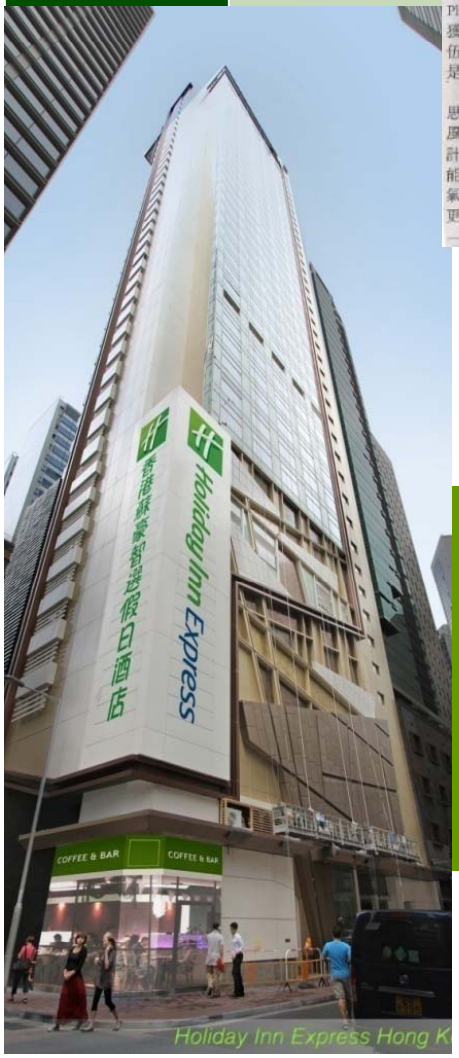
Triple Green Implementation

(LEED, BEAM plus and BCA Green Mark)

Experience from Holiday Inn Express Hong Kong SoHo



最環保酒店採22項綠色設計

【香港商報訊】記者葉佩瑜報道：有利集團旗下的智選假日酒店已正式開幕，酒店榮獲美國 LEED、新加坡 Green Mark 及香港 BEAM Plus 頒發的鉑金級環保認證，是全球首棟同時獲多項環保建築驗證的高標大廈。酒店總經理伍啓華表示，酒店總共有 22 項綠色設計，可算是全港最環保的酒店。

酒店爲了得到環保驗證，特別在設計上花心思，當中較特別的包括太陽能熱水系統、智能風機盤管、雨水循環使用系統、綠化屋頂設計，伍啓華透露，太陽能板以管道吸熱，不需能源便可將水溫加熱；智能風機盤管成功將冷氣系統分成六級，有別於以往的高、中、低，更方便控制能源；雨水循環系統將雨水收集，儲起作澆灌之用；綠化屋頂則顧名思義以綠色植物覆蓋酒店外層，減低室外天氣對酒店內部的影響。另一方面，酒店房間更設有智能系統，窗簾及冷氣都會因應房間情況作出自動調節，以減低光污染及非必要的冷氣排放。

向第四個綠色驗證進軍

伍啓華表示，建造環保建築的開支約 1400 萬元，佔成本的百分之四，但有信心以 4 年時間能回本，他稱，酒店如想獲持已得的三個驗證，必須緊守機構準則，他對此有信心，又透露酒店現時正申請中國的三星級綠色建築評價標識，希望成爲全球首間擁有四個綠色驗證的酒店。

綠色酒店環保認證 港美雙

全球首間 自動關窗簾牀頭冷氣

新聞 22

太陽能製熱水 冷氣自動調溫

上環綠色酒店 碳排減七成

CASE SHARING :

HOLIDAY INN EXPRESS HONG KONG SOHO

Enhancement of Energy Utilization in Building

Ir. Antonio Chan, Executive Director
REC Engineering Co., Ltd
REC Green Technologies Co., Ltd.

21 May 2013

Consultants & Project Team

Architect & Interior Designer	Structural Engineer	Main Contractor	E&M Engineer	EOS Provider	Environmental Consultant	Hotel Operator
Chau, Ku & Leung Architects Engineers Ltd	T.K. Tsui & Associates Limited	Yau Lee Building Construction & Decoration Co., Ltd.	REC Engineering Company Limited	REC Green Technologies Company Limited	Telemax Environmental & Energy Management Ltd.	InterContinental Hotels Group

2005

Property Development
Holiday Inn Express Hotel, Causeway Bay, Hong Kong

Holiday Inn Express Hotel, Causeway Bay, HK

- Located at 33 Sharp Street East, Causeway Bay
- Comprises of 269 rooms and several restaurant floors
- Fitting out works completed in 2005
- Valuable experience was gained in completing the task with high standard of workmanship in a very short working period and confined working space
- Lack of good efficiency solution resulted in high energy bill of HK$5.5M

2010 Holiday Inn Express Hong Kong SoHo

Project Profile

Commencement Date of Superstructure	10 September 2010
Anticipated Completion Date of Construction	15 March 2012
Project Duration	Sub-structure – 180 days (6 mths) Superstructure – 552 days (1.5 year) Licensing – 150 days (4 mths)
Site Area	612 m^2 (i.e. 0.0612 hectares)
Construction Contract Sum	HK$350M / US$45M
Gross Floor Area	9,163 m^2
Number of floors	36 storey
Number of Guest Rooms	274 nos.

Double bed room:	162 nos.
Twin bed room:	106 nos.
Disabled room	6 nos.

Holiday Inn Express Hong Kong SoHo

The 1st triple platinum rating hotel in the world

HK BEAM-Plus Platinum (Final)
Achieved points : 79.8

US LEED Platinum
Achieved Points : 82

BCA Green Mark Platinum

3 Star 3-Star System (In process)

中國綠色建築與節能(香港)委員會
China Green Building (HK) Council

Achieved max. points under energy used

Green Building Award 2012 – Merit Award

Asian Institute of Intelligent Buildings Intelligent Hotel (Distinction Rank) Of 2012

