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

SWIRE PROPERTIES

By Dr. Raymond Yau,
General Manager, Technical Services and Sustainable Development
Swire Properties Limited

HONG KONG WORLDSBE 2017
WORLD Sustainable Built Environment Conference
Organisers:
CONSTRUCTION INDUSTRY COUNCIL 建造業議會
HKGBC 香港綠色建築議會
SBE SERIES
International Co-owners:
cib
iiSBE
UNEP Sustainable Buildings and Climate Initiative
FIDIC
Global Alliance for Buildings and Construction

Our Company

Mainland China

Hong Kong

Singapore

United States

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: [Office, Retail and Hotel]	26.5 Million sq. ft.
Revenue:	16,792 Million HK$
Underlying Profit:	7,112 Million HK$

SWIRE PROPERTIES

Dow Jones Sustainability Indices

Hang Seng Corporate Sustainability Index Series Member 2016-2017

FTSE4Good

SUSTAINABILITY RANKING

MSCI 2016 Constituent MSCI Global Sustainability Indexes

caringcompany

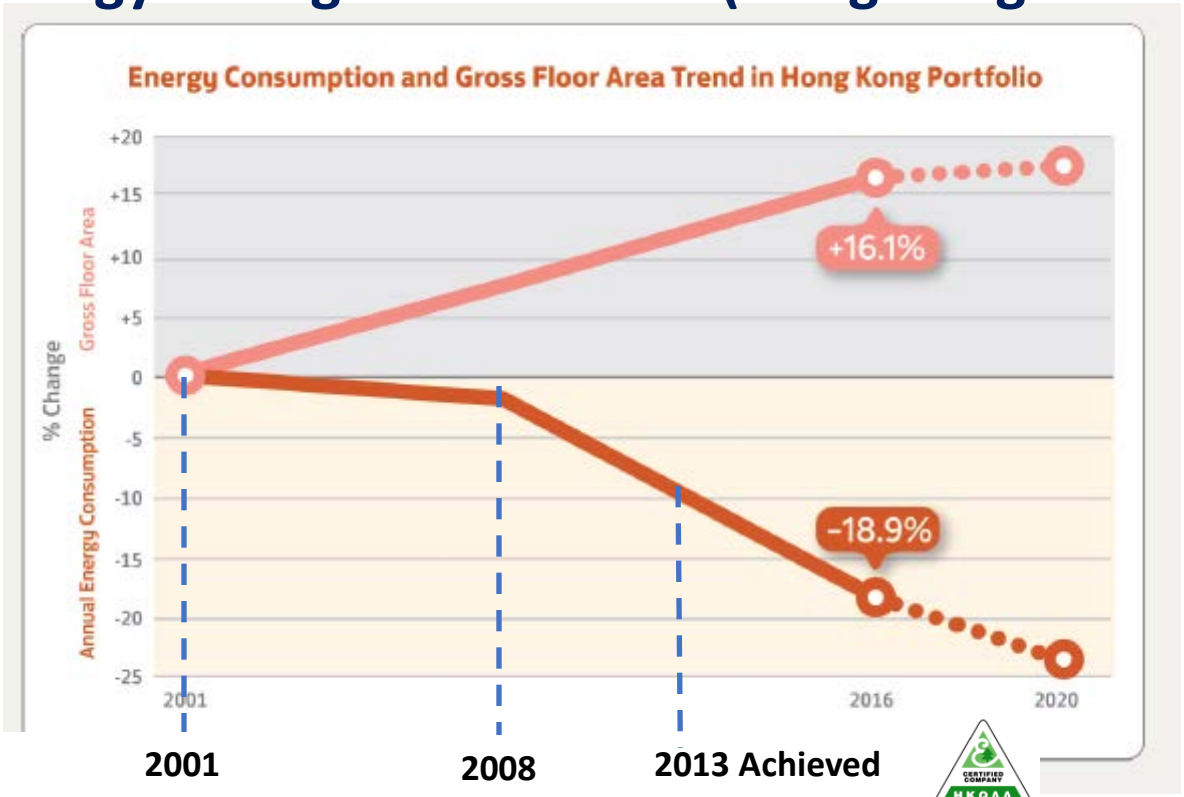
WINNER

WORLD SB 2017 HONG KONG

WORLD Sustainable Built Environment Conference

SWIRE PROPERTIES

Energy Saving Achievement (Hong Kong Portfolio)



