屋宇署 BUILDINGS DEPARTMENT

樓宇發展項目每年能源消耗量聲明
Declaration on Annual Energy Use of a Building Development

認可人士、註冊結構工程師及註冊岩土工程師作業備考
PNAP
APP-151
附錄 Appendix **B**

• 請以正楷填寫，並在適當方格內加上『√』號。填寫前，請細閱《注意事項》。
• Read the "Matters to Note", complete in BLOCK LETTERS and tick the appropriate boxes.

致建築事務監督 **To the Building Authority**

第一部 樓宇詳情
Part 1 Building Particulars

樓宇名稱(如知悉) (中文) Name of Building (if known) (Chinese)

OUHK Jockey Club Institute of Healthcare

樓宇名稱(如知悉) (英文) Name of Building (if known) (English)

香港公開大學賽馬會健康護理學院

地盤地址(中文) Address of Site (Chinese)

九龍何文田常盛街1號

地盤地址(英文) Address of Site (English)

1 Sheung Shing Street, Ho Man Tin,
Kowloon

地段編號 Lot No.

KIL 11265

樓宇類型 Type of Building

☐ 住宅樓宇 Domestic Building
☑ 非住宅樓宇 Non-domestic Building
☐ 綜合用途樓宇 Composite Building

提供中央空調 Provision of Central Air Conditioning

☑ 是 Yes ☐ 否 No

提供具能源效益的設施 Provision of Energy Efficient Features

☑ 是 Yes ☐ 否 No

擬安裝 / 已安裝的具能源效益的設施
Proposed / Installed Energy Efficient Features

☐ 擬安裝 Proposed / ☑ 已安裝 Installed

VSD?

	中文 Chinese	英文 English
1.	高效能冷凍機	High COP Chiller Plant
2.	高效能燈具	High efficiency lighting
3.	一氧化碳傳感器(停車場)	CO Sensor in Carpark

ⓘ 如空位不敷應用，請於附加頁填寫。
If space is insufficient, please fill in the additional sheet(s).

☐ 另加附加頁 Additional ☐ 張 Pages

Energy efficient ITH system

第二部 擬興建 / 已竣工樓宇 / 部分樓宇預計每年能源消耗量
Part 2 Predicted Annual Energy Use of Proposed / Completed Building / Part of Building

☐ 擬興建 Proposed / ☑ 已竣工 Completed ☑ 樓宇 Building / ☐ 部分樓宇 Part of Building ⓘ 見註 See Note (1)

發展項目類型 Type of Development	位置 Location	使用有關裝置的內部樓面面積 Internal Floor Area Served (平方米 m²)	基線樓宇每年能源消耗量 Annual Energy Use of Baseline Building (平方米/年 m²/annum) ⓘ 見註 See Note (2)		擬興建/已竣工樓宇每年能源消耗量 Annual Energy Use of Proposed/Completed Building (平方米/年 m²/annum)	
			電力 Electricity 千瓦小時 kWh	煤氣 / 石油氣 Town Gas / LPG 用量單位 Unit	電力 Electricity 千瓦小時 kWh	煤氣 / 石油氣 Town Gas / LPG 用量單位 Unit
住用發展項目 (不包括酒店) Domestic Development (excluding Hotel)	中央屋宇裝備裝置 Central building services installation ⓘ 見註 See Note (3)	N.A.				
非住用發展項目 (包括酒店) Non-domestic Development (including Hotel) ⓘ 見註 See Note (4)	平台 (中央屋宇裝備裝置) Podium(s) (central building services installation)					
	平台 (非中央屋宇裝備裝置) Podium(s) (non-central building services installation)					
	塔樓 (中央屋宇裝備裝置) Tower(s) (central building services installation)	21633.25	245.47	0	191.65	0
	塔樓 (非中央屋宇裝備裝置) Tower(s) (non-central building services installation)	N.A.				

一般來說,樓宇的預計每年每平方米能源消耗量愈低,樓宇的能源消耗愈有效。例如,如果擬興建樓宇的預計每年能源消耗量少於基線樓宇預計的每年能源消耗量,則表示擬興建樓宇的預計能源使用較基線樓宇有效。減少愈多,效能愈大。

In general, the lower the estimated "Annual Energy Use" of the building, the more efficient the building in terms of energy use. For example, if the estimated "annual energy use of proposed building" is less than the estimated "annual energy use of baseline building", it means the predicted use of energy is more efficient in the proposed building than in the baseline building. The larger the reduction, the greater the efficiency.

第三部 按機電工程署公布的相關實務守則設計 / 完成的裝置
Part 3 Installation(s) Designed / Completed in Accordance with the Relevant Codes of Practice Published by the Electrical and Mechanical Services Department

以下裝置乃按機電工程署公布的相關實務守則
In accordance with the relevant Codes of Practice published by the Electrical and Mechanical Services Department, the following installation(s) is / are ☐ 設計 designed / ☑ 完成 completed :

裝置類型 Type of Installations	是 Yes	否 No	不適用 N/A
照明裝置 Lighting Installations	☑	☐	☐
空調裝置 Air Conditioning Installations	☑	☐	☐
電力裝置 Electrical Installations	☑	☐	☐
升降機及自動梯的裝置 Lift & Escalator Installations	☑	☐	☐
以總能源為本的方法 Performance-based Approach	☐	☐	☑

註冊專業工程師 / 註冊能源效益評核人資料
Details of the Registered Professional Engineer / Registered Energy Assessor

