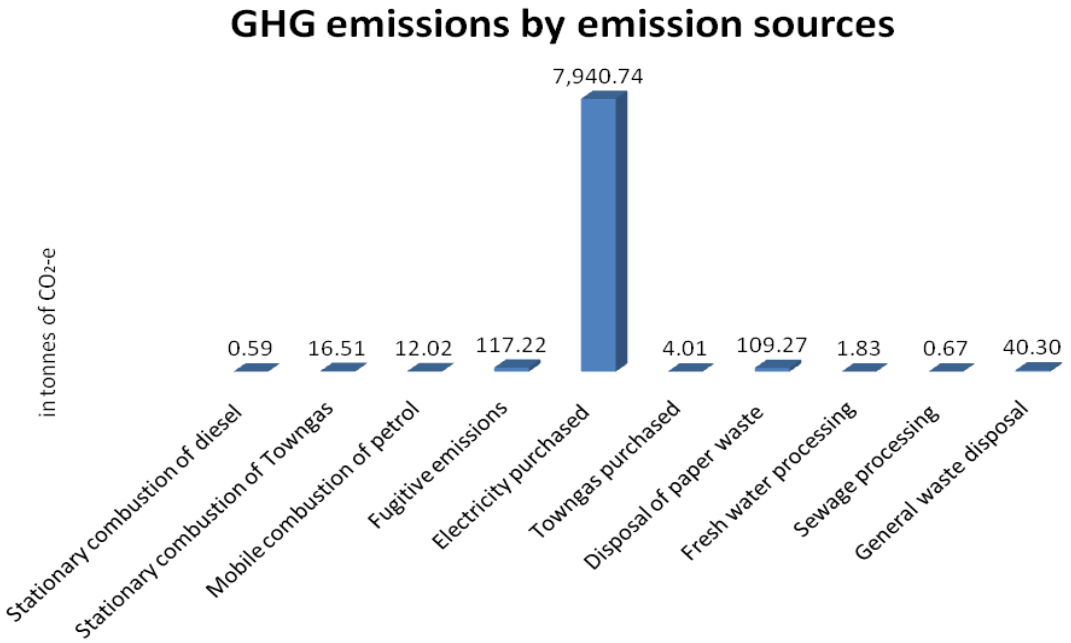

Figure 2. GHG emission profile by emission sources

Figure 2 illustrates that GHG emissions from purchased electricity represents the dominant contribution of 7,940.74 tonnes CO_2-e, accounting for approximately 96.33% of the total accountable GHG emissions, and this is followed the 117.22 tonnes CO_2-e released by fugitive emissions, which make up 1.42% of the total. Fugitive emissions are generated by fugitive agents with relatively high GWP value – HFC-227e. Paper waste disposal and general waste disposal together contribute to 149.57 tonnes CO_2-e, approximately 1.81% of the emissions profile.

