Triple Green Implementation
(LEED, BEAM plus and BCA Green Mark)

Experience from Holiday Inn Express Hong Kong SoHo
CASE SHARING:
HOLIDAY INN EXPRESS HONG KONG SOHO

Enhancement of Energy Utilization in Building

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REC Engineering Co., Ltd
REC Green Technologies Co., Ltd.

21 May 2013
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
## Project Profile

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commencement Date of Superstructure</td>
<td>10 September 2010</td>
</tr>
<tr>
<td>Anticipated Completion Date of Construction</td>
<td>15 March 2012</td>
</tr>
</tbody>
</table>
| Project Duration                           | Sub-structure – 180 days (6 mths)  
                                           | Superstructure – 552 days (1.5 year)  
                                           | Licensing – 150 days (4 mths)          |
| Site Area                                  | 612 m² (i.e. 0.0612 hectares)  |
| Construction Contract Sum                  | HK$350M / US$45M               |
| Gross Floor Area                           | 9,163 m²                      |
| 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 Achieved max. points under energy used

3 Star 3-Star System (In process)

- 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: **2,070,381 kWh**
- 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

<table>
<thead>
<tr>
<th>Energy Consumption Benchmark of Hotel</th>
<th>Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong</td>
<td>437.5 kWh/m²/year</td>
</tr>
<tr>
<td>US</td>
<td>401 kWh/m²/year</td>
</tr>
<tr>
<td>Sharp Street East (actual bill)</td>
<td>460 kWh/m²/year</td>
</tr>
<tr>
<td>Jervois Street (Hotel SoHo)</td>
<td>181 kWh/m²/year</td>
</tr>
</tbody>
</table>
Structural Aspect

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. CO₂ 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

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
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

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: 165m² (26.9% of site area)
- Vertical Greening: 126m² (20.6% of site area)

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™ Metal - External Facade
- Starfon™ Glass with Fibre Optics - G/F lobby
- Starfon™ Wood - External Facade
**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

**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

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

<table>
<thead>
<tr>
<th>Glass Type</th>
<th>Lighting transmission</th>
<th>Shading Coefficient</th>
<th>U-Value (W/m²K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGU with Low E Coating &amp; Argon Gas</td>
<td>66%</td>
<td>0.42</td>
<td>1.3</td>
</tr>
<tr>
<td>IGU</td>
<td>78%</td>
<td>0.79</td>
<td>2.7</td>
</tr>
</tbody>
</table>

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 CO₂ sensors to regulate the amount of ventilation air admitted
**Major Sustainable Building Design**  
**Reduction of cooling load**

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**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

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**Control logic**

**System turn-on**
- Lux level: 0; and
- Time: 23:00-7:00

**System turn-off**
- Lux level: >0;
- Time: After 7:00
- Press to adjust a thermostat

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**Bed area temp : Lower 3°C of room temp.**

* Chilled headboard will not affected by desk lamp, TV & corridor lighting
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 on lights & iFCU™ in occupied area

Turning off lights & iFCU™ in unoccupied area
Major Sustainable Building Design
Make use of solar energy & waste heat

**Integrated Hot Water Supply System**

1) Solar Hot Water Collector System; (72m², 24 nos. solar collector panel)
2) Heat Pump; &
3) Integrated Solar Hot Water Cladding

⇒ Primary hot water supply

Total Energy saving: 264,353kWh/year

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

Solar Hot Water Collector
Integrated Solar Hot Water Cladding
Acoustic Panel for Cooling Tower System

REC Green Technologies Co., Ltd.
(A wholly-owned subsidiary of Yau Lee Holdings Limited)
Major Sustainable Building Design
High Efficiency Equipments

High CoP Water Cooled Chiller

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

Energy Saving : 373,846 kWh/year
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.