中文姓名* Name in Chinese* ⓘ 姓氏先行 Surname first
孫仲權

英文姓名* Name in English* ⓘ 姓氏先行 Surname first
Suen Chung Kuen , Victor

註冊證明書編號* Certificate of Registration Number*
RP 0246468 /

註冊屆滿日期* Date of Expiry of Registration*
3 1 0 1 2 0 2 1
日 dd 月 mm 年 yyyy

專業身份 Professional Capacity
☑ 註冊專業工程師 Registered Professional Engineer ☐ 註冊能源效益評核人簽署 Registered Energy Assessor

申請人資料
Details of the Applicant

姓名/公司名稱(中文) Name / Company (Chinese)
香港公開大學

姓名/公司名稱(英文) Name / Company (English)
The Open University of Hong Kong

第四部 聲名
Part 4 Declaration

認可人士姓名(中文)*
Name of Authorized Person (Chinese)* ⓘ 姓氏先行 Surname first
黃智健 /

認可人士姓名(英文)*
Name of Authorized Person (English)* ⓘ 姓氏先行 Surname first
WONG Chi-Kin, Kenneth /

註冊證明書編號* Certificate of Registration Number*
AP(A) 1 9 / 9 5 /

註冊屆滿日期* Date of Expiry of Registration*
1 7 1 2 2 0 2 0 /
日 dd 月 mm 年 yyyy

本人在載有此聲明書的唯讀光碟上簽署並謹衷誠作出此項鄭重聲明確信上述資料為真確無訛。
By signing the DVD Rom containing this declaration, I make this solemn declaration conscientiously believing the information contained in this declaration is true.

日期 Date
2 2 0 6 2 0 2 0
日 dd 月 mm 年 yyyy

* 根據註冊記錄
* In accordance with the registration record

wsp

APP 151 Submission

- **THE OPEN UNIVERSITY OF HONG KONG PHASE III CAMPUS DEVELOPMENT AT FAT KWONG STREET / SHEUNG SHING STREET, HO MAN TIN, K.I.L. 11265.**

- **Energy Simulation Summary Report**

5 June, 2020

REV.0

Project Title:	THE OPEN UNIVERSITY OF HONG KONG. PHASE III CAMPUS DEVELOPMENT AT FAT KWONG STREET/SHEUNG SHING STREET, HO MAN TIN, K.I.L. 11265. - Energy Simulation Summary Report

REVISION HISTORY

Revision 0	Date:	5 Jun 2020	By:	Emily Choy
	Description:	First Issue	Checked:	Anthea Ng (BEAM Pro)
			Approved:	Wency Wong (BEAM Pro)
Revision	Date: Description:		By: Checked: Approved:	
Revision	Date: Description:		By: Checked: Approved:	
Revision	Date: Description:		By: Checked: Approved:	
Revision	Date: Description:		By: Checked: Approved:	

CONTENTS

1. Introduction

1.1 Objectives

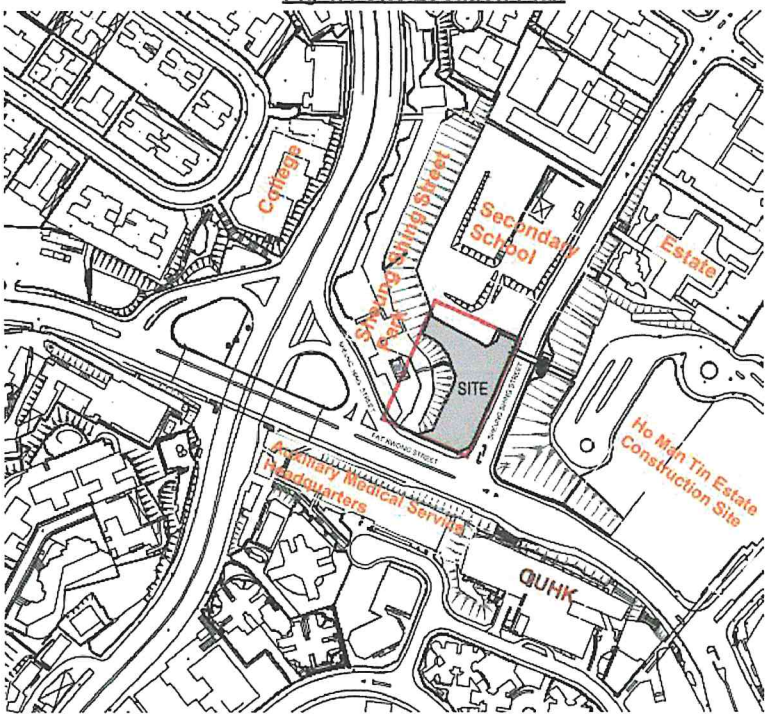
WSP Asia Ltd was appointed to be the BEAM Professional and Consultant to facilitate and coordinate the building design in compliance with BEAM Plus New Building Version 1.2 Platinum Rating.

Building energy analysis was carried out to analyse the performance of energy saving strategies Development at Proposed Institution Development at Fat Kwong Street / Sheung Shing Street, Ho Man Tin, K.I.L. 11265. The Open University of Hong Kong. The energy performance and savings under the current building design, and impact of all the strategies applied were evaluated. This report is to provide energy simulation for supporting the provisional assessment stage of BEAM Plus Certification. It is to indicate the energy saving by design strategies according to BEAM Plus standard.

1.2 Project Background

The site is located at Fat Kwong Street / Sheung Shing Street. It is mainly surrounded by park, schools, government complex building and a residential development to the east of the site which is expected to be completed slightly ahead of our project. The site location plan is shown in **Figure 1.1** below.

