Sustainability Strategies on Deep Energy Saving and Energy Management of Property Developer

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Swire Properties Limited
Swire Properties develops and manages commercial, retail, hotel and residential properties, with a particular focus on mixed-use developments in prime locations at major mass transportation intersections. Swire Properties investment portfolio in Hong Kong comprises Taikoo Place, Cityplaza and Pacific Place as its core holdings. In addition to Hong Kong, the Company has investments in Mainland China, the United States and Singapore.

We are committed to incorporating environmental sustainability principles and practices throughout our business operations.

Year 2016
Investment Properties: 26.5 Million sq. ft.
[Office, Retail and Hotel]
Revenue: 16,792 Million HK$
Underlying Profit: 7,112 Million HK$
2001 Energy Management Program start

2001-2008: Chiller Control, Delta T Optimization, Waterside differential pressure reset, CHWS Temperature Reset, Supply Air Temperature Reset, Duct Static Pressure Reset

2008 Energy Baseline

2008-2016: 10 years Chiller Replacement Plan, Lighting Replacement, Conversion to Chilled Water Primary Variable Flow, Conversion to VSD AHU

2013 Achieved ISO 50001 Energy Management System

2013-2020: +16.1%

2001-2013: -18.9%
Energy Saving Achievement (Mainland Portfolio)

2010-2016: Lighting retrofit, Conversion to VSD Cooling Tower, Conversion to VSD PAU, System Optimization & Retro-commissioning
Taikoo Place Redevelopment

- Connecting Places
- Liveability
- Natural Ventilation

- Employee Contributions
- Integrated Design Approach
- Partnering on Innovation

- Capitalising on Data Analytics
- Waste to Energy
- Green Technology
- Optimising Resource Efficiency

- Long-term Investment

PLACES
PEOPLE
PARTNERS
PERFORMANCE (ENVIRONMENT)
PERFORMANCE (ECONOMIC)
Closely monitor each service at each building, enable detailed analysis [HVAC air / water-side, lighting, lift, small power]

Over 20 million pieces of data are collected each day

Store building energy data centrally since 2005

Energy Metering System

Extensive Building Operating Data
Sufficient energy meter to record electricity consumption among each system.

Start to install from 2011
Over 2,100 energy meters
Until 2016.

*Inline with BEEO TG-EAC clause 8.5 (AIT1)
Template 1 on Additional Information to Executive Summary of Energy Audit Report
Extensive Building Operating Data (Output)

HK Portfolio (landlord) 2016

Electricity Consumption Breakdown (Site 1)
Yr. 2016
- Site 1: 43.2%
- Site 2: 24.8%
- Site 3: 24.8%
- Site 4: 7.2%

Electricity Consumption Breakdown (Site 2)
Yr. 2016
- 1. AC-Waterside: 57%
- 2. AC-Airside: 13%
- 3. Lighting and Small Power: 15%
- 4. Lift and Escalator: 10%
- 5. Others: 4%

Electricity Consumption Breakdown (Site 3)
Yr. 2016
- 1. AC-Waterside: 52%
- 2. AC-Airside: 19%
- 3. Lighting and Small Power: 15%
- 4. Lift and Escalator: 10%
- 5. Others: 4%

Electricity Consumption Breakdown (Site 4)
Yr. 2016
- 1. AC-Waterside: 57%
- 2. AC-Airside: 19%
- 3. Lighting and Small Power: 13%
- 4. Lift and Escalator: 5%
- 5. Others: 6%
Knowledge-based Energy Management Opportunities (EMO)

HVAC Water Side
- Variable Speed Control for Pumps
- High Efficiency Chillers Replacement
- Optimised Chiller Plant Control
- Chilled Water Primary Variable Flow

HVAC Air Side
- Variable Speed Control for Fans
- Duct Static Pressure Reset
- VAV Fault Detection and Diagnosis
- Supply Air Temp. Reset

Lighting
- Time Schedule for Lightings
- High Efficiency Lightings Replacement
- Daylight / Occupancy Control