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

<table>
<thead>
<tr>
<th>Speed</th>
<th>iFCU™ motor (°C)</th>
<th>AC motor (°C)</th>
<th>Diff. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>1.2</td>
<td>26.9</td>
<td>95%</td>
</tr>
<tr>
<td>Middle</td>
<td>2.3</td>
<td>18.1</td>
<td>87%</td>
</tr>
<tr>
<td>High</td>
<td>4.9</td>
<td>11.6</td>
<td>58%</td>
</tr>
</tbody>
</table>

Operating temperature rise of motor
## Major Sustainable Building Design
### High Efficiency Equipments

### Energy Saving Performance

<table>
<thead>
<tr>
<th>Operation Mode</th>
<th>Conventional AC Motor</th>
<th>PM Motor with Intelligent Control Driver</th>
<th>Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>85.0</td>
<td>17.0</td>
<td>68.0</td>
</tr>
<tr>
<td>Med</td>
<td>98.2</td>
<td>33.4</td>
<td>64.8</td>
</tr>
<tr>
<td>High</td>
<td>112.0</td>
<td>67.2</td>
<td>44.8</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Electricity consumption at low speed</th>
<th>Conventional FCU</th>
<th>iFCU™</th>
</tr>
</thead>
<tbody>
<tr>
<td>18hr/d x 365d x 274 fcu x W</td>
<td>84W = 150,585.06kWh</td>
<td>17W = 30,603.06kWh</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electricity consumption at high speed</th>
<th>Conventional FCU</th>
<th>iFCU™</th>
</tr>
</thead>
<tbody>
<tr>
<td>6hr/d x 365d x 274 fcu x W</td>
<td>100.58W = 60,354.03kWh</td>
<td>51.5W = 30,903.09kWh</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual Elect. Bill</th>
<th>HK$274,220.8</th>
<th>HK$79,958.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saving per annum</td>
<td>HK$194,262.8 (71%)</td>
<td>HK$1,500.00 per unit</td>
</tr>
<tr>
<td>Extra Cost per iFCU™</td>
<td>HK$1,500.00</td>
<td>HK$708.99</td>
</tr>
</tbody>
</table>

| Payback Period | HK$1,500.00/HK$708.99 | 2.12 year |

iFCU™
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

or

Original Thermostat

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
- Real-Time ambient environment information
- PowerBox™
- On-line Energy Management & Monitoring Solution
- RGT Building Management System

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 ("EOSTM")

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.

- DDC controlling the speed of cooling tower fan so that the supply condensing water will reach the supply condensing water set point.

- Supply condensing water set point will be calculated according to outdoor air temp. and RH.
- i.e. outdoor air temp ↓ outdoor RH ↓
- Supply condensing water set point ↓
- Cooling Tower Fan Speed ↓

- Main Supply Chilled Water
- Main Return Chilled Water
- Supply Condensing Water
- Condensing Water Temperature Sensor
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 on 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
PowerBox™ WEB display (Navigation page)

Energy Consumption: 870,704 kWh
Energy Use per m²: 196 kWh/m²/year
Energy Saving: 241 kWh/m²/year
CO₂ Reduction: 1,775.42 Ton/year
Money saved: $2,920,570.69/year

Electricity consumption since 1 Jun 2012
EMSD-Energy Consumption Indicator & Benchmark (2007) -
Principal Group 2: B1b-437.5kWh/m²/year

powered by Powerpeq
Summary of Green Products involving electronic engineering efforts

Motorized Roller Blind System

Intelligent Fan Coil Unit

Lift Counter Weight Optimization

Variable speed control + sensors

Chilled Headboard

PRESS

Integrated Hot Water Supply System

PowerBox™

By setting the optimal LW counter weight energy can be saved!
MEP & Energy Saving Solutions

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

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

Yau Lee Holdings Limited
(A wholly-owned subsidiary of Yau Lee Holdings Limited)

Yau Lee Holdings Limited
(Incorporated in Bermuda with limited liability)
Enhancement of Energy Utilization in Building

Thank you

Questions & Answers

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