Fig 1.1 Site Location Plan



2. Assessment Criteria

Whole Building Energy is assessed against criteria in BEAM Plus New Buildings version 1.2 credits EU 1 Reduction of CO_2 Emission and EU 2 Peak Electricity Demand Reduction. Fourteen credits in EU 1 and three credits in EU 2 are available in this section and credits requirement is shown as below:

In view of this institutional development, the credit scale is demonstrated as below:

EU1 Reduction of Carbon Emission

b) Educational Buildings

- 4 credits for a reduction of CO2 emissions or annual energy consumption by 1%
- 5 credits for a reduction of CO2 emissions or annual energy consumption by 2%
- 6 credits for a reduction of CO2 emissions or annual energy consumption by 4%
- 7 credits for a reduction of CO2 emissions or annual energy consumption by 6%
- 8 credits for a reduction of CO2 emissions or annual energy consumption by 8%
- 9 credits for a reduction of CO2 emissions or annual energy consumption by 10%
- 10 credits for a reduction of CO2 emissions or annual energy consumption by 12%
- 11 credits for a reduction of CO2 emissions or annual energy consumption by 14%
- 12 credits for a reduction of CO2 emissions or annual energy consumption by 16%
- 13 credits for a reduction of CO2 emissions or annual energy consumption by 19%
- 14 credits for a reduction of CO2 emissions or annual energy consumption by 22%
- 15 credits for a reduction of CO2 emissions or annual energy consumption by 25%

EU2 Peak Electricity Demand Reduction

b) Educational and Residential Buildings

- 1 credit for a reduction in the maximum electricity demand by 2%
- 2 credit for a reduction in the maximum electricity demand by 6%
- 3 credit for a reduction in the maximum electricity demand by 9%

3. Assessment Methodology

3.1 BEAM Plus Energy Assessment Methodology

The building energy performance assessment is based on the energy budget approach, which aligns with BEAM Plus and other international practices. The assessment addresses certain design features including the envelope design, the energy performance of major equipment and the system control. The "energy budget" for proposed building is comparing against the annual energy use for a "baseline" building (zero-credit benchmark). The baseline building model is set according to BEAM Plus Section 8.2. The number of credits awarded is determined by the percentage reduction in the predicted annual energy use of the assessed building relative to the baseline building.

3.2 Reference Standards

The following codes, standard and guidelines are followed accordingly, they are:-

- BEAM Plus for New Buildings (Version 1.2)
- Code of Practice for Energy Efficiency of Building Services Installation 2015
- Guidelines on Performance-based Building Energy Code, 2007 Edition
- ASHRAE 90.1-2007 Energy Standard for Buildings Except Low-rise Residential Buildings

3.3 Simulation Approach

eQUEST version 3.64 is adopted as energy simulation tools for evaluation of building energy consumption. eQUEST is a software accepted as commonly used in Guidelines on Performance-based Building Energy Code, 2007 Edition. It is an hourly simulation tool which can evaluate energy consumption and peak cooling/heating demand accurately on an hourly basis. Energy models are set up for the two scenarios: baseline and design cases.

Simulation input data includes weather data, building data, HVAC system data and equipment plant data. The energy input data are elaborated in Section 4.

4. Building input parameters

The project is an institution development comprises of a 14-storey high building with CFA 22500sqm, which includes a basement (B/F) below grade, 13 floors (G/F to 12/F) above grade and a roof for mechanical rooms. The building is a typical institution building with classrooms, laboratories, lecture theatres, activity rooms, learning area, office, etc.

4.1 Input Data

Tables listed below are some major information and input data of the energy simulation model.

Data in Table 4.1 is the general information of the building modelling which help to define the basic location and climate data of the model.

Table 4.1 General Information

Location	Hong Kong
Longitude	114.2
Latitude	22.3
Time Zone	GMT +8.0 Hours
Quantity of Stories	1 tower of institutional building with a basement below grade and 13 floors above grade
Energy Code Used	BEAM Plus NB Appendices 8.1 and 8.2, BEC 2012 Addenda
Weather File	Hong Kong SAR 450070 (CityUHK)

Table 4.2 to Table 4.5 presents the comparison of design case versus baseline case energy model inputs. These mainly include the building envelope, HVAC system, internal load and operation schedule.

Table 4.2 Input Data List

Sampling Point	Baseline Case	Design Case
Building Envelope		
External Wall Construction[1]	U-value = 3.94 W/m²K (refer to BEAM Plus guidebook Table 8.2)	U-value = 1.83 W/m²K(Wall 1)
Roof Construction[1]	U-value = 0.528 W/m²K (refer to BEAM Plus guidebook Table 8.2)	U-value = 1.02 W/m²K
Wall below Grade	U-value = 1.99 W/m²K (As per PBEC)	U-value = 1.99 W/m²K (As per PBEC)
Window – to – Wall Ratio	65% (refer to BEAM Plus v1.2 Manual Table 8.2, Window to wall area ratio for other building types)	19.82% (As design)