2001 Energy Management Program start

2008 Energy Baseline

2013 Achieved ISO 50001 Energy Management System

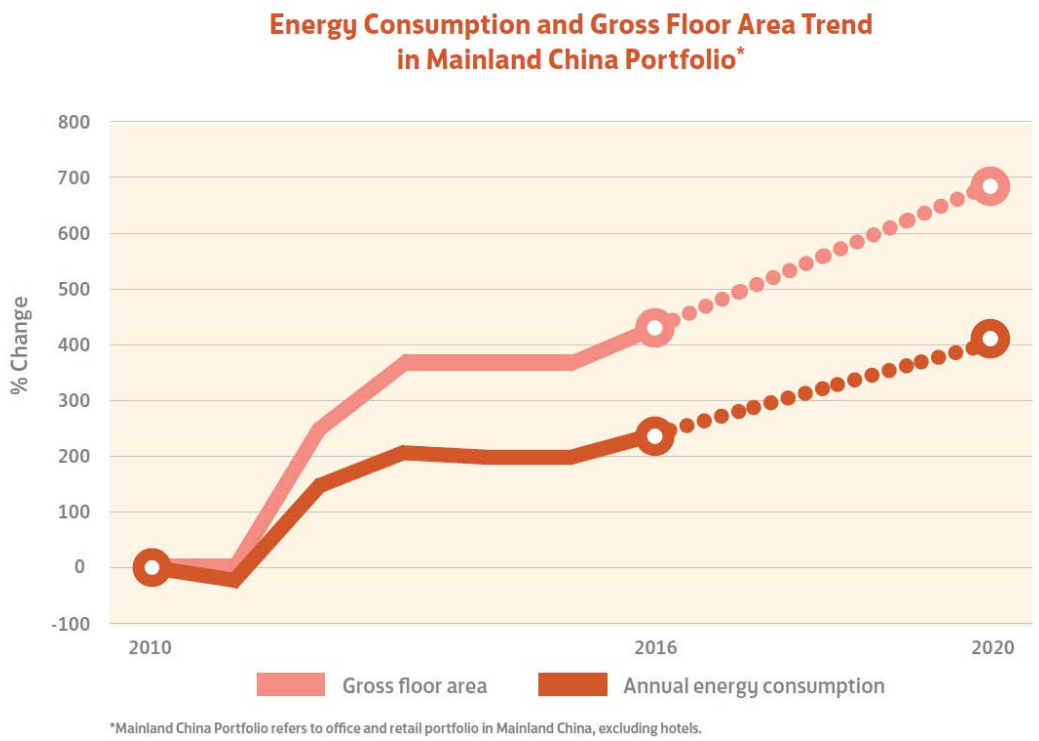
ISO 50001 : 2011
Certificate No.: CC 5760

2001-2008:	Chiller Control, Delta T Optimization, Waterside differential pressure reset, CHWS Temperature Reset, Supply Air Temperature Reset, Duct Static Pressure Reset
2008-2016:	10 years Chiller Replacement Plan, Lighting Replacement, Conversion to Chilled Water Primary Variable Flow, Conversion to VSD AHU

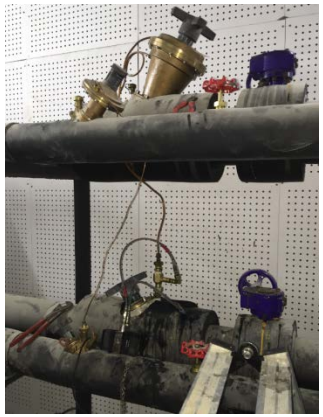
WORLD Sustainable Built Environment Conference 2017 HONG KONG

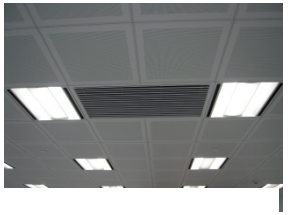
SWIRE PROPERTIES

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

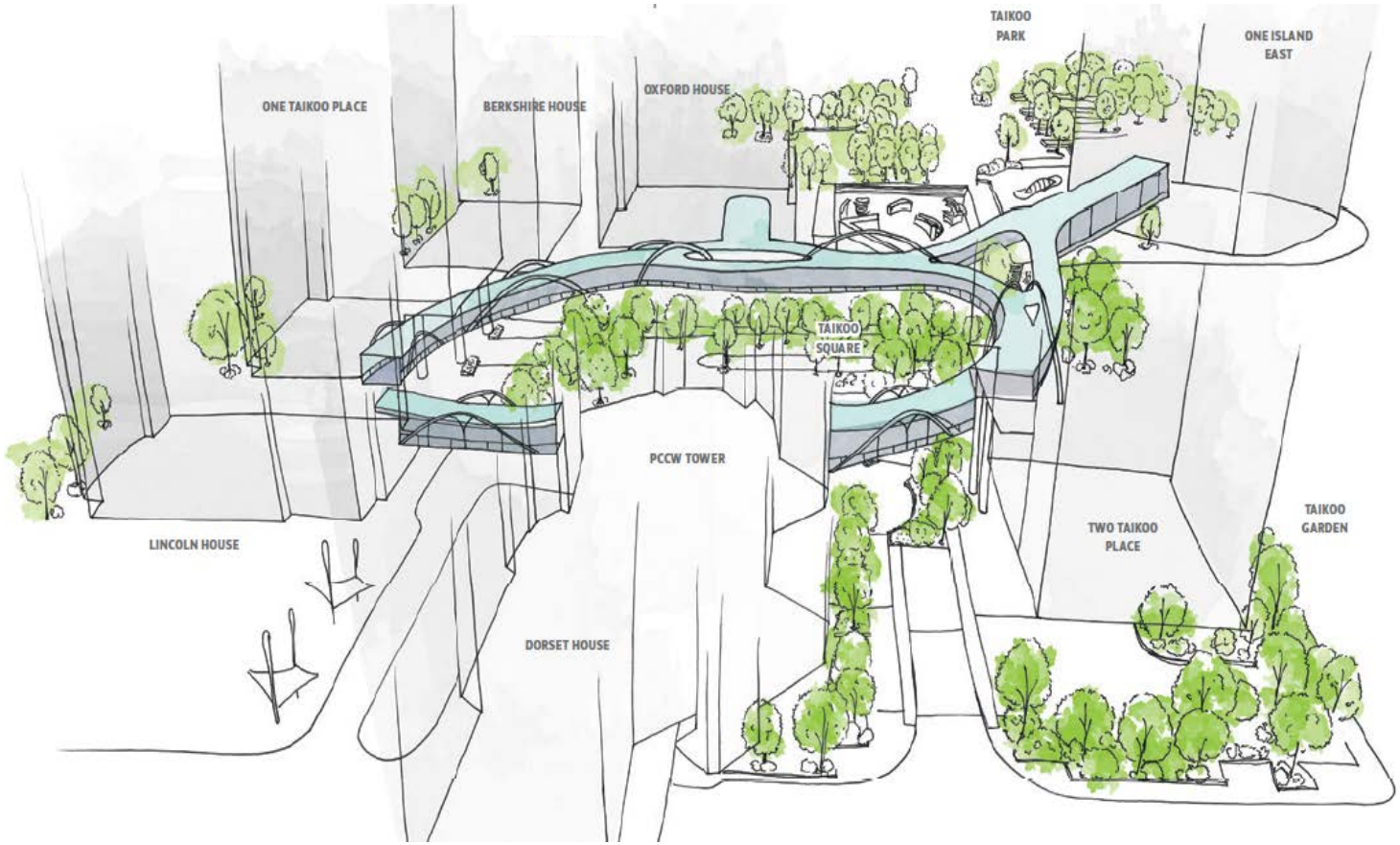
PLACES
- Connecting Places
- Liveability
- Natural Ventilation