ii. Scope 2 GHG emissions

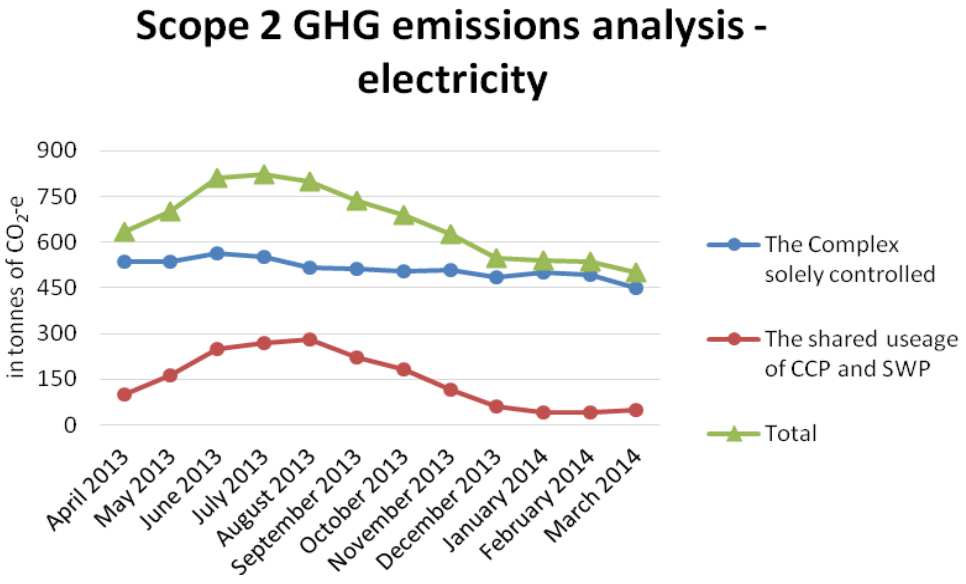

Figure 3. Scope 2 GHG emissions analysis – electricity

The monthly variations on GHG emission from electricity consumption in the Complex are presented in Figure 3. The peak season happens in June, July and August of 2013, which could be due to the increased air conditioning usage in summer time. In general, the electricity usage solely controlled by the Complex shows slight declining trend during the reporting period, while the electricity usage shared with CCP and SWP reaches its peak in August when the demand for electricity is the highest. The shared usage of electricity has contributed to 22.44% of the total usage during the year, while the electricity solely controlled by the Complex takes up the major 77.56%. The decrease in electricity consumption is mainly attributable to the environmental measures adopted in the Complex.

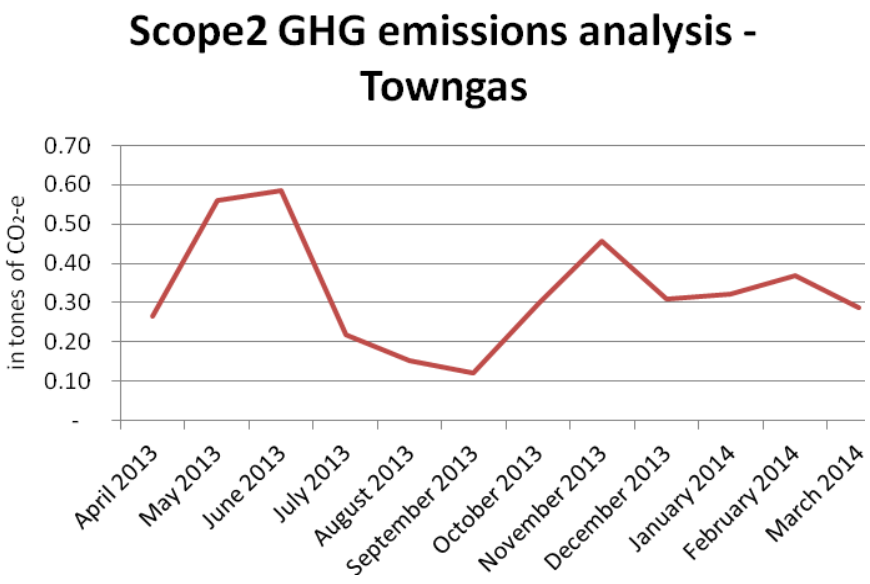

Figure 4. Scope 2 GHG emissions analysis – Towngas

Figure 4 demonstrates the monthly variations of Towngas usage in the Complex, indicating the lowest value in the summer, which may be due to the hot weather and summer recess. The greatest number of meals served in Dining Hall is served in May of the 2013, and this is also reflected by the high amount of Towngas usage in the Complex in this month.

iii. Scope 3 GHG emissions

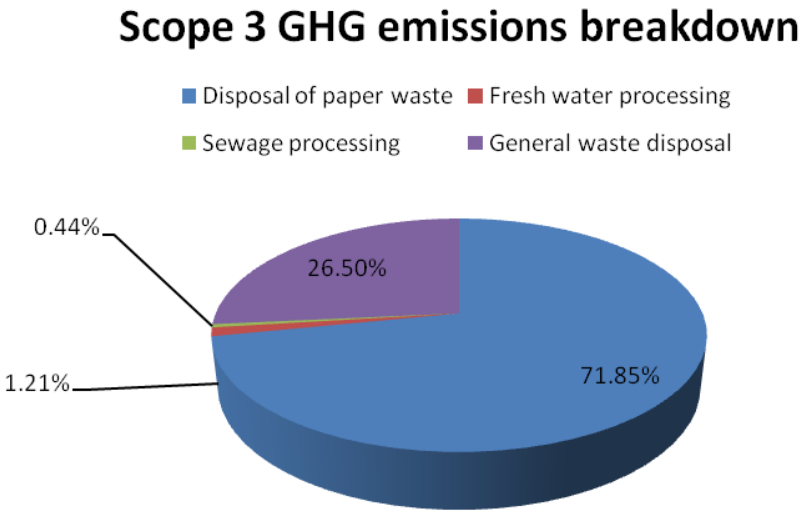

Figure 5. Scope 3 GHG emissions breakdown

As illustrated in Figure 5, GHG emissions from the waste paper disposal account for the most significant contribution (71.85%), which is followed by the general waste disposal (26.50%). GHG emissions from fresh water processing and sewage treatment make up the remaining proportions of the profile, contributing to only 1.21% and 0.44% of the Scope 3 emissions respectively.