Sampling Point	Baseline Case	Design Case
Fenestration Assembly U-value	U-value = 4.49 W/m²K (refer to BEAM Plus guidebook Table 8.2)	U-value = 1.82 W/m²K
Fenestration Assembly SC	0.65 (Refer to BEAM Plus V1.2 Manual)	Weighted SC 0.46
HVAC Air Side		
Indoor Design Temp. (°C) / RH (%)	Nursing Lab: 20 / 60% Study Room: 22 / 60% Observation Room: 22 / 60% Music / Play Room: 22 / 60% Group Training Room: 22 / 60% Interview Room: 22 / 60% Speech Therapy Room: 22 / 60% Individual Training Room: 22 / 60% Lecture Room: 22 / 60% Classroom: 22 / 60% Community Health Center Seminar Room: 22 / 60% Chinese Medicine Skill Education Unit: 22 / 60% Virtual Reality Education Unit: 22 / 60% Community Health Centre Exercise Room: 22 / 60% Community Health Center / Personal Care Training: 22 / 60% Clinical Simulation Units: 22 / 60% Fit Test Room: 22 / 60% Prep Room: 22 / 60% Physio Lab.: 22 / 60% Occupation Lab: 22 / 60% Fitness Room: 22 / 60% Sport Activities Room: 22 / 60% Workshops: 22 / 60% Staff/ Student Activity Room: 22 / 60% Rehearsal Room: 22 / 60% Council Chamber: 22 / 60% Pre-Function Area: 22 / 60% UPS Room: 22 / 60% Wiring Closet: 22 / 60% IT Server Room: 22 / 60% Discussion Room: 23 / 60% Learning Common Area: 24 / 60% Maintenance/Management Office: 24 / 60% Security Control Room: 24 / 60% Reception: 24 / 60% Staff Office: 24 / 60% Meeting Room: 24 / 60%	Nursing Lab: 20 / 60% Study Room: 22 / 60% Observation Room: 22 / 60% Music / Play Room: 22 / 60% Group Training Room: 22 / 60% Interview Room: 22 / 60% Speech Therapy Room: 22 / 60% Individual Training Room: 22 / 60% Lecture Room: 22 / 60% Classroom: 22 / 60% Community Health Center Seminar Room: 22 / 60% Chinese Medicine Skill Education Unit: 22 / 60% Virtual Reality Education Unit: 22 / 60% Community Health Centre Exercise Room: 22 / 60% Community Health Center / Personal Care Training: 22 / 60% Clinical Simulation Units: 22 / 60% Fit Test Room: 22 / 60% Prep Room: 22 / 60% Physio Lab.: 22 / 60% Occupation Lab: 22 / 60% Fitness Room: 22 / 60% Sport Activities Room: 22 / 60% Workshops: 22 / 60% Staff/ Student Activity Room: 22 / 60% Rehearsal Room: 22 / 60% Council Chamber: 22 / 60% Pre-Function Area: 22 / 60% UPS Room: 22 / 60% Wiring Closet: 22 / 60% IT Server Room: 22 / 60% Discussion Room: 23 / 60% Learning Common Area: 24 / 60% Maintenance/Management Office: 24 / 60% Security Control Room: 24 / 60% Reception: 24 / 60% Staff Office: 24 / 60% Meeting Room: 24 / 60%

Sampling Point	Baseline Case	Design Case
	Lift Lobby/ Corridor/Foyer/ Other Circulation Area: 24 / 60% PABX: 24 / 60% Store: 24 / 60% LV Main Switch Room: 28 / 65% MCC Room: 28 / 65% TBE Room: 28 / 65% FS Control Center: 28 / 65% (As Design)	Lift Lobby/ Corridor/Foyer/ Other Circulation Area: 24 / 60% PABX: 24 / 60% Store: 24 / 60% LV Main Switch Room: 28 / 65% MCC Room: 28 / 65% TBE Room: 28 / 65% FS Control Center: 28 / 65%
Mechanical Ventilation[2]	Basement Carpark: 7431 L/s Plant Rooms: 22120 L/s Toilets, Restrooms, Pantry & Janitor Room: 15650 L/s Laboratories: 570 L/s Lv Main Switch & Emergency Switch Room: 1470 L/s Dietitian Kitchen: 6530 L/s RS&MRR: 1120 L/s Jet Fans: 402.78 L/s	
Fan Power	Building: (Per BEC 2015 requirement, Fan Power should be <0.000519 kW/cfm, i.e. 1.1W per L/s) For AHU &PAU: (Per BEC 2015 requirement, fan power of a VAV should be < 0.000911kW/cfm, i.e. 2.1 W/L/s) Carpark: Exhaust Fan: 0.000944 kW/cfm (As per EMSD Code of Practice for Energy Efficiency of Building Services Installation)	Building: (Per BEC 2015 requirement, Fan Power should be <0.000519 kW/cfm, i.e. 1.1W per L/s) For AHU &PAU: (Per BEC 2015 requirement, fan power of a VAV should be < 0.000911kW/cfm, i.e. 2.1 W/L/s) Carpark: Exhaust Fan: 0.000608 kW/cfm
Cooling Type	Fire Control Center/ Sprinkler Control Valve Room: Split AC Lv Main Switch & Emergency Switch Room; IT Server Room; MCC Room Wiring Closets; UPS Room; TBE Room: VRV system	Fire Control Center/ Sprinkler Control Valve Room: Split AC Lv Main Switch & Emergency Switc h Room; IT Server Room; MCC Room Wiring Closets; UPS Room; TBE Room: VRV system
Coefficient of performance[3]	Water Cooled Screw type Chiller (>1000kW): 5.5	VSD Screw Type Chiller: COP – 5.5 80% efficiency – 7.63

Sampling Point	Baseline Case	Design Case
		50% efficiency – 11.89 20% efficiency – 7.49
	Split Type: 2.5 (As per EMSD Code of Practice for Energy Efficiency of Building Services Installation 2015)	Split Type: SOU-1.5HP: 3.43
HVAC Water Side		
Chiller Type	screw-type chillers	Centrifugal-type chillers
Chiller	COP: 5.5	COP: 5.67
Chilled Water inlet/outlet	12.5℃ / 7℃	12.5℃ / 7℃
Condenser Water inlet/outlet	35℃ / 29.4℃	35℃ / 29.4℃
Condenser Water Pump	Mechanical Efficiency: 60% Pump Head: 35.7m Variable Speed Type	Mechanical Efficiency: 83.2% Power: 37Kw Pump Head: 35.7m Variable Speed Type
Primary Chilled Water Pump	Mechanical Efficiency: 60% Pump Head: 30.6m Variable Speed Type	Mechanical Efficiency: 80% Power: 22kW Pump Head: 30.6m Variable Speed Type
Energy Saving Strategies		
Efficient Building Services System	N/A	Yes - Performance of Selected equipment will be higher than the requirement of BEC.
CO Sensor	N/A	Yes - CO Sensor provided at Carpark
Automatic Lighting Control	Yes (as per requirement of Code of Practice for Energy Efficiency of Building Services Installation 2015)	Yes (Occupancy sensors shall be adopted in classrooms, office and common area ; Daylight sensors shall be adopted in classrooms, office and corridor next to windows)
PV Panel	N/A	Yes
Efficient Cooling Unit	N/A	Yes - Spilt type and VRV units with high COP are selected
External, Internal Loadings & Operation Schedule		