PEOPLE
- Employee Contributions

PARTNERS
- Integrated Design Approach
- Partnering on Innovation

PERFORMANCE (ENVIRONMENT)
- Capitalising on Data Analytics
- Waste to Energy
- Green Technology
- Optimising Resource Efficiency

PERFORMANCE (ECONOMIC)
- Long-term Investment



Energy Management Program

Knowledge-Base Energy Management

Building Operation Data → System Optimization Energy Saving

Feedback to Design

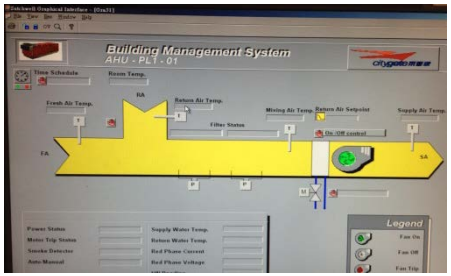
In-depth Research

BMS

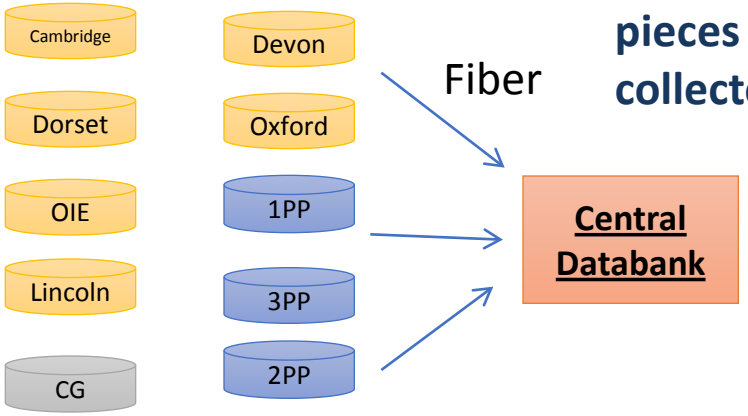
- Application
  - EMO Identification
    - **Retrofits**
    - **Retro-commissioning**
- Knowledge
  - Equipment/System Characteristics
  - Correlation between data
  - [e.g. COP vs %load/condensing temperature, energy vs outdoor temperature]
- Information
  - Function/Fault
  - Performance (KPI)
- Data
  - Temperature/Pressure/Flow
  - Energy/Water use
  - On/Off, %load
- Instrument
  - Sensors
  - Meters
  - Controllers