4. DISCUSSION AND RECOMMENDATIONS

4.1 Discussion

4.1.1 Data collection

During the data collection stage, the Commission is able to revert quickly on provision of raw data and offer timely feedback on data clarification. This shows an efficient data management system in its data collection process and enables a smooth and accurate assessment of the GHG emissions profile of the Complex for current reporting period.

4.1.2 Electricity usage

Emissions from electricity consumption accounted for the majority (96.38%) of the total reported GHG emissions of the Complex. In Hong Kong, about 89%[4] of total electricity consumption is contributed by buildings. Similarly, most of the carbon emissions from buildings also come from electricity consumption. With various programmes in place, energy efficiency should be given a higher priority in reduction measures planning. A rigorous review of costs and benefits of different reduction measures should be conducted when installations and changes are being considered, in order to enable the best use of resources, while at the same time combining the advantages of lower long-term operating costs and reduced GHG emissions.

4.2 Recommendations

4.2.1 GHG information management system

- *System setup:* It is recommended that the management establish a comprehensive system for GHG data collection and accounting, particularly for fuel consumptions, energy consumption, fugitive emissions from refrigeration/air-conditioning and fire suppression systems, waste and recycling data. The data collection system provides a helpful foundation for the Commission to be well-prepared for GHG accounting for the Complex. To set up the system, the following steps could be taken into consideration:
    - Establish carbon management team and assign tasks of data collection, data input, calculation, reporting and checking
    - Centralise (collect) the activity data of emission sources and monthly/quarterly update
    - Review GHG inventory template and update the emission factors of electricity and Towngas

[4]Source: http://www.epd.gov.hk/epd/english/climate_change/ca_intro.html

- Fill in the template and report

- Conduct an internal checking

A properly set up GHG information management system will enable the Commission to measure the carbon performance of the Complex, to identify and implement improvements, to monitor progress, and internally verify results. The Measurement, Reporting and Verification (MRV) of GHG emission performance results is an internationally-agreed action focus committed to by all countries at the World Climate Conference as continued efforts to the Kyoto Protocol.

- *Monitoring:* To enable an enhanced level of data analysis, the following measures can be considered to provide more insights on the GHG emissions of the Complex profile versus different criteria:
  - Sub-metering system for electricity usage – This will help tracking progress and benchmarking the different floors/rooms and ultimately engage complex users and staff in the energy saving and efforts. There exist available technology of energy monitoring and control system which installs power monitoring module upon the Miniature Circuit Breaker (MCB) box and enables
    - display of electricity consumption;
    - display of indoor air quality to encourage clean working environment; and
    - wireless panel control through multi-platforms.

  - Power monitor panels for individual offices – Individual power monitor Panels can be installed at each office or group of offices (e.g. divided among Legislative Council Members) so that the responsible member in each office can understand the power consumption level and patterns, which will enable effective improvement actions.

  - Review the possible impact of key events towards GHG emissions (e.g. increased use of electricity usage, extended operating hours, use of special equipment); and

  - Periodic review of GHG data in monthly, quarterly and biannual basis could be of help to enable timely findings of any possible error. The frequency of review could be determined by the data readiness and resources of the carbon management team.

4.2.2 Implementation of GHG emission reduction measures

- *Best Practices Manual:* Best practices guidelines can be provided to staff to help them implement GHG emission management in the operations of the Complex. Supported with the adequate and appropriate commitments and resources by the management, the Best Practices Manual is a helpful management tool for building knowledge and skills in continuous improvements in GHG emission reduction among all employees.

- *Energy saving:* As the major contributor to the GHG emissions, energy consumption, particular electricity usage also needs to be prioritised in reduction planning. Several measures could be further explored to reduce the electricity consumption of the Complex and to enhance the energy efficiency of energy using facilities, while the original design and functionality of the Complex should be balanced.
    - Renewable energy
      Though photovoltaics (PV) panel has already been installed in the Complex, the feasibility of more building attached/integrated PV could be studied, for instance, the rooftop arrays or sun shades, which will generate considerable renewable energy and help to keep a relatively low indoor temperature. In order to further demonstrate the benefits of the renewable energy, a real-time monitoring panel could be installed to additionally showcase the achievement of energy saving.