Sampling Point	Baseline Case	Design Case
Lift Electrical Power[2]	(As per EMSD Code of Practice for Energy Efficiency of Building Services Installation)	10% reduced from EMSD baseline lift power
Hot Water Heater	For Shower: 4kW For Bath: 21kW (As Design)	For Shower: 4kW For Bath: 21kW (As Design)
Exterior Lighting	0.5562 kW (As Design)	0.5562 kW

Table 4.3 Internal Loading of Different Types of Spaces for Baseline and Design Case

Space Type	Occupancy Density (m^2/ppl)	Occupancy Load (W/ppl)		Lighting Power Density*		Equipment Power Density	
		Sensible	Latent	(W/m^2), Baseline	(W/m^2), Design	(W/m^2)	(W/ft^2)
Classroom	2	71.8	45.4	12	9.8	10	0.929
Activity Rooms	9-10	71.8	45.4	12	9.8	10	0.929
Laboratory	10	73.3	73.3	15	9.51	10	0.929
Office	9	73.3	58.6	12	4.85	25	2.32
Learning Common	1	73.3	58.6	15	6.72	10	0.929
Common Area	-	-	-	13	6.72	-	-
Corridor	-	-	-	8	3.11	-	-
Staircase	-	-	-	7	6.64	-	-
Lift Lobby	10	73.3	73.3	11	3.27	-	-
Female Toilet	-	-	-	11	10.7	-	-
Male Toilet	-	-	-	11	8.76	-	-
PAU Room	-	-	-	10	6.38	-	-
Water Pump Room	-	-	-	10	9.26	-	-
LV Switch Room	-	-	-	10	4.95	-	-
FS Pump Room	-	-	-	10	6.85	-	-
Carpark	-	-	-	5	2.65	-	-
RSMRC	-	-	-	9	8.54	-	-
Store Room	-	-	-	9	5.48	-	-

Table 4.4 Operation Schedules of Institutional Building

Table G-M—School Occupancy

Hour of Day (Time)	Schedule for Occupancy Percent of Maximum Load			Schedule for Lighting Receptacle Percent of Maximum Load			Schedule for HVAC System			Schedule for Service Hot Water Percent of Maximum Load			Schedule for Elevator Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1 am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0
2 (1-2 am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0
3 (2-3 am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0
4 (3-4 am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0
5 (4-5 am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0
6 (5-6 am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0
7 (6-7 am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0
8 (7-8 am)	5	0	0	30	5	5	On	Off	Off	10	3	3	0	0	0
9 (8-9 am)	75	10	0	85	15	5	On	On	Off	34	3	5	30	0	0
10 (9-10 am)	90	10	0	95	15	5	On	On	Off	60	5	5	30	0	0
11 (10-11 am)	90	10	0	95	15	5	On	On	Off	63	5	5	30	0	0
12 (11-12 pm)	80	10	0	95	15	5	On	On	Off	72	5	5	30	0	0
13 (12-1 pm)	80	10	0	80	15	5	On	On	Off	79	5	5	30	0	0
14 (1-2 pm)	80	0	0	80	5	5	On	Off	Off	83	3	5	30	0	0
15 (2-3 pm)	80	0	0	80	5	5	On	Off	Off	61	3	3	30	0	0
16 (3-4 pm)	45	0	0	70	5	5	On	Off	Off	65	3	3	15	0	0
17 (4-5 pm)	15	0	0	50	5	5	On	Off	Off	10	3	3	0	0	0
18 (5-6 pm)	5	0	0	50	5	5	On	Off	Off	10	3	3	0	0	0
19 (6-7 pm)	15	0	0	35	5	5	On	Off	Off	19	3	3	0	0	0
20 (7-8 pm)	20	0	0	35	5	5	On	Off	Off	25	3	3	0	0	0
21 (8-9 pm)	20	0	0	35	5	5	On	Off	Off	22	3	3	0	0	0
22 (9-10 pm)	10	0	0	30	5	5	On	Off	Off	22	3	3	0	0	0
23 (10-11 pm)	0	0	0	5	5	5	Off	Off	Off	12	3	3	0	0	0
24 (11-12 am)	0	0	0	5	5	5	Off	Off	Off	9	3	3	0	0	0
Total/Day	710	50	0	990	170	120	1500	500	0	691	80	84	285	0	0
Total/Week		36.00 hours			52.40 hours			80.00 hours			36.19 hours			14.25 hours	
Total/Year		1877 hours			2732 hours			4171 hours			1887 hours			743 hours	

Wk = Weekday

Schedules for occupancy, lighting, receptacle, HVAC system, and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.