Building Operation Data

Extensive Building Operating Data



BMS SQL Server



Over 20 million pieces of data are collected each day

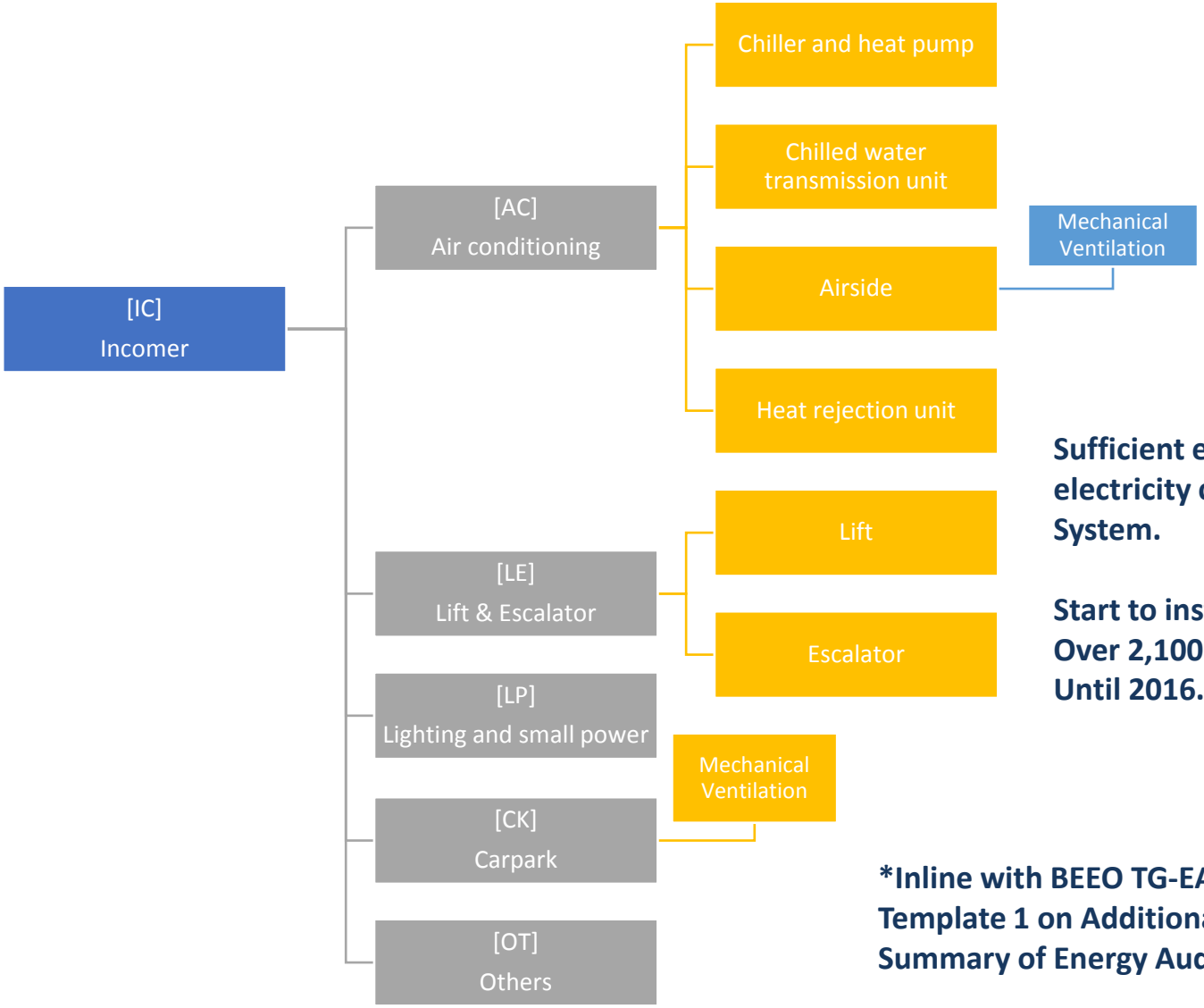
Energy Metering System

Closely monitor each service at each building, enable detailed analysis

[HVAC air / water-side, lighting, lift, small power]

Store building energy data centrally since 2005

Extensive Building Operating Data (Energy Metering Strategy)