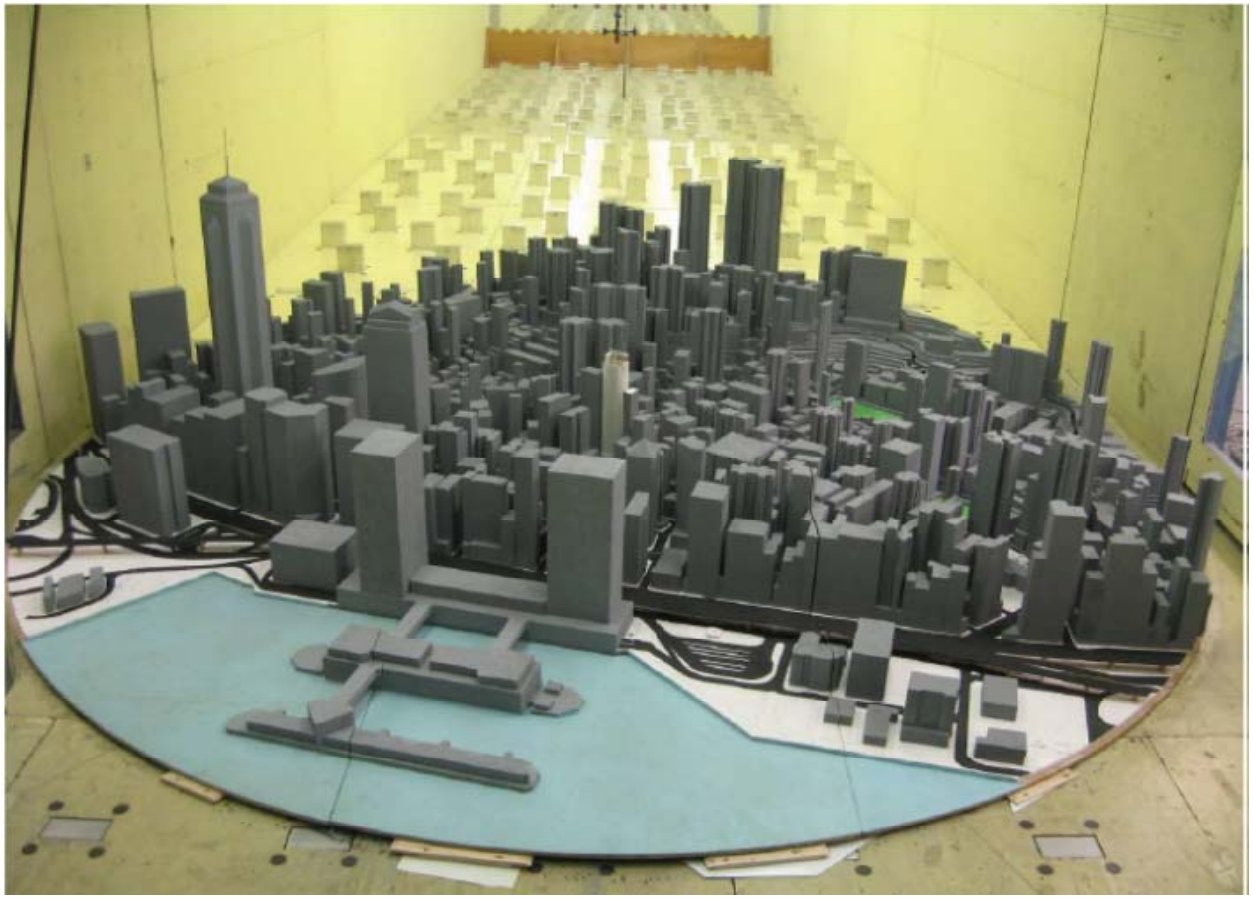
Latest Energy Saving Performance

Sustainable Building Design

- Energy Saving : **58.5%** (compared with EMSD HK hotel energy consumption benchmark)
- Energy consumption reduced: **2,070,381kWh**
- Energy Bill Saved: **HK$3.33M / US$0.43M** per year
- Additional Cost**:** **HK$13.26M** / US$1.7M**,** **3.8%** increased
- Pay Back Period: 4 years
- Higher initial cost but sustainable operation

Energy Consumption Benchmark of Hotel		Saving
Hong Kong	437.5kWh/m^2/year	58.5%
US	401 kWh/m^2/year	54.8%
Sharp Street East (actual bill)	460 kWh/m^2/year	60.6%
Jervois Street (Hotel SoHo)	181 kWh/m^2/year	*

Structural Aspect



1:400 scale wind tunnel model

Material Reduction: HK$1.40M

1. Rebar - Saved 45 ton = HK$0.28M
2. Concrete - Grade 40 instead of Grade 60 = HK$1.13M
3. CO_2 emission reduced

Structural Aspect

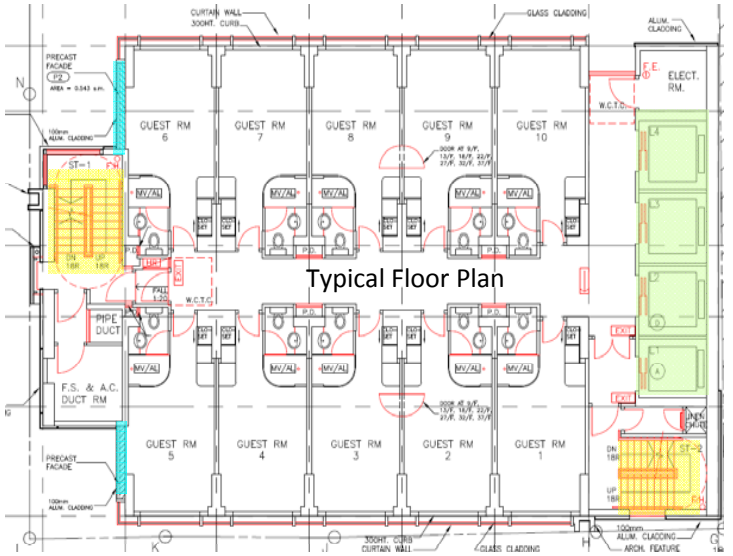
Modular and Standard design

- Enhancement in construction buildability and reduction in C&D waste
- 50% of major building elements specified modularized and standardized for typical floor

PRECAST FAÇADE (End Wall)

Offsite Fabrication & Metal Formwork Panels

- Encourage off-site fabrication of building elements in order to reduce wastage of materials and quantities of on-site waste
- Use of metal formwork for erection of lift shafts to enhance the buildability



Typical Floor Plan

METAL FORMWORK

PRECAST STAIRCASE

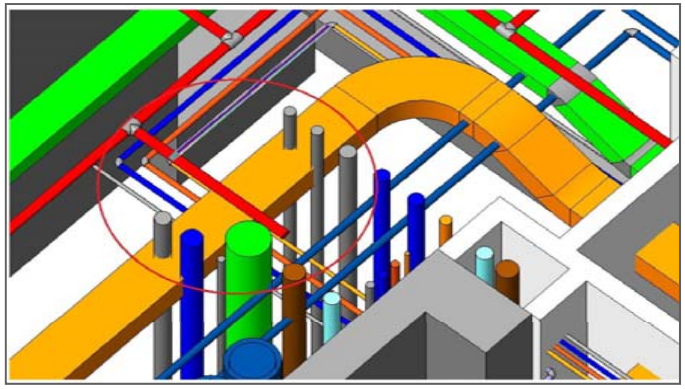
Construction Aspect

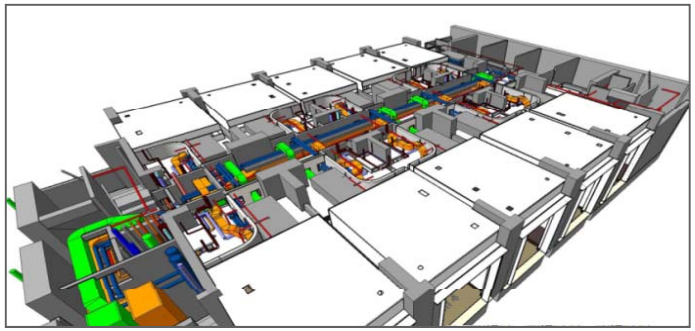
BIM Virtual Construction

Less Rework approx. 02% - 0.5% = HK$1.25M

Application of BIM (Building Information Modeling) to the following areas :

- Underground utilities construction
- Typical floor construction
- External facade construction





Further Development in 5D BIM

1) 3D REVIT Model
2) Clash detection
3) Construction Programme
4) Standard Method of Measurement for quantity taking off
5) Accurate construction cost