Table A4. Operating schedule 'A': offices

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Occupants																								
Mon – Fri	0	0	0	0	0	0	0.1	0.7	0.9	0.9	0.9	0.5	0.5	0.9	0.9	0.9	0.7	0.3	0.1	0.1	0.1	0.1	0	0
Sat	0	0	0	0	0	0	0.1	0.4	0.7	0.7	0.7	0.7	0.7	0	0	0	0	0	0	0	0	0	0	0
Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Equipment																								
Mon – Fri	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.5	0.3	0.2	0.2	0.2	0.2
Sat	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.8	0.9	0.9	0.9	0.9	0.9	0.8	0.6	0.5	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Sun	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Lighting																								
Mon – Fri	0.05	0.05	0.05	0.05	0.05	0.05	0.3	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.5	0.3	0.1	0.05	0.05
Sat	0.05	0.05	0.05	0.05	0.05	0.05	0.3	0.8	0.9	0.9	0.9	0.9	0.9	0.8	0.6	0.5	0.5	0.3	0.3	0.1	0.1	0.05	0.05	0.05
Sun	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Fans																								
Mon – Fri	Off	Off	Off	Off	Off	On	On	On	On	On	On	On	On	On	On	On	On	On	On	Off	Off	Off	Off	Off
Sat	Off	Off	Off	Off	Off	On	On	On	On	On	On	On	On	On	On	Off	Off	Off	Off	Off	Off	Off	Off	Off
Sun	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Cooling	(*) = temperature as design																							
Mon – Fri	Off	Off	Off	Off	Off	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	Off	Off	Off	Off	Off	Off
Sat	Off	Off	Off	Off	Off	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	Off	Off	Off	Off	Off	Off	Off	Off	Off
Sun	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Heating	(*) = temperature as design																							
Mon – Fri	Off	Off	Off	Off	Off	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	Off	Off	Off	Off	Off	Off
Sat	Off	Off	Off	Off	Off	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	Off	Off	Off	Off	Off	Off	Off	Off	Off
Sun	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Hot Water																								
Mon – Fri	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.5	0.5	0.9	0.9	0.9	0.9	0.9	0.9	0.7	0.5	0.3	0.2	0.2	0.2	0.05	0.05	0.05
Sat	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.5	0.5	0.9	0.9	0.9	0.9	0.9	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sun	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

4.2 Energy/cost Conservation Measures

Several Energy / Cost Conservation Measures are applied in this project to achieve the energy saving target. This section introduces the measures which have signification contribution in energy cost saving.

4.2.1 CO Sensor in Car Park

CO sensor shall be installed in car park area control the two speed type exhaust and supply fans based on the demand of usage. Therefore, energy wastage during low/ no occupancy can be reduced while ventilation quality during peak hours can be maintained.

4.2.2 High Performance AC Equipment

VSD chiller plant was selected to enhance the part load efficiency during operation. The part load efficiency could reach 7-8 at 75% loading condition.

4.2.3 Energy Efficient Lighting Design

Energy efficient lighting shall be adopted in common areas including plant room, carpark, lobby and corridor. The arrangement of lighting with efficient equipment shall lead to lower lighting power density in design case than designated baseline of EMSD Building Energy Codes.

4.2.4 Energy Efficient Lift System

Lift system shall be installed in the building. Adopting low energy use lift system reduces the energy usage for the lifts. Therefore, lift car shall be selected with power consumption less than the baseline requirement from EMSD Code.

5. Building Simulation Result

This section illustrates the simulation results of design case and baseline design case in terms of energy consumption.

The peak electricity demand was calculated around July in this model.

5.1 Baseline Case Energy Consumption & Demand

The Baseline model is set up based on the BEAM Plus New Building Version 1.2 and Performance-based Building Energy Code issued by EMSD. Table 5.1 to 5.2 give the simulation result of the Baseline Model. Figure 5.1 summarize the annual energy consumptions of the Educational Building Area in Baseline Model. Figure 5.2 summarize the annual energy consumptions of the Car Park in Baseline Model.

Table 5.1 Baseline Energy Consumption for Educational Building

Electricity			
Energy Use		Energy Source	Energy Consumption kWh x 000
Space Cool		Electricity	1779.6
Space Heat		Electricity	-
Heat Rejection		Electricity	84.6
Vent. Fans	Vent. Fans (conditioned)	Electricity	769.6
	Vent. Fans (unconditioned, common area)		564.6
Misc. Equip	Receptacle Equip	Electricity	471.7
	Lift		390.5
Exterior Lighting		Electricity	2.4
Area Lights		Electricity	556.8
Pump & Aux.	Supply & Flushing Water Pump	Electricity	46.5
	Chiller & Condenser Water Pump		401.8
Hot Water		Electricity	82
Summary			
Total Elec. Consumption(*000kWh)		Electricity	**5,150.2**

Figure 5.1 Annual Electricity Energy Consumptions – Baseline Case (Educational Building)