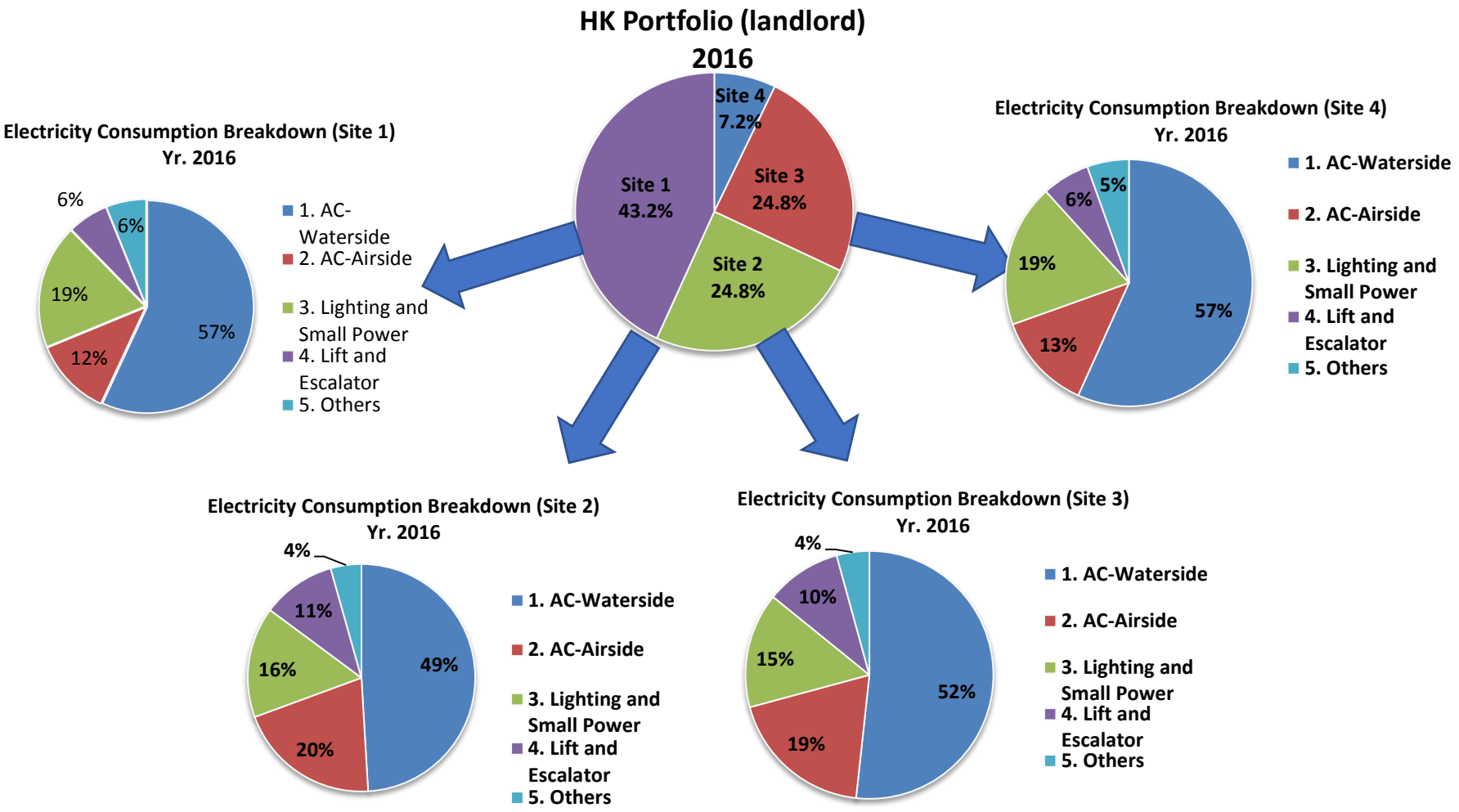


Sufficient energy meter to record electricity consumption among each System.

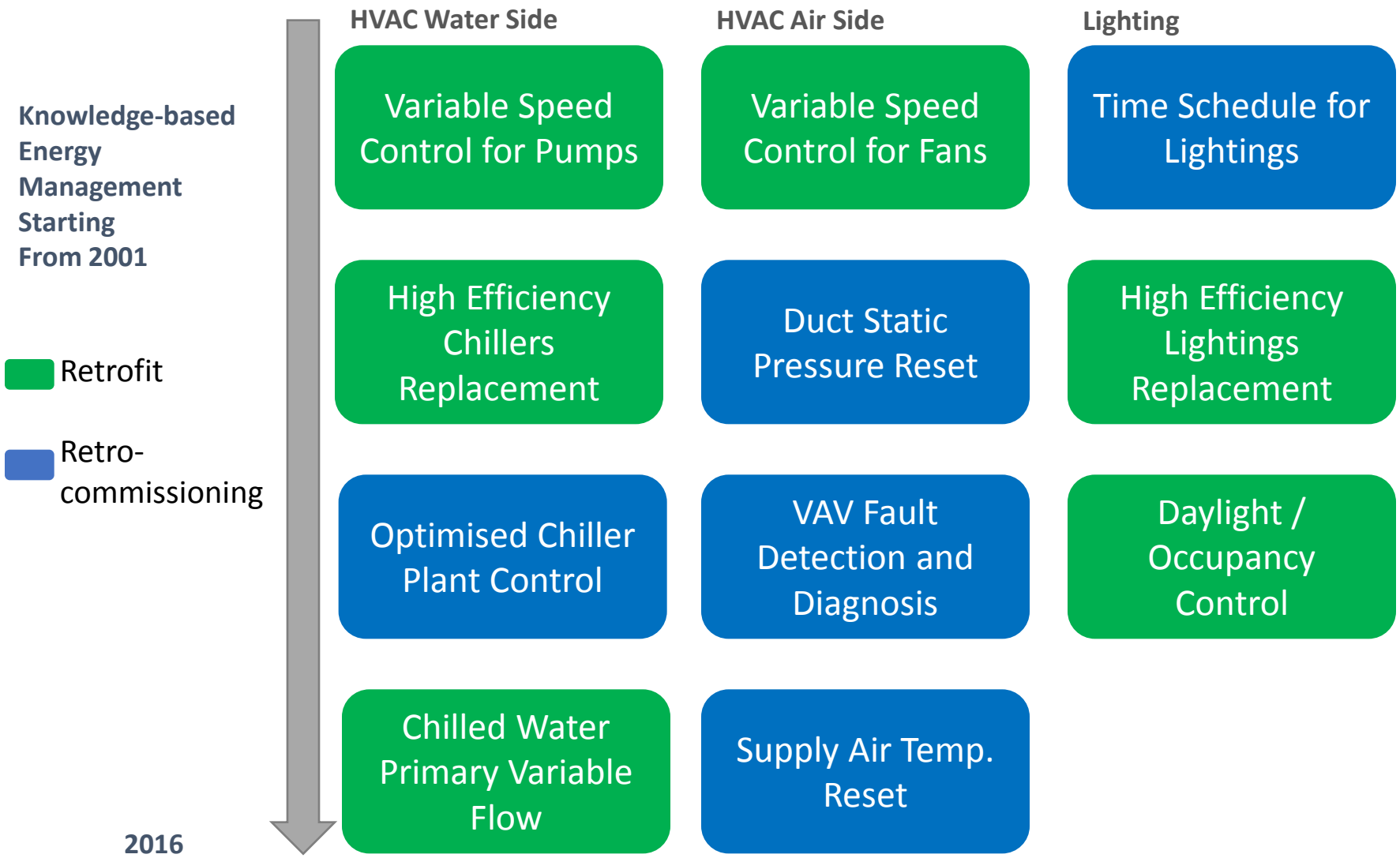
Start to install from 2011
Over 2,100 energy meters
Until 2016.