    - Lighting
      Given that day light sensors and lighting control systems are already installed in the Complex with preset time-management devices, it may be advantageous to upgrade the T5 fluorescent tubes to T5-LED tubes which are beneficial to health, safety (mercury free) and electricity saving. A rough estimate on the saving performance is made as below, based on the assumption that 1500 pieces of 4 feet T5 fluorescent tubes are currently in operation:

      Annual electricity saving on lighting
      = (Baseline scenario - upgrade scenario) × 8 hours × 365 × 1500
      = (28W + 4W – 14 W) × 8 hours × 365 × 1500
      = 78,840 kWh

      Then,
      Expected annual GHG reduction
      = Annual electricity saving on lighting × Emission factor
      = 61.50 tonnes CO_2-e

      Where

Baseline scenario indicates that every set of 4 feet T5 fluorescent tube includes a 28W tube and a 4 W driver; and
Upgrade scenario indicates a 14W T5-LED tube.

- Server room
  Physical barriers could be installed to separate the hot air in front of the server racks. For instance, Google has used blanking panels or flat sheet of metal, and even simply hung inexpensive curtains to prevent "hot aisle" air. These methods are both cost effective and applicable to the Complex.

- *Waste reduction:* The Commission has been actively reducing waste level through separation and recycling. As general waste is a key contributor of the Scope 3 GHG emissions, the following measures might offer helpful opportunities to further enhance the effectiveness in reducing waste generation at the Complex:
  - Review the types of waste collected which would end up in landfill - this could provide valuable information to consider what specific actions can be taken to reduce waste level; and

  - Use of materials at source - the Commission could consider engaging suppliers to reduce packaging materials.

4.2.3 Carbon Roadmap Strategy Assessment

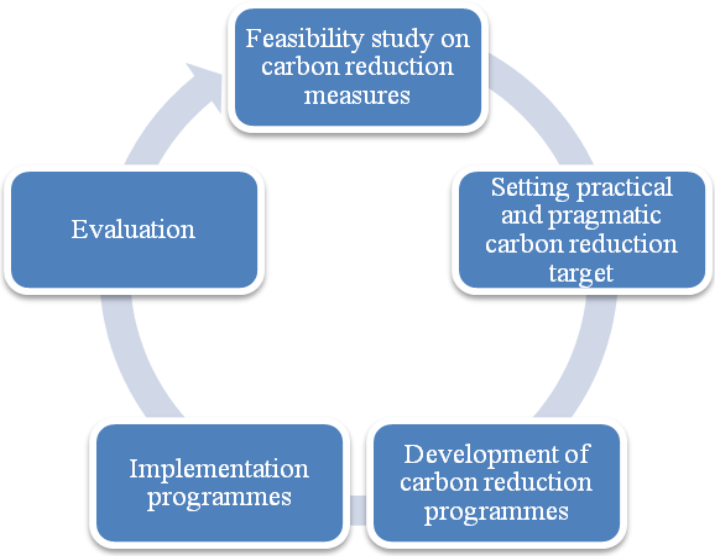

Figure 6. Carbon Roadmap Strategy Assessment

Following GHG accounting in the base year, the next step for the Commission is to set out practical reduction targets, both short term and long-term. In order that realistic targets can be defined to take into account of reduction potentials and the stakeholder aspirations, a Strategic Assessment for the Carbon Roadmap of the Complex will be desirable, details of which are contained in Figure 6.

4.2.4 Reporting

- *Quality assurance:* While developing in-house capability on GHG accounting is essential, a professional independent review should be arranged to assure quality control. New emission sources and reporting requirements emerge as GHG reporting becomes more widespread and comprehensive. Professional consultation will also help to ensure the GHG information management system is well-designed and managed, that the data reported are timely, accurate and in line with both international and local requirements.

- *Reporting in public platforms:* With GHG accounting and management systems well in place, and enhanced by professional quality assurances, The Commission can demonstrate its best practices in public platforms. For instance, the Parliament of UK has a dedicated section towards sustainability information on its official website, covering carbon footprint, targets, and updated environmental policy and measures[5]. This will bring benefits in drawing more public's attention on climate change and support for mitigation.

4.2.5 Labels and Awards

With a GHG management strategy in place and commitment to carbon reduction, the Commission may be able to attain several reputable GHG and sustainability awards and labels, by adopting following measures.

- *Establish baseline:* In its first year of accounting, the Complex should have a comprehensive and accurate assessment of GHG emissions from operation. This can form the baseline emission benchmark for The Commission to develop reduction target for the Complex in subsequent years.