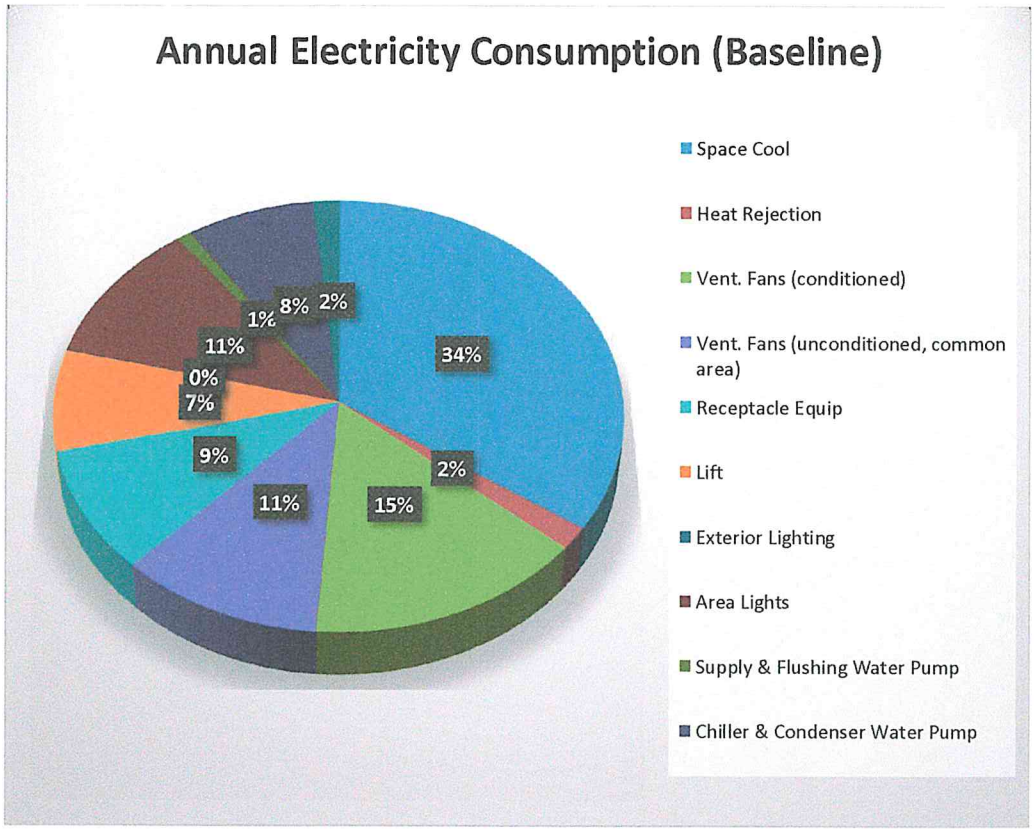
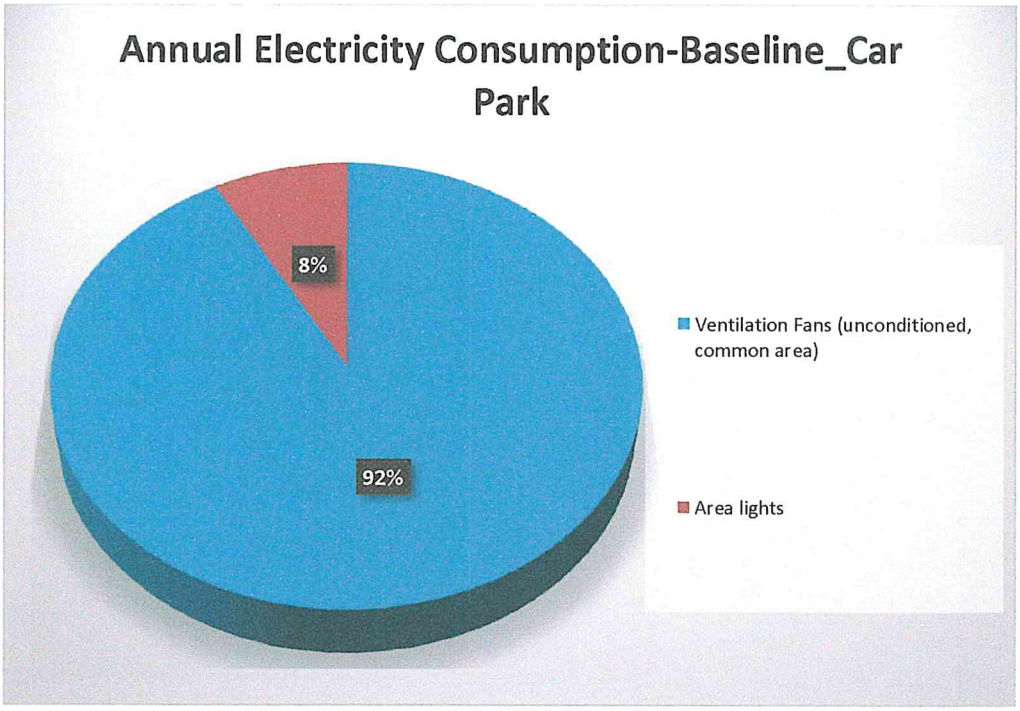


Table 5.2 Baseline Energy Consumption for Car Park Area

Electricity			
Energy Use		**Energy Source**	**Energy Consumption kWh x 000**
Space Cool		Electricity	-
Space Heat		Electricity	-
Heat Rejection		Electricity	-
Vent. Fans	Vent. Fans (conditioned)	Electricity	-
	Vent. Fans (unconditioned, common area)		149.8
Misc. Equip	Receptacle Equip	Electricity	-
	Lift		-
Exterior Lighting		Electricity	-
Area Lights		Electricity	10.3
Pump & Aux.	Supply & Flushing Water Pump	Electricity	-
	Chiller & Condenser Water Pump		-

Hot Water	Electricity	-
Summary		
Total Elec. Consumption(*000kWh)	Electricity	**160.1**

Figure 5.2 Annual Electricity Energy Consumptions – Baseline Case (Car Park)



5.2 Design Case Energy Consumption & Demand

Table 5.3-5.4 gives the simulation result of the Design Model. Figure 5.3 summarizes the annual energy consumptions of the Educational Building Area in Proposed Design Model. While Figure 5.4 summarizes the annual energy consumptions of the Car Park Area in Proposed Design Model.

