APCBC presentation in ICEBO
(*Asia Pacific Conference on Building Commissioning*)
Sept. 2014, Beijing, China

14th SHASEJ Special award ‘DECADE AWARD’
(Society of Heating, Air-Conditioning and Sanitary Engineers of Japan)

Continuous Commissioning Performance of Panasonic Tokyo-Shiodome Building

Presented by Jeffrey Zhang (Nikken Sekkei)

Planning/Operating
Design/Verification
HVAC Construction/Verification
Automation Construction/Verification
Maintenance/Management

Panasonic Echo Solutions
Nikken Sekkei
Takasago Industry
Panasonic ES Engineering
Panasonic ES Facility
Management
INTRODUCTION
Introduction

- Corporation Headquarter
  - Completed at Jan 31st 2003
  - Underground 4F, Up-ground 24F
  - Total area 47,275sqm

- Concept
  - ‘Show room for the whole building’
  - ‘Lighting fixture for the whole building’
  - ‘Energy saving for the whole building’
Advanced HVAC System

VAV System

Low-E Glass

Natural Ventilation To Toilet EA Tower

Air Flow Window

Floor Diffuser System

Fanless Diffusers

AHU: 4Pipes, Airside economizer, VAV, VWV, Calorie meter(all AHUs)

EAST

WEST

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FOOTPRINT IN THE PAST DECADE
Infrastructure construction for energy saving after construction

- **HARDWARE**: Construction of ‘visible’ system
  - Measuring point: 15,000 points
  - Detailed power measurement
  - Calorie meter for all AHUs
  - Data collecting & Analyzing software: SatTool

- **SOFTWARE**: Construction of promoting organization

  - Optimal operation
  - Trouble solving
  - Data analysis & study
  - Favorite registering
  - Aim setting
  - Budget
  - Confirmation of solutions

- **OPERATOR**
- **DESIGNER**
- **CONSTRUCTOR**
- **OWNER**
- **FAVORITE**
One diagram including all equipment, setting points, etc
Daily & weekly report graphs including outdoor air condition, chilled water temperature and other operating data.
Collection of operating methods

- Operation description and evaluation standards for optimal operation
Early Performance Verification

- Performance verification for automation
  - Airflow window
  - VAV, VWV
  - Air side economizer
  - Day lighting intake
  - Lighting control by human sensor

- Verification of annual energy consumption

Additional temporary measurement for confirmation
Tuning 1: Stabilization period

- 4 Viewpoints
  1. Basic on design purpose
  2. Improving sensors and automation
  3. Adjustment into more rationalized operation
  4. Advanced tuning for equipment

Energy saving special committee (organized once per month)
Main Tuning Items

Detailed items of different categories and sub categories

- Load reduction
  - Temperature
    - Setting point for canteen temperature (3)
  - Outdoor air amount
  - Mixing loss
- Machine operation efficiency
  - Automation
    - Position of sensor for heat exchanger control (2)
    - Parameter of several AHUs (4)
- Reduction of delivering power
  - Pumps
  - Fans
- Operational optimization
  - Operation management
  - Maintenance
  - Ventilation equipment
    - Air flow control of Outdoor AHU of kitchen (1)
  - Architectural
Air Flow Control of OAHU of Kitchen

- Viewpoint 1. Basic on design purpose

**BEFORE**

- Fan maximum operation all the time

**AFTER**

- Variable air flow
- Variable chilled flow

- Air side economizer

- SA: 20°C

By improving operating method according to design purpose, air flow is controlled variably and air side economizer is applied at proper season. As a result, power consumption and processing load is reduced significantly.
Viewpoint 2. Improving sensors and automation

Chilled water supply temperature appeared unstably during night time of low load. After adjustment of the position of sensor for heat exchanger control, water flow become stable throughout the whole day.
Tuning 2: Challenging energy saving 50%

- Aggressive introducing new energy saving technology and materials by Panasonic group
- ZEB promotion of Japan: 50% energy cut for exist
- Electricity peak cut under power company’s request

![Adjusted daily AC consumption curve](chart)

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Lighting for Peak Cut

- Reduce setting illumination intensity

- Achieve maximum 48kwh/hour, 540kwh/day power reduction
AC Operation for Peak Cut

- Adjust operating time

Office hourly HVAC power

OA temperature

- Pre-operate HVAC 1 hour early
RESULTS
Annual Primary Energy Reduction

Contracted: 2,300kw

2003: 2,300kw
2006: 1,955kw 15% cut
2010: 1,507kw 37% cut
2011: 1,292kw 46% cut
2006: 1,250kw 47.7% cut
2018: 1,196kw 50% cut

2006 Economic and Industrial Minister Award
2010 Tokyo Top Level Certification
2010 Energy Saving Promotion Model Certification by Environment Ministry

MJ/m2/year

2,000
1,000
0

2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2018

Contracted: 1,350kw 41.3% cut
Water Consumption: 45,000 -> 32,000m³/year

![Water Consumption Chart]

- Raw water consumption
- Recycled water consumption

-27.8% decrease over the years.
Peak Power: 28.4 W/m²

- Maximum power
- Contracted power

Contracted power is -41.3% lower than maximum power over the years 2003 to 2012.
CO2 Emission: 54.9kg-CO2/m²/year

- Tenant bldg. of major real estate company
- Normal office bldg.

Average of Tenant bldg. of major real estate company
- 100kg-CO2/m²/year (2,300MJ/m²/year)

Normal office bldg. (including data center)
- 124kg-CO2/m²/year (2,850MJ/m²/year)

CO2 unit: 0.425kg-CO2/kWh
Primary energy unit: 9.76MJ/kWh
THANK YOU!

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