Environmental Controls & Measures

Enhancement in environmental controls & measures to reduce negative impact to environment and provide better working environment

Air Pollution Measure- Application of BreeZer™ for fitting-out site, office building, shopping mall

- Handy mobile air purification system to eliminate indoor air pollution
- Continually purify air and maintain a good air quality working condition at fitting-out site, e.g. shopping mall, office building
- Removal of Dust, Respirable Suspended Particulates (97.5%), VOCs, Odor etc. in 30 mins

Noise Pollution Measure - Noise Prevention Zone

Acoustic insulation installed at Noise Prevention Zone to minimize noise generated on site

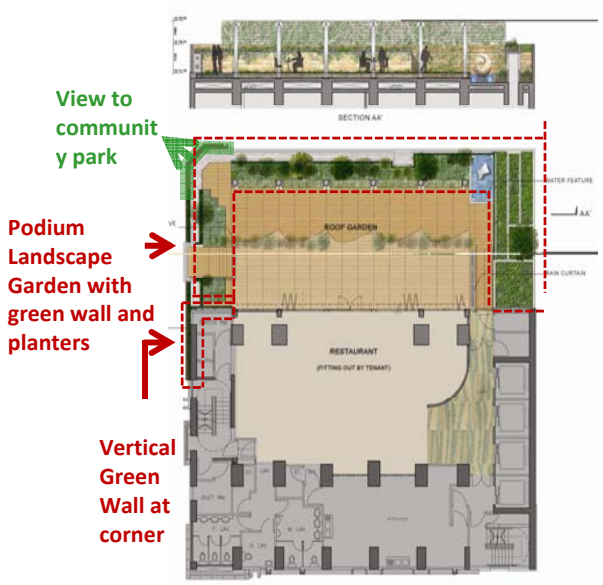
Water Pollution Measure Water Treatment Plant

Reuse of treated sewage for vehicle wheel washing

Architectural Aspect
Greenery Area

Green Response to Site and Neighbourhood
This Hotel provides 47.5 % greenery to site

- Horizontal Greening: 165m^2 (26.9% of site area)
- Vertical Greening:126m^2 (20.6% of site area)



2/F Landscape Roof Garden

Vertical Greenery (1/F-6/F) facing Cleverly St. & Burd St.

Architectural Aspect
Irrigation System

Water recycling for landscape irrigation purpose

- 2 nos. of recycle storage tanks are installed to collect the rainwater and condensed water from A/C system for reuse
- Filtration System with UV light is adapted for simple treatment of the recycled water

Architectural Aspect
Green Building Materials

Green Building Material - Starfon™ Applications

Printing on Starfon™ Glass and Starfon™ Tiles
- Great Room & G/F lobby

Starfon™ Glass with Fibre Optics
- G/F lobby

Starfon™ Wood
– External Facade

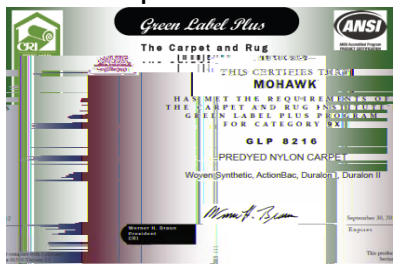
Starfon™ Metal
- External Facade

Architectural Aspect
Green Building Materials

Selection of Materials

Low VOC Products

- 100% use of low-VOC products
  (based on BEAM Plus and LEED requirements)
  - Adhesive & Sealants
  - Painting and Coating
  - Composite Wood and Argrifiber products
  - Carpet



- Ensure airborne contaminants, predominantly from inside sources, do not give rise to unacceptable levels of indoor air pollution in normally occupied spaces

LEGEND
Technical Services, Inc.

VOC Content Test Certificate

October 26, 2009

Supplier: Hilti Entwicklungsgesellschaft mbH
BU Chemicals
Hiltistrasse 6
86916 Kaufering
GERMANY

Sample Description: Hilti CP 606

Date tested: July 30, 2009

Test Method: SCAQMD method 304-91 Determination of Volatile Organic Compounds (VOC) in various materials as referenced by South Coast Air Quality Management District (SCAQMD) rule 1168. The values also comply with the requirements of EPA test method #24.

Test Data: Legend Project Number 0903311

Specification	Product
LEED 2009 (LEED 3.0) LEED 2.2 IEQ-4.1: Low-Emitting Materials – Architechtural Sealant	Hilti CP 606
Green Building Council of Australia Green Star Office Design 3.0, IEQ-13 Green Star Office Design 2.0, IEQ-13 Green Star Office Interiors 1.1, IEQ-11	
Architectural Sealant; VOC Limit: 250 g/L	Product contains: 75 g/L of VOC

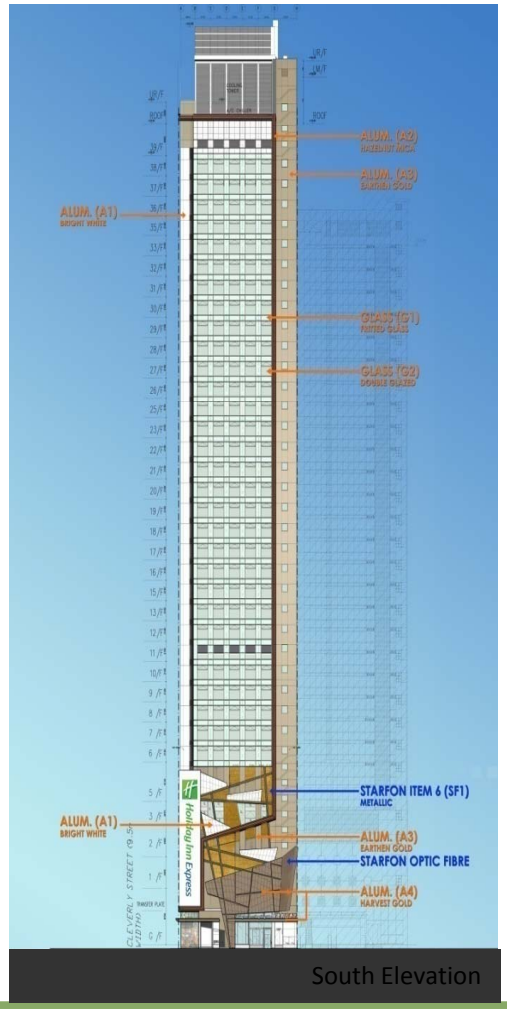
William Welbes, Vice President of Laboratory Operations
Allen Norsen, Ph.D., Technical Director

FSC Timber

- 100% use of Reused timber or timber from sustainable forest
  (based on BEAM Plus and LEED requirements)
  - For temporary use
    - Formwork & Falsework
  - For permanently use
    - Furniture
    - Dado
    - Door
- Reduce the consumption of timber from virgin forests

Architectural Aspect
Blocking solar heat gain into the building

Application of Low-E Glass



South Elevation

Encourage the consideration of building envelop to reduce heat gain and overall energy loading by application of **IGU with Low-E coating Glass** at Unitized Curtain Wall System

Comparison between IGU** & IGU with Low E coating

Glass Type	Lighting transmission	Shading Coefficient	U-Value (W/m^2K)
IGU with Low E Coating & Argon Gas	66%	0.42	1.3
IGU	**78%**	**0.79**	**2.7**