***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)

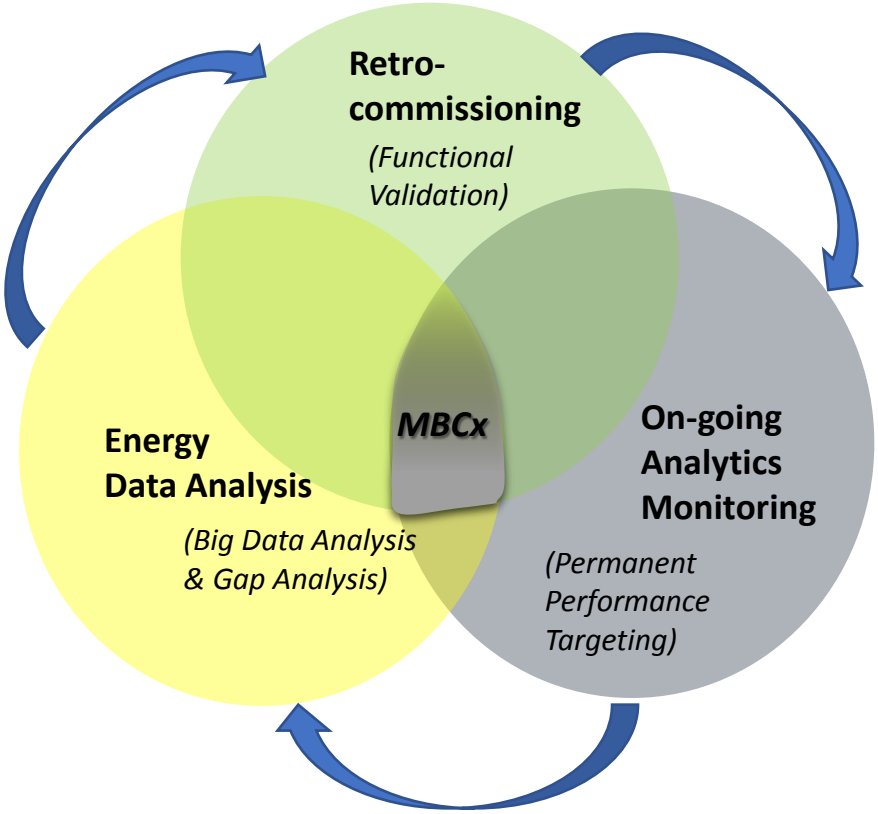


Knowledge-based Energy Management Opportunities (EMO)



Retro-commissioning (RCx)

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)

Chiller Before Replacement

Replacement Work in Progress

Chiller Replacement Completed

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

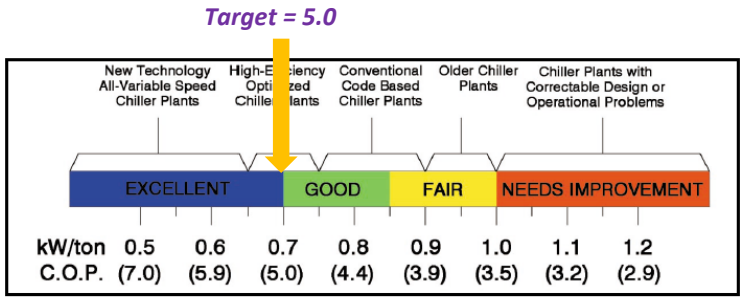
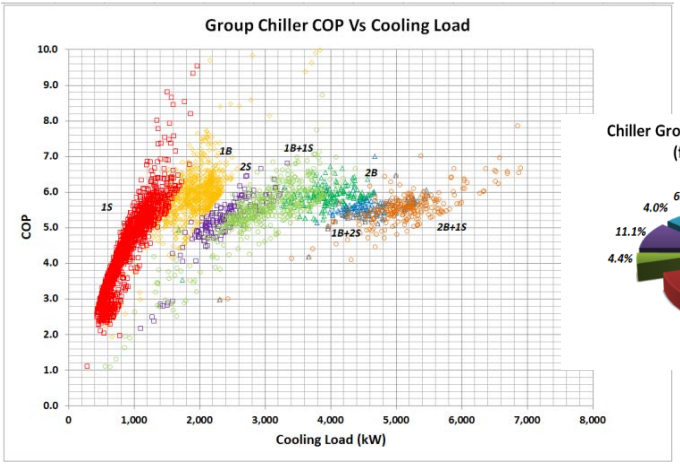


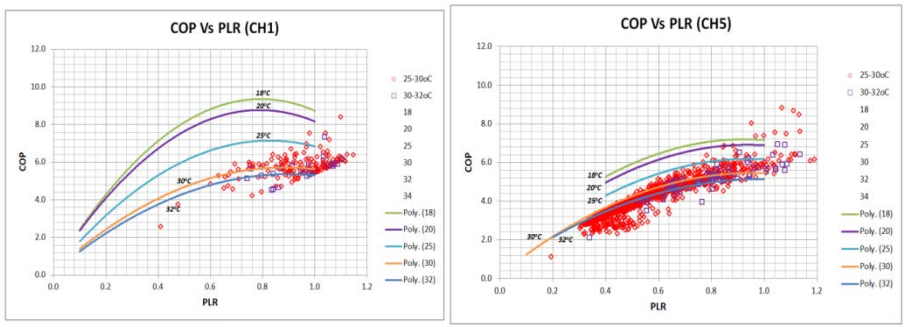
Figure 5: Average annual chiller plant efficiency in kW/ton (COP). Input energy includes chillers, condenser pumps and tower fans, based on electrically driven centrifugal chiller plants in comfort conditioning applications with 42°F (5.6°C) nominal chilled water supply temperature and open cooling towers sized for 85°F (29.4°C) maximum entering condenser water temperature. Local climate adjustment for North America climates is ±0.05 kW/ton.