Table 5.3 Design Energy Consumption of the Educational Building Area

Electricity			
Energy Use		**Energy Source**	**Energy Consumption kWh x 000**
Space Cool		Electricity	1220.7
Heat Rejection		Electricity	56.0
Vent. Fans	**Vent. Fans (conditioned)**	Electricity	826.1
	Vent. Fans (unconditioned, common area)		549.6
Misc. Equip	**Receptacle Equip**	Electricity	471.7
	Lift		318.4
Exterior Lighting		Electricity	2.4
Area Lights		Electricity	259.4
Pump & Aux.	**Supply & Flushing Water Pump**	Electricity	46.6
	Chiller & Condenser Water Pump		211.7
Hot Water		Electricity	82
Summary			
Total Elec. Consumption(*000kWh)		Electricity	**4044.7**

Figure 5.3 Annual Electricity Energy Consumptions – Design Case (Educational Building)

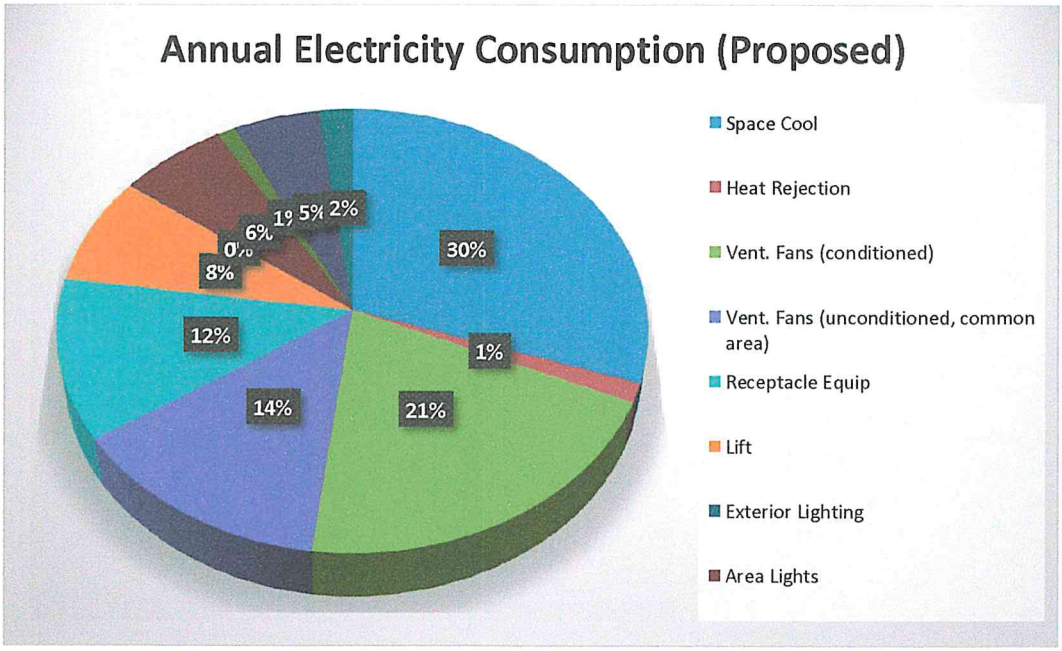
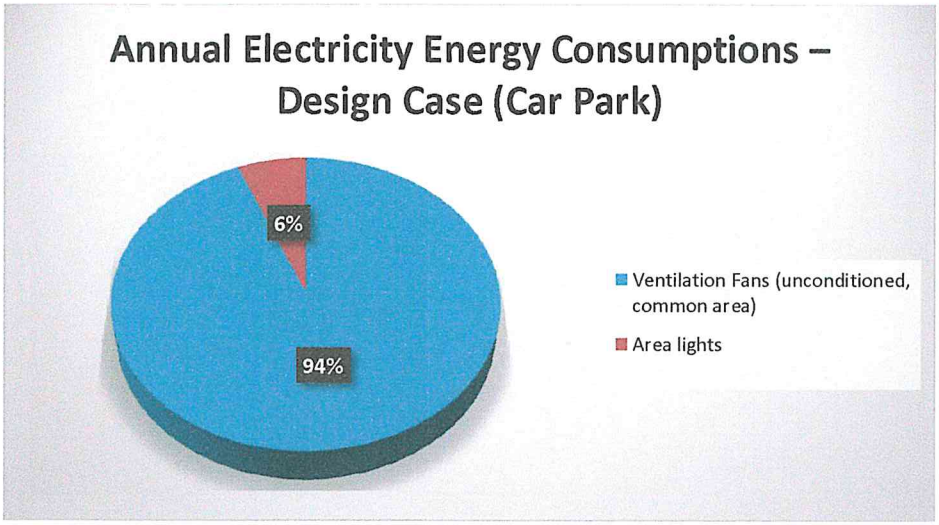


Table 5.4 Design Energy Consumption of the Car Park Area

Electricity			
Energy Use		**Energy Source**	**Energy Consumption kWh x 000**
Space Cool		Electricity	-
Space Heat		Electricity	-
Heat Rejection		Electricity	-
Vent. Fans	Vent. Fans (conditioned)	Electricity	-
	Vent. Fans (unconditioned, common area)		96.4
Misc. Equip	Receptacle Equip	Electricity	-
	Lift		-
Exterior Lighting		Electricity	-
Area Lights		Electricity	4.9
Pump & Aux.	Supply & Flushing Water Pump	Electricity	-
	Chiller & Condenser Water Pump		-
Hot Water		Electricity	-
Summary			
Total Elec. Consumption(*000kWh)		Electricity	**101.3**

Figure 5.4 Annual Electricity Energy Consumptions – Design Case (Car Park)



5.3 Results for APP 151 Appendix B

Type of Development	Location	Internal Floor Area (m2)	Annual Energy Use of Baseline Building		Annual Energy Use of Proposed/ Completed Building	
			Electricity (kWh)	Towngas (LPG)	Electricity (kWh)	Towngas (LPG)
Non-domestic Development	Towers (central building services)	21633.25	245.47	-	191.65	-

6. Conclusion

Based on energy saving measures incorporated into building development, the energy consumption in the completed building will be reduced from baseline building in BEAM Plus New Building v1.2 standard and EMSD Building Energy Code. Compliance with APP 151 is demonstrated.