Estimated energy saving when using IGU with Low E coating is 3%

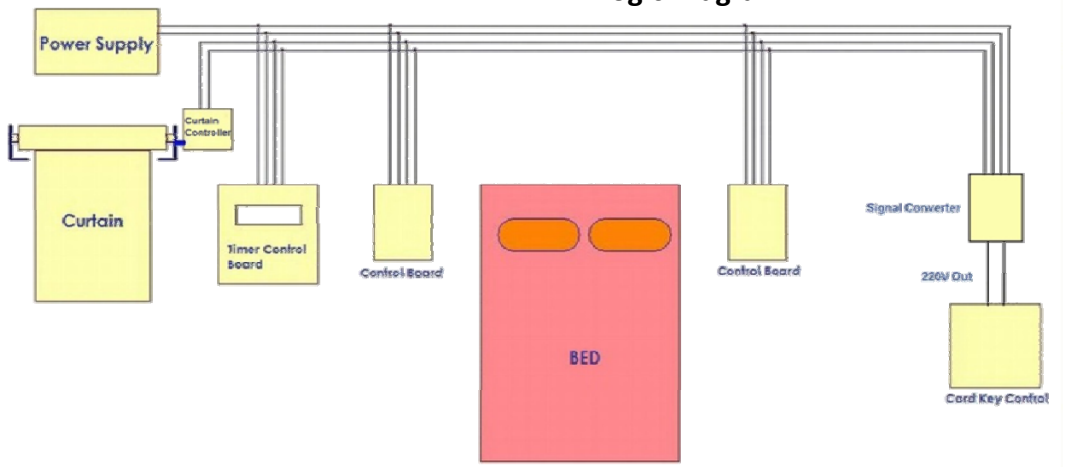
(**) 1. IGU : Insulated known as double glazing are double or triple **glass window** panels separated by an air or argon gas filled space to reduce **heat transfer** across a part of the **building envelope**
2. Low emissivity (Low E) coating on the glass provides the possibility of reducing the long wave radiation exchange between the panels.

Major Sustainable Building Design
Reduction of cooling load

Motorized Roller Blind System

- Installation of Motorized roller blind system at 274 guestrooms
- Roller blind auto closed when guest leaves
- Reduction of solar heat gain
- Minimized lighting pollution at night

Roller Blind System Control Logic Diagram



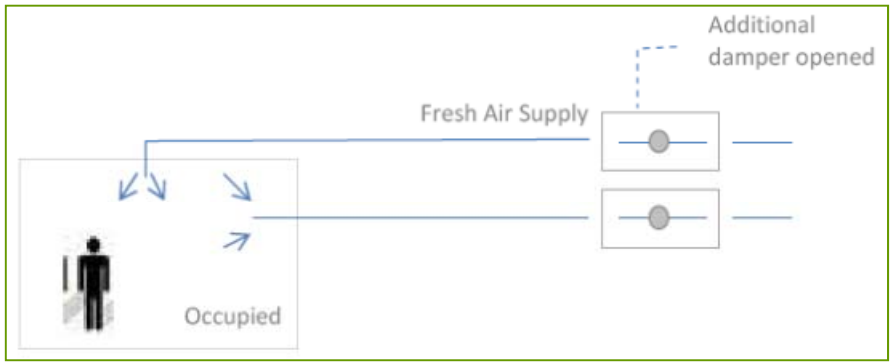
Roller blind auto open when guest lock in

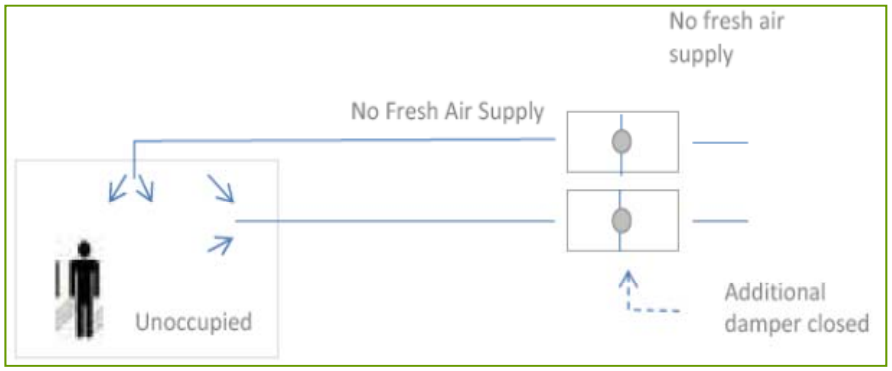
Roller blind auto closed when guest leaves

Major Sustainable Building Design
Reduction of cooling load

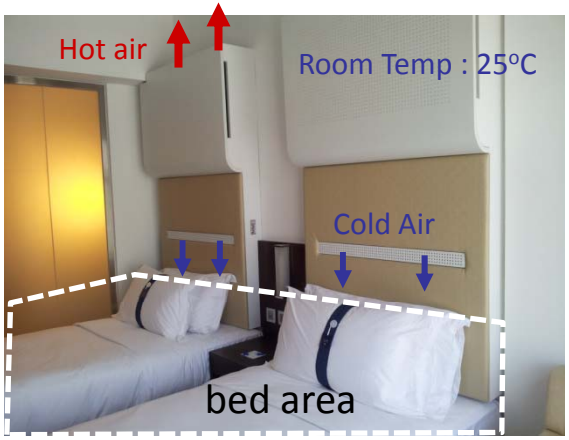
Room Fresh Air Control

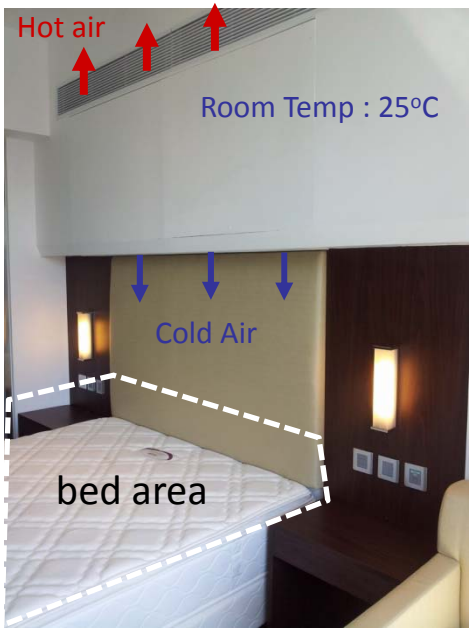
- ✓ **Reduction in fresh air by 50%** during unoccupied mode (while guests are mostly out of hotel) for guest rooms
- ✓ Saving in PA - cooling energy when there is a low demand
- ✓ Using CO_2 sensors to regulate the amount of ventilation air admitted





Major Sustainable Building Design
Reduction of cooling load





Peltier Headboard

Innovation : 1 Credit

Principle:

- Intelligent Personal cooling concept
- Turn on after 1 hour when the light is diminished
- Using peltier cooling technology to lower the 2-3°C around the bed area while the room temp. keeps at 25°C
- Energy to cool down the spaces apart from the bed will be wasted

Advantages:

- Electricity for air-conditioning can be reduced.
- Further enhance the cooling effect at bed area
- Lower 3°C of room temperature
- Reduce A/C energy during bed time

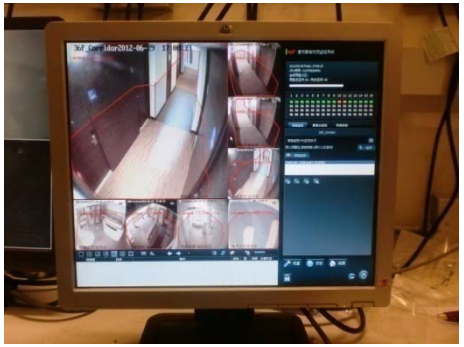
Control logic

System turn- on • Lux level : 0; and • Time : 23:00-7:00	1. Room Temp changes to 25°C 2. iFCU keeps at low speed	Bed area temp : Lower 3°C of room temp.
System turn-off • Lux level : >0; • Time : After 7:00 • Press to adjust a thermostat	1. Room Temp resumes to the set point 2. iFCU keeps at low speed.	