Knowledge-based Energy Management Starting From 2001

Retrofit

Retro-commissioning

2016
Retro-commissioning (RCx) is a systematic process to periodically check an existing building’s performance to identify operational improvements that can save energy and thus lower energy bills and improve indoor environment. (Source: Technical Guidelines on Retro-commissioning – EMSD)
Case Study
Case 1: Chiller Plant Replacement Work (Retrofits)

Key Benefits

- **Deep power saving** for chiller system from COP 4.7 (Existing Chillers) to COP 6.5 (New Chillers), more than 25% improvement.
Case 1: Chiller Plant Replacement Work (Retrofits)

Energy Data Analysis after chiller replacement work

**Observation:**
2S chiller require more electricity consumption than 1B

**Action:**
Logic Control strategies for chillers operation need to be revised.

### Building Load (kW) Comparison

<table>
<thead>
<tr>
<th>Building Load (kW)</th>
<th>Comparison</th>
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</thead>
<tbody>
<tr>
<td>2,000-2,200</td>
<td>1B Chiller COP &gt; 2S Chiller COP</td>
</tr>
<tr>
<td>4,000-4,600</td>
<td>2B Chiller COP &gt; 1B + 2S Chiller COP</td>
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2S chiller require more electricity consumption than 1B

**Logic Control strategies for chillers operation need to be revised.**
Case 2: Optimised Chiller Plant Control (Retro-commissioning)

**Objective:**
Operating chillers capacity tie-in with cooling demand.

**Data Analysis:**
- Terminal flow demand
- Excessive deficit flow
- Third chiller operation
- Gap Between cooling load and chiller capacity from collected data

**Enhancement:**
- Instead of switch on third Chiller, switch on one more primary pump

**Benefits:**
- No deficit flow
- Delay 2 hours later switch on the third chiller
- Saving 847kWh per day
Case 3: Electronically Commutated (EC) Motor Plug Fan for AHU Retrofits

This fan technology is a backward curved centrifugal impeller directly mounted on a brushless direct current (DC) motor. Its variable speed control can be achieved by varying the DC voltage delivered to the fan.

Key Benefits

- **Deep power saving** for air-side system
- **Reduce maintenance**
  - Reduce tear and wear parts such as belt, bearing
- **Optimize system operation**
  - DC rotation speed control technology can maintain high efficiency from the rotation speed of 10% to 100%.

Pilot study shows proven 40% fan energy saving annually
Experience Sharing with the Industry

Joint Research Centre for Building Energy Efficiency and SD with Tsinghua University
• as testing pilot site
• Experiences sharing with industry via book publication and seminar

• Published technical research papers regularly in Hong Kong and overseas conferences.
Engaging Stakeholders (Tenant)

Tenant Engagement

• First shopping mall in supporting the HKGBC Green Shop Alliance in 2015
• Green Pledge for office tenants
• Provide free energy audits for office tenants since 2008
• Facilitate green building certificate application for tenants
• Provide preliminary energy check on M&E design for tenants
Concluding Remark

Data

Power Metering

BMS operating data

Knowledge

Energy Saving

64 Millions kWh

Tenant Engagement Programme

Joint Research

Integrated Design

Promoting Green Building Industry

Concluding Remark
SD2030 Strategy

Creative Transformation

Innovation and Experimentation

Communication and Engagement

Performance (Economic)

People

Places

Partners

Performance (Environment)

**PERFORMANCE**

**FOCUS AREAS**

**PERFORMANCE CATEGORIES**

**2020 KPI**

### Energy

- **Energy Reduction**
  - Hong Kong: Achieve 26% annual energy reduction, which is equivalent to energy reduction of 64 million kWh/year. Achieve 29% energy intensity reduction (kWh/m²/year).
  - Conduct energy audits for investment portfolios every five years (which is more frequent than the statutory requirement of once every 10 years).

- **Mainland China**
  - Reduce annual energy consumption by 23 million kWh/year.

- **Renewable Energy**
  - Formulate a strategy to increase the use of renewable energy where possible, by on-site generation, purchase from renewable sources and other methods.

- **Intelligent Energy & Facility Management System**
  - Implement pilot energy management automation projects in four selected properties (two in Hong Kong, two in Mainland China).
  - Adopt facility management electronic databases in all investment portfolios.