Source from: Hartman, T.B. 2001. "All-Variable Speed Centrifugal Chiller Plants" ASHRAE Journal.

Chiller Group COP Coefficient of Performance



Part Load Coefficient of Performance (COP)



Observation:

Building Load (kW)	Comparison
2,000-2,200	1B Chiller COP > 2S Chiller COP
4,000-4,600	2B Chiller COP > 1B + 2S Chiller COP

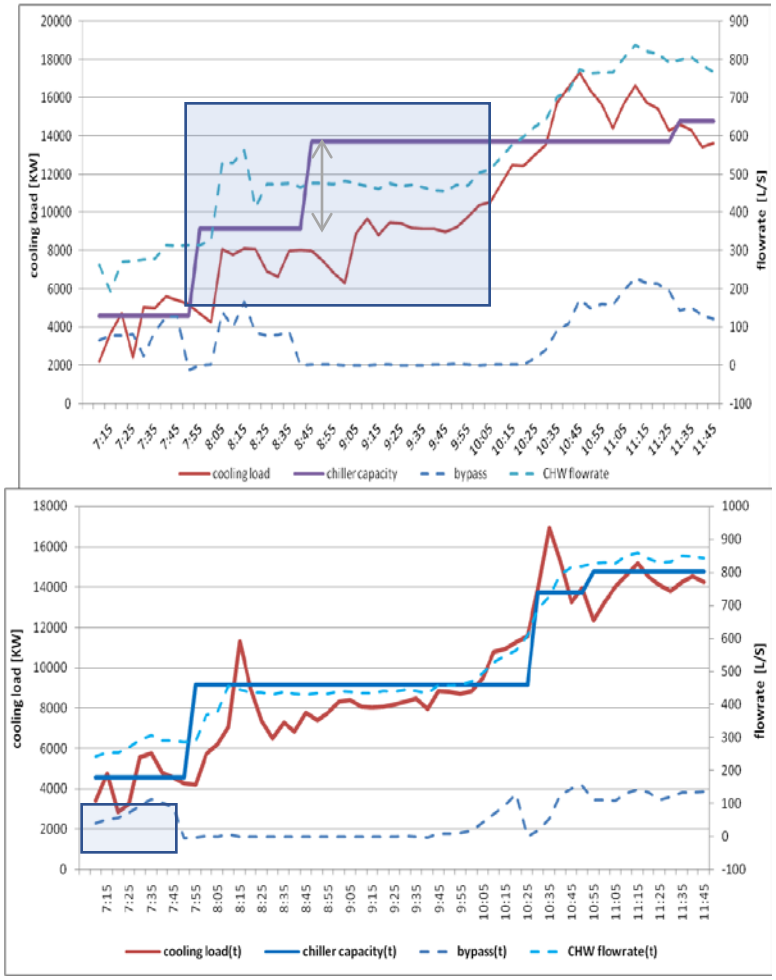
2S chiller require more electricity consumption than 1B

Action:

Logic Control strategies for chillers operation need to be revised.

Case 2: Optimised Chiller Plant Control (Retro-commissioning)

Cooling Load Profile



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**

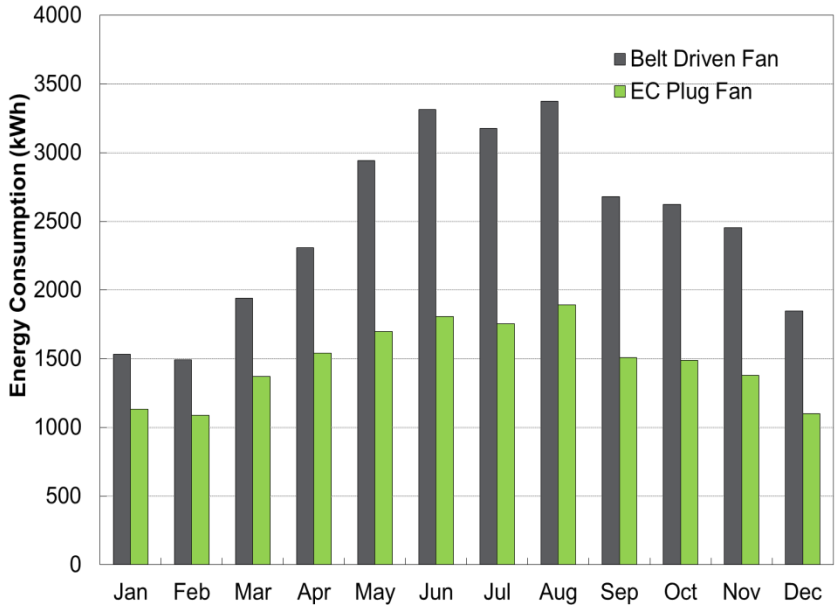
Case 3: Electronically Commutated (EC) Motor Plug Fan for AHU Retrofits

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.