* Chilled headboard will not affected by desk lamp, TV & corridor lighting

Major Sustainable Building Design
Reduction of cooling load and lighting energy

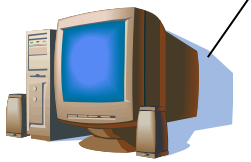
ONE Invention TWO Applications



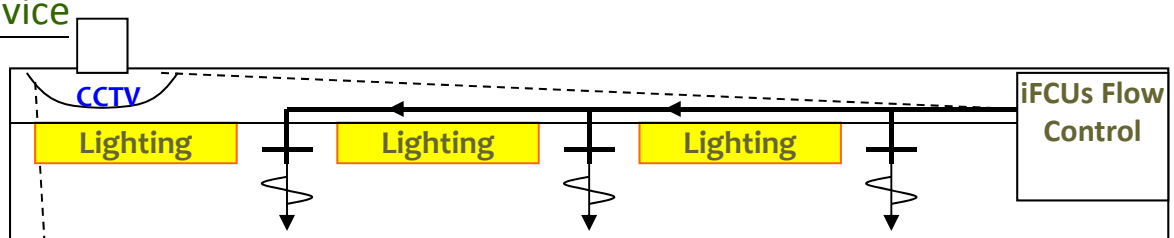
Pattern Recognition Energy Saving Solution "PRESS"

"PRESS" provides additional energy saving solution to the traditional CCTV cameras –

- Application of pattern recognition software and electronic interfacing devices with CCTV cameras to control the on/off lighting and air-conditioning system according to occupancy inside the target area
- No extra sensing device



Existing CCTV camera connect to RGT PRESS Controller with digital video recorder



PRESS Controller can control lighting on/off and air-conditioning supply according to occupancy inside the target area

Turning off lights & iFCU™ in unoccupied area

Turning on lights & iFCU™ in occupied area

Major Sustainable Building Design
Make use of solar energy & waste heat

Integrated Hot Water Supply System

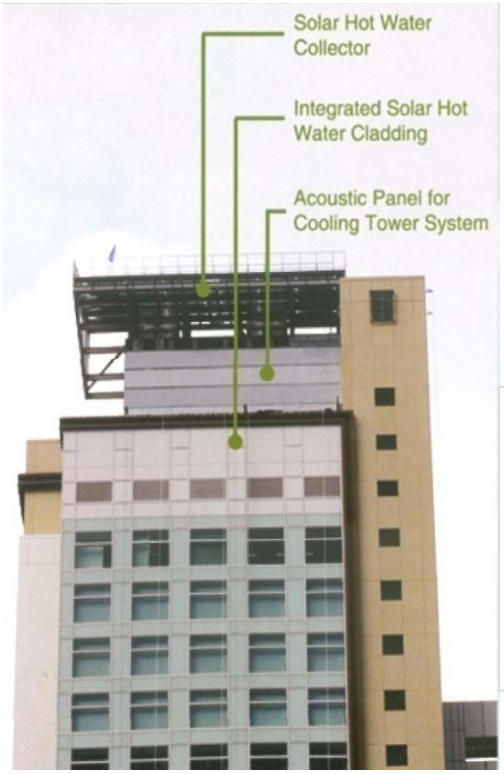
⇨ Primary hot water supply

1) Solar Hot Water Collector System; (72m^2 , 24 nos. solar collector panel)

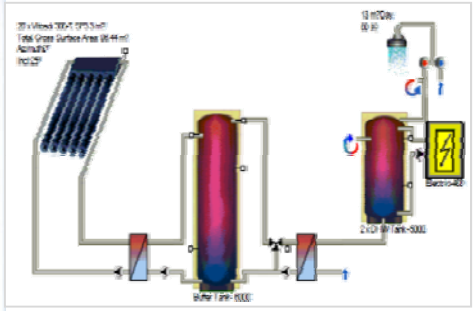
2) Heat Pump; &

3) Integrated Solar Hot Water Cladding

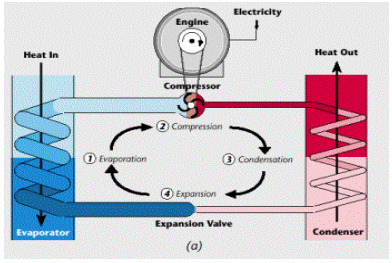
Total Energy saving: 264,353kWh/year



Solar Hot Water Collector



Integrated Solar Hot Water Cladding



Heat Pump
Offer cooling for room space and hot water for usage

Major Sustainable Building Design
High Efficiency Equipments

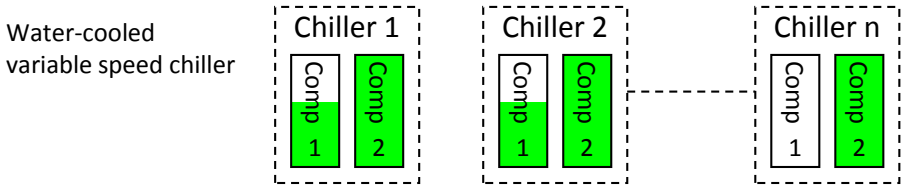
High CoP Water Cooled Chiller

Energy Saving : 373,846 kWh/year

1. Total cooling load : 380 Tonne
   - Use 2 nos. of high CoP (5.48) variable speed chillers with twin compressors (190 Tonne per chiller)
   - **Optimal performance during part-load operation**
   - Lower starting current and prevent frequent start-up
2. Reduce use of secondary pumps
   - Reduce capital cost & running cost

eCOOL™

Supplied by REC Green Technologies



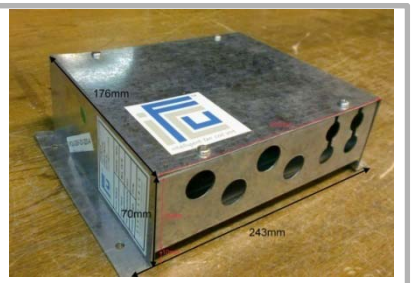
Major Sustainable Building Design
High Efficiency Equipments

Energy Saving Smart Intelligent Fan Coil Unit – iFCU™ (R&D by RGT)

Energy Saving Solution by replacing high efficiency **permanent magnet motor** and control driver, thus saving as much as **80%** power consumption at low speed.