- *Confirm reduction targets:* Based on the baseline and a review of internal capacity, the Commission may engage different stakeholders to develop its reduction targets in the short, medium and long term. The targets can be set for absolute emissions, or for intensity benchmarks with reference to relevant denominators.

- *Existing schemes:* There are a few schemes which the Commission may consider joining to illustrate its achievement and support towards sustainable development, such as "Carbon Reduction Certificates" by The Hong Kong Awards for Environmental Excellence (HKAEE) and "CarbonCare® Label" by CCA. Both schemes require verification procedure and carbon reduction achievement compared to base year or commitment to certain reduction target (for first time applicant only).

[5] Source: http://www.parliament.uk/about/sustainability/

4.2.6 Communication and Engagement

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

- *Engaging the Complex users:* As guided educational tour is an opportunity for public to visit the facilities in the Complex and understand the work of the Legislative Council, the Complex is in a strong position to engage the visitors to promote sustainability practices for a carbon-caring fun experience. This can be realized in several areas:
    - Education about impacts from climate change and highlights of carbon reduction initiatives which have been in place;
    - To visualise the carbon reduction efforts that the Complex has achieved – an example might be the real-time monitor for the rooftop solar panel's equivalent carbon reductions, and this enables them to obtain immediate feedback (including curiosity, support and comments);
    - To improve and increase recycling facilities to enhance recycling effectiveness;
    - To highlight/ promote the use of electronic guide map, with sharing of the existing carbon reduction initiatives
    - To advocate carbon reduction measures through behavioural change by guiding visitors in their own activities.

- *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.

- *Engagement program for employees*:
    - Capacity building workshop - to effectively embrace carbon caring values throughout the operation of the Commission, staff training is essential for two purposes: (i) By equipping them with a good understanding of the issues and benefits; (ii) By enabling them to become ambassadors of environmental and carbon caring culture; and
    - Internal communication platform could be established to engage staff with environmental information by the environmental team, and this could

encourage the sharing of innovative initiatives among the Commission on sustainability and carbon reduction.

- *Evaluation:* An efficient 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.

//end of text//

APPENDIX 1: SUMMARY OF ACTIVITY DATA

Activity	Emission source	Activity data	Unit	Scope (1, 2, 3)
Stationary fuel combustion	Diesel	227	litre	1
Stationary fuel combustion	Towngas	6,466	unit	1
Mobile fuel combustion	Unleaded petrol (ULP)	4,438	litre	1
Fugitive emission – Portable extinguishers	CO_2	45	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	10,180,441	kWh	2
Towngas purchased	GHG emissions from the utility	6,466	unit	2
Paper waste disposal	Methane gas generation at landfill	22,765	kg	3
Fresh water processing	Electricity used for processing by WSD	4,424	m^3	3
Sewage discharge	Electricity used for processing by DSD	4,028	m^3	3
General waste disposal	Methane gas generation at landfill	26,867	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	0.78	HK Electric Investments Sustainability Report 2013
	Towngas purchased from The Hong Kong and China Gas Company	unit	0.62	Towngas Sustainability Report 2013
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	0.414	WSD Annual Report 2012/2013
	Electricity used for sewage processing by DSD	m^3	0.167	DSD Sustainability Report 2012-2013
	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	227	Diesel	2.614	0.59	0.0239	0.0001	0.0074	0.001
Towngas consumption	6,466	Towngas	2.549	16.48	0.045	0.0061	0.0099	0.02
Total				17.07		0.01		0.02

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	1,725	ULP	2.36	4.07	0.253	0.0092	1.105	0.59
LC2	1,324	ULP	2.36	3.12	0.253	0.0071	1.105	0.45
LC3	1,389	ULP	2.36	3.28	0.253	0.0074	1.105	0.48
Total				10.47		0.0237		1.52

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	1,117	4%	1	0.05
HFC-227ea – FM 200 system	3,970	1%	2,900	115.13
R-134a - refrigerators	2.2	0.1%	1,300	0.00
R-410A – air-conditioning equipment	59	2%	1,725	2.04
			Total	117.22

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	7,896,187	0.78	6,159.02
Share usage CCP and SWP	2,284,254	0.78	1,781.72
		Total	7,940.74

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	6,466	0.62	4.01
		Total	4.01

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	0	51,792.86	22,845	6,182.89	4.8	109.27
					Total	109.27

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	4,424	0.414	1.83

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	3,105	0.167	0.52
Sewage generation - 1/F kitchen[Note 2]	1,319	0.117	0.15
		Total	0.67

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	26,867	1.5	40.3
		Total	40.3