Pilot study shows proven 40% fan energy saving annually

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%.



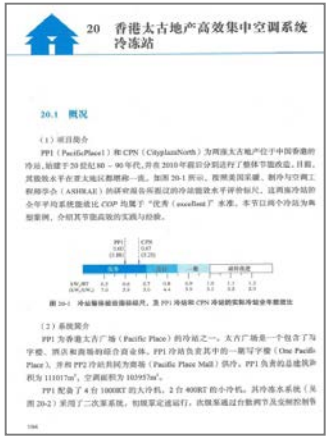
Experience Sharing with the Industry

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 in 2015

2014 Annual Report on China Building Energy Efficiency



2015 Best Practice for China's Building Energy Conservation

- Published technical research papers regularly in Hong Kong and overseas conferences.

Engaging Stakeholders (Tenant)

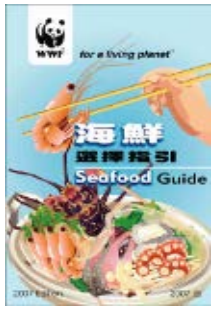
Tenant Engagement

- 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

Green Shop Alliance


Energy Audit for Tenant


SD F&B Forum



Green Menu

Foodlink
Replacing hunger with a smile
除飢困 展歡容
膳心連

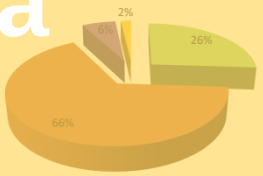
FOOD ANGEL
惜食堂
by Bo Charity Foundation

WORLD 2017
WORLD Sustainable Built Environment Conference

SWIRE PROPERTIES

Concluding Remark

Data



Power

Metering

BMS

operating data

Knowledge

Energy

Saving

64 Millions kWh

Tenant

Engagement

Programme

Joint

Research

Integrated

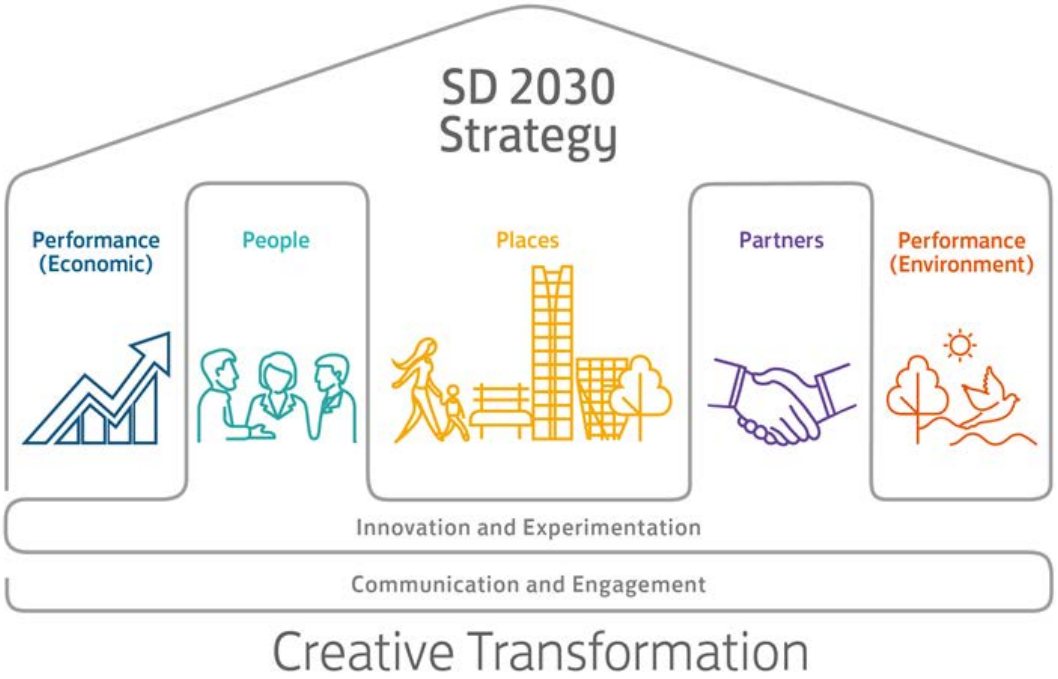
Design

Promoting

Green Building

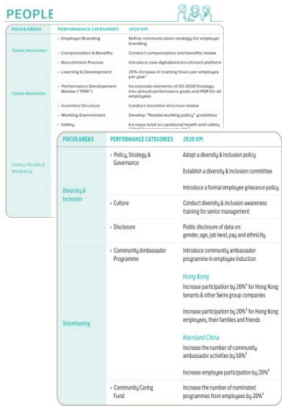
Industry

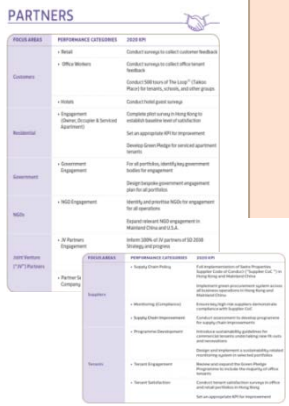
SD2030 Strategy



PERFORMANCE (ENVIRONMENT)

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 [14, 15] Achieve 29% energy intensity[16] reduction (kWh / m^2/year)[17] 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[18]
	• 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





SWIRE PROPERTIES

THank you!