iFCU™

Permanent Magnet Motor & iFCU™ retrofit kit



Integrated iFCU™ Control Box

Advantages

(1) Energy consumption is reduced by 40%-80%
(2) Variable speed FCU, 100% speed controllable
(3) Temperature control accuracy up to ±0.5°C
(4) Power Factor ＞0.85 at all speeds (high, med, low)
(5) Motor heat dissipation is lowered from 58% - 95%
(6) Ability to switch to either high or low static pressure FCU
(7) Lower noise level

Speed	IFCU™ motor (°C)	AC motor (°C)	Diff. %
Low	1.2	26.9	95%
Middle	2.3	18.1	87%
High	4.9	11.6	58%

Operating temperature rise of motor

Major Sustainable Building Design
High Efficiency Equipments

Energy Saving Performance

Operation Mode	Conventional AC Motor	PM Motor with Intelligent Control Driver	Saving	
	Power consumption (W)		(W)	%
Low	85.0	17.0	68.0	80%
Med	98.2	33.4	64.8	66%
High	112.0	67.2	44.8	40%

Hotel 24-hour operation : 274 sets (600 cfm) of iFCU™ in Guestroom

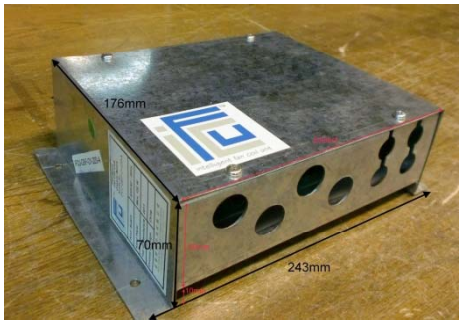
Energy Saving : 149,432.94 kWh / Year or 545 kWh/year/Room

	Conventional FCU	iFCU™
Electricity consumption at low speed 18hr/d x 365d x 274 fcu x W	84W = 150,585.06kWh	17W = 30,603.06kWh
high speed 6hr/d x 365d x 274 fcu x W	100.58W = 60,354.03kWh	51.5W = 30,903.09kWh
Annual Elect. Bill	HK$274,220.8	HK$79,958.0
Saving per annum	HK$194,262.8 (71%)	
Extra Cost per iFCU™	HK$1,500.00 per unit	
Payback Period	**HK$1,500.00/HK$708.99**	***2.12 year***

IFCU™ – Options

(1) iFCU™ Package (Direct replacement to fan coil unit)

iFCU™ Fan Coil Unit

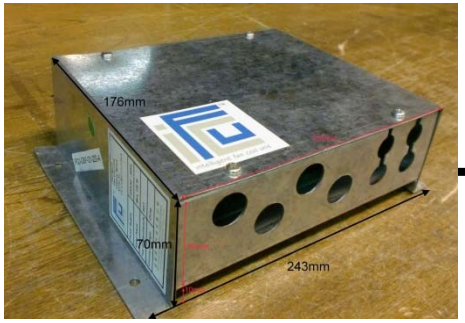


Integrated iFCU™ Control board
Dimension : 176 (L) x 243 (W) x 70 (H) mm

iFCU™ Thermostat

(2) iFCU™ Retrofit Kit (Direct replacement to AC motor)

iFCU™
Permanent Magnet Motor



Integrated iFCU™ Control board
Dimension : 176 (L) x 243 (W) x 70 (H) mm

Original
Thermostat

or

iFCU™
Thermostat

Major Sustainable Building Design
High Efficiency Equipments

Energy Efficient Products

LED Lighting (Architectural Application)

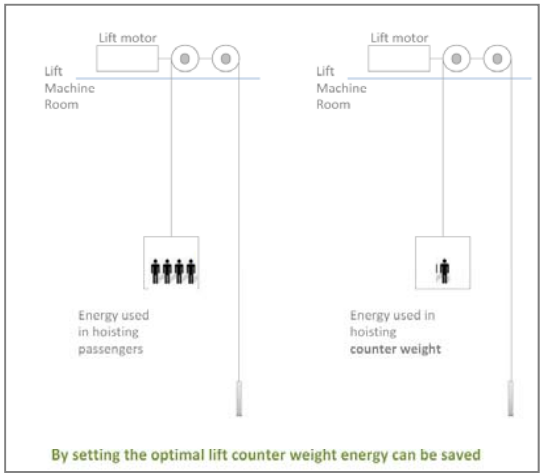
- Energy Saving : 700Wh/year

T5 tubes with electronic ballast
Distributive Intelligent Lighting System
(Staircase, back of office)

- Specially designed for back of house, corridors and public areas where traffic is low.
- Energy Saving : 5,800Wh / Year

Lift Counter Weight Optimization

- By setting the optimal lift counter weight, energy can be saved
- Energy Saving: 15,930kWh / year



Major Sustainable Building Design
Energy Optimization Solution ("EOS")

EOS enables the building owner to enhance its building MEP system and maximize the overall energy consumption performance of HVAC System according to building loads, profiles and external weather conditions

Energy Saving : 234,200kWh / Year

EOS Configuration : Variable speed equipments + Additional sensors + DDC

Water-cooled variable speed chiller

Cooling Tower with Variable Speed Fan

Chilled water pump with variable speed drive

CO_2 Sensor, Temperature Sensor, EM Flow meter, Differential Pressure Sensor, Outdoor Temp. & Humidity Sensor

Real-Time ambient environment information

RGT Building Management System

PowerBox™
On-line Energy Management & Monitoring Solution

Energy Optimization Solution ("EOS™")
Software & DDC to implement an energy optimization of HVAC system

Energy Optimization Solution ("EOS")

Concept of EOS optimizing system energy efficiency

Typical Examples in Central Air Conditioning System: -

Chilled water temperature optimization

Energy Saving : 8,000kWh / Year

Ordinary Control:

Fixed chilled water temperature set point

Optimized for both full and part load condition:

- ***Variable Chilled water temperature*** *is determined by real-time ambient temperature*
- *Variable compressor capacity control to fit different loading demand*

Energy Optimization Solution ("EOS™")

Major control strategies includes :

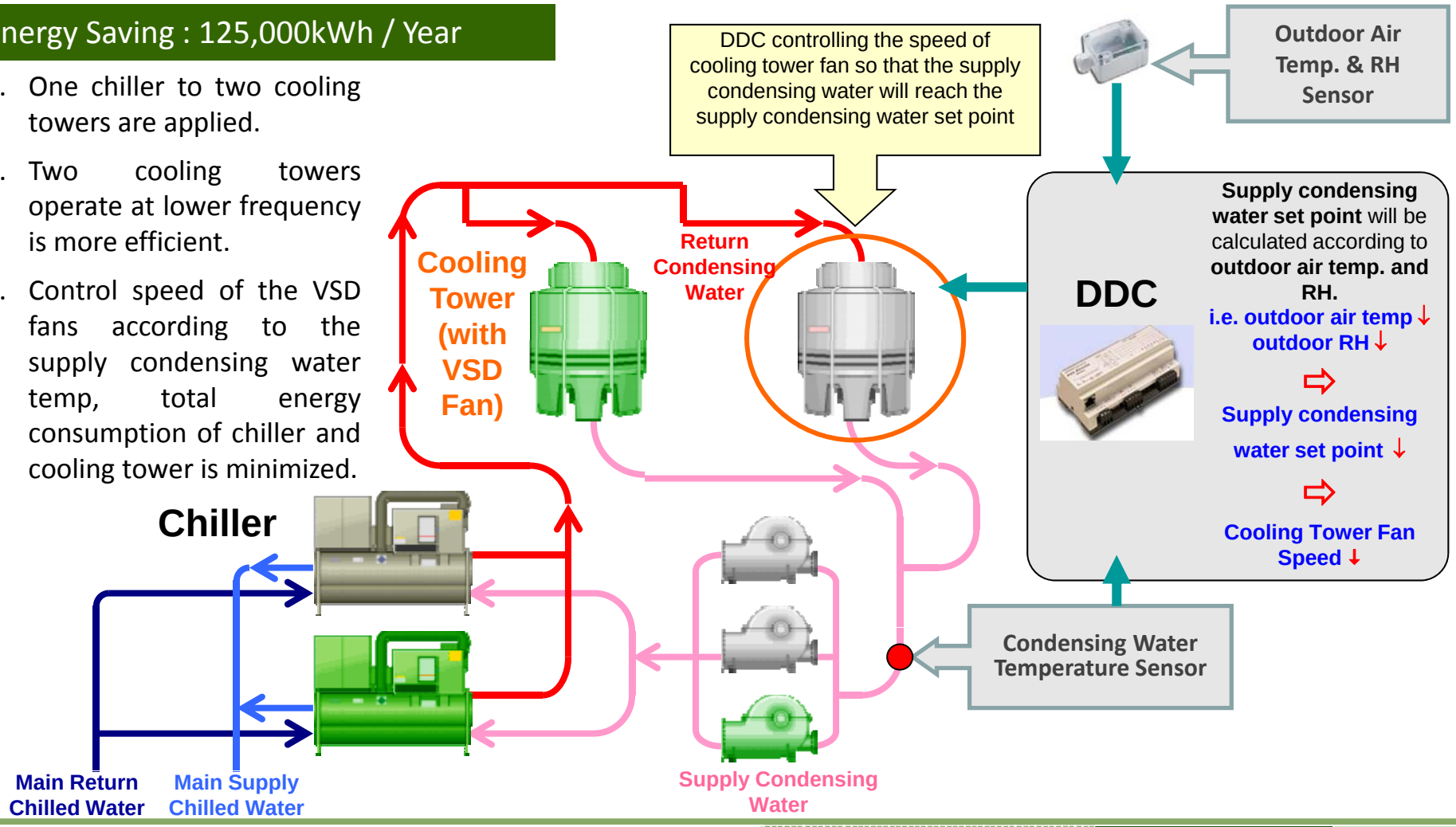
1. Chiller
   - Chiller sequence control
   - Chilled water temperature optimization
   - Chilled water pump sequence and speed control
   - Lower limit of chilled water flow rate for by-pass flow control
2. Cooling Tower
   - Cooling tower fan speed control
   - Cooling tower sequence control
   - Cooling water pump sequencing control
3. PAU
   - Demand Control
   - PAU fan speed control

Energy Optimization Solution ("EOS")

Cooling Tower Fan Speed Control & Sequence optimization

Energy Saving : 125,000kWh / Year

1. One chiller to two cooling towers are applied.
2. Two cooling towers operate at lower frequency is more efficient.
3. Control speed of the VSD fans according to the supply condensing water temp, total energy consumption of chiller and cooling tower is minimized.



Active Water Balancing Solution

Zonal Automatic Flow Control Valve

- Zonal flow control and balancing
- Modulating control based on design water flow rate & real time return water temperature
- Regulated water flow -> prompt response to change to zonal cooling load

Conventional

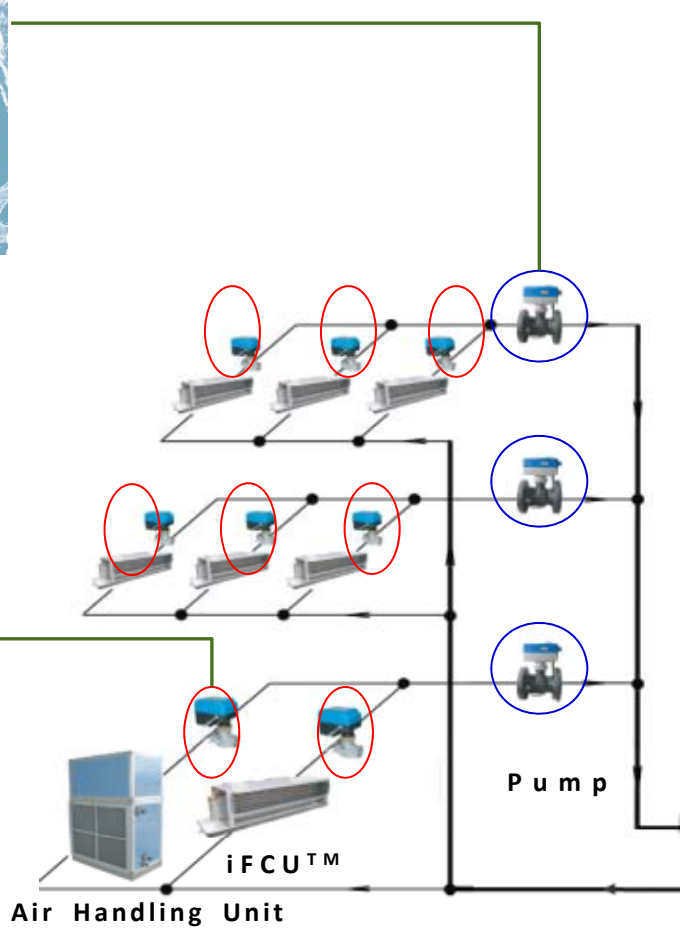
- Maintain constant flow under changing pressure condition

Terminal Thermal Energy Control Valve

- Modulating control based on room temp & return water temp.
- Maintain a constant return water temperature
- Accurate room temperature control

Conventional

- On/off control based temperature setting



PowerBox™ - Energy Management & Monitoring Solution

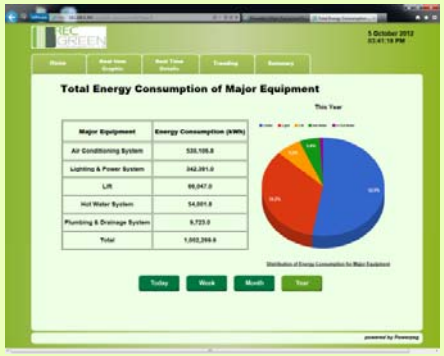
PowerBox™ - On-line energy management and monitoring reporting software

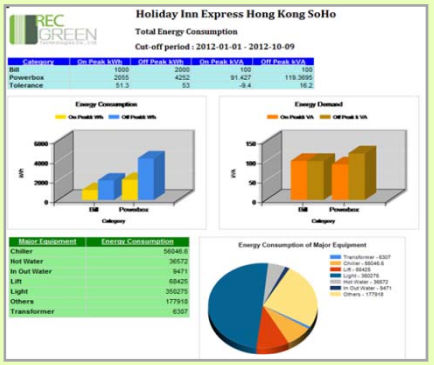
1) PowerBox™
   - Energy data logging and online intelligent software
   - Energy data management and analysis solution
   - Peak Demand Reduction
   - Energy related notification and alarms

2) PowerBox™ Reporter
   - Analysis Report, Energy Distribution, improvement Opportunity Advice and Benchmarking

Power / Energy meter

IPC - Data logging & analysis



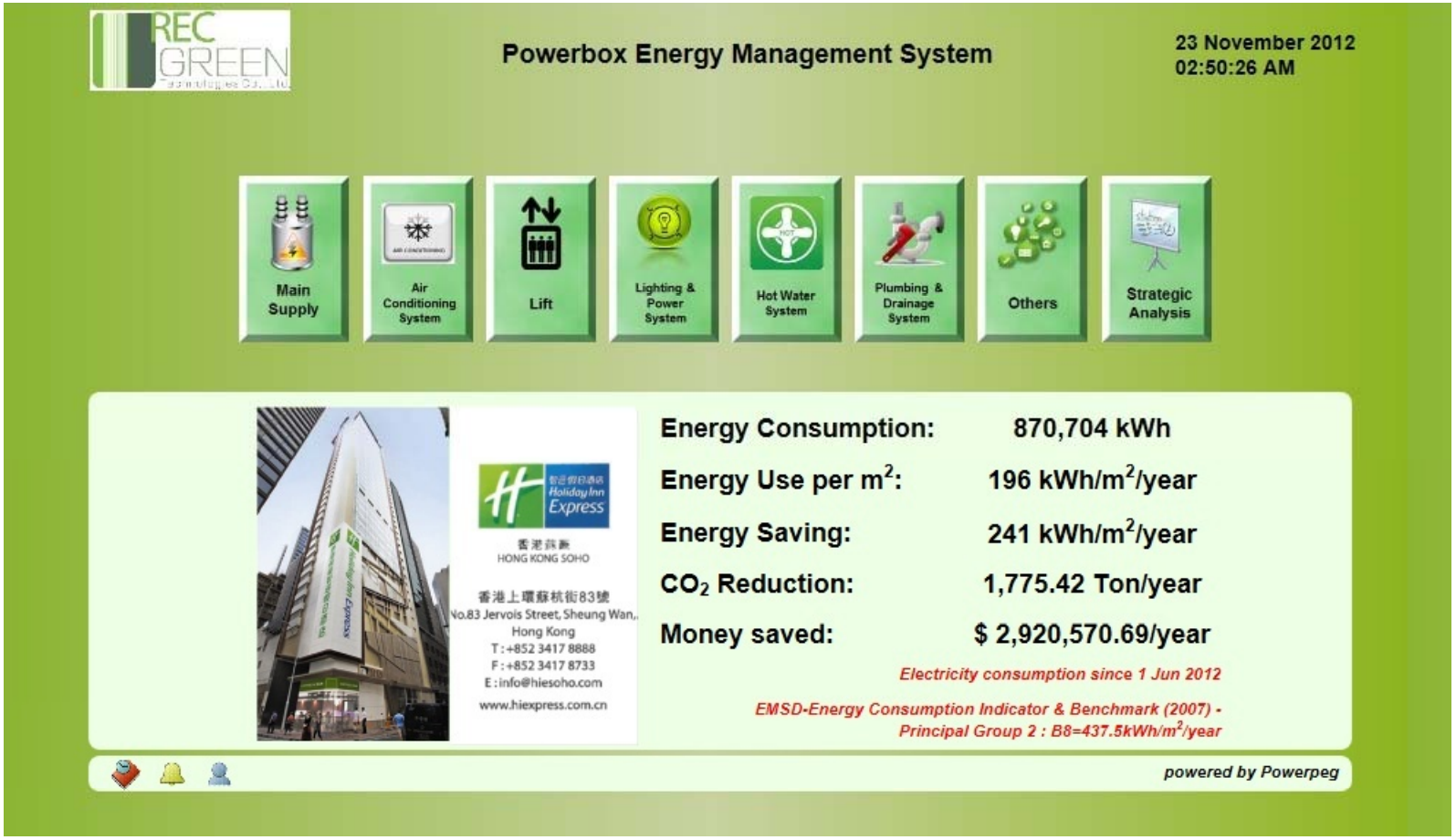


Energy Data Analysis Report

PowerBox™ - Energy Management & Monitoring Solution

PowerBox™ WEB display (Navigation page)

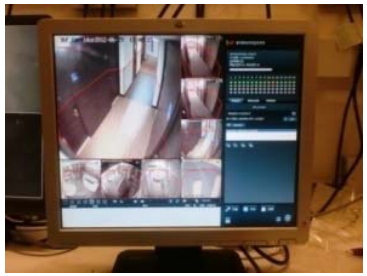
Live Demo



Summary of Green Products involving electronic engineering efforts

Motorized Roller Blind System

Chilled Headboard

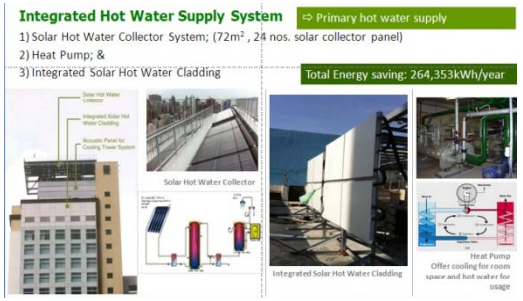


PRESS

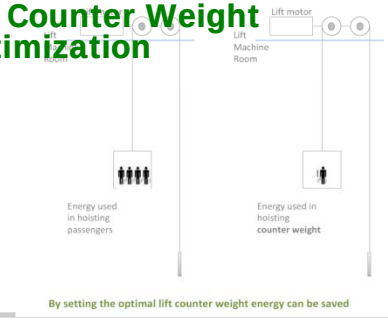
Intelligent Fan Coil Unit

TM

intelligent fan coil unit



Lift Counter Weight Optimization



ENERGY OPTIMIZATION SOLUTION

Variable speed control + sensors,

PowerBox™

MEP & Energy Saving Solutions

有利集團有限公司
Yau Lee Holdings Limited
(Incorporated in Bermuda with limited liability)

盈電工程有限公司
REC Engineering Company Limited
(A wholly-owned subsidiary of Yau Lee Holdings Limited)

1. MEP Project Management
2. MEP contracting Implementation
3. Testing & Commissioning

REC GREEN Technologies Co., Ltd.
A wholly-owned subsidiary of Yau Lee Holdings Limited

1. Energy Enhancement Solution Services
2. Energy Saving HVAC System & Equipments
   - i-FCU™ – Intelligent Fan Coil Unit
   - ECool™ - HVAC System
   - PAU/AHU/Cooling Tower
   - Automatic Water Balancing Valves
   - PRESS – Pattern Recognition Energy Saving Solution & Surveillance Control
3. Green Products
   - BreeZer™
   - Bamako Burner™
   - Solar Heat Reclaimed Panel
   - Peltier Headboard

REC GREEN Energy Solutions Co.,Ltd.

1. PowerBox™ – On-line Intelligent Energy Management Analysis
2. RGE HVAC Energy Optimization Solution
3. Performance Monitoring

REC Engineering Co., Ltd. (“REC”)
REC Green Technologies Co., Ltd. (“RGT”)
REC Green Energy Solutions Co., Ltd. (“RGE”)

Enhancement of Energy Utilization in Building

Thank you

Questions & Answers

Email : rgt@rec-eng.com