ACT-Shop - A Retro-commissioning Scheme for Existing Buildings in Hong Kong

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Content

• Background
• Progress and findings of ACT-Shop
• Way forward
Background

A target to meet by 2030

26-36% absolute carbon emission reduction
Current Practice of the Industry

Knowledge-Based Practice

- Continuous Improvement
- Work with stakeholders
- Knowledge transfer
- Optimisation
- Retro-Cx
- Metering

Adopt Best Practice

- Lift Modernisation
- Advanced Control
- Air-cool to Water-cool
- Early Replacement
- Chiller
- Lighting
- O&M Manual
- Mandatory Audit
- Routine Inspection
- Routine Maintenance
- Housekeeping

Maintenance Requirement

- Basic Need
- Run to Life

Background

Organisers:

International Co-owners:
Background

Summary of Government Initiatives

Government building stock

- Set saving target and timeline
- Energy audits; carry out EMOs, including retrofits
- Pilot retro-commissioning projects
- Do green procurement
- Out-perform BEC for new buildings
- Showcase compliance for Green Building (BEAM Plus)
A mission to drive Retro - Commissioning to private buildings
What is Retro-commissioning?

- A cost-effective systematic process to periodically check an existing building’s performance
- The process identifies operational improvements that can effectively save energy and thus lower energy bill

Source: Technical Guidelines on Retro-commissioning (Draft) - Electrical and Mechanical Services Department, Hong Kong 2017.
What is ACT-Shop?

- Knowledge-based
- Buildings as living laboratories
- HKGBC as facilitator
- Learning from peers
- Building up in-house competence
Knowledge based approach

Analysis

Theories

Experience

Decision & Action
Knowledge based approach

How good? How bad?

1. Daily Profile from Logsheet / BMS

2. Plotting parameters against demand and weather condition

3. Draw Design Curve & Customisation Curve

4. Identify “Good” and “Poor” Area
Establish a Knowledge Sharing Platform

Building Operator
- Government
- Private Sector

Services Provider

Industry
- HKIE
- BSOMES
- ASHRAE
- RICS...

Education
- VTC/IVE
- Universities

- Detailed databank
- Develop competence within the industry
- Standardise energy analysing method / format
- Raise next energy audit standard
- Robust benchmarking system

Organisers:

International Co-owners:
Objectives of ACT-Shop

• Actively supporting HK gov’s Climate Ready@HK
• Building up the competence for the industry on retro-commissioning through
  • developing the data/knowledge base
  • developing a systematic approach for retro-commissioning
  • demonstrating the value of retro-commissioning
  • transferring the knowledge and skills to the industry
  • establishing a practical operation & management system
• Promoting the adoption of best practices to the industry
Progress and finding of ACT-Shop
## Different types of building, system design, age,

<table>
<thead>
<tr>
<th></th>
<th>Bldg A</th>
<th>Bldg B</th>
<th>Bldg C</th>
<th>Bldg D</th>
<th>Bldg E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Composite</td>
<td>Hotel</td>
<td>Composite (Podium+Towers)</td>
<td>Composite (Office +Education)</td>
<td>Office (Industrial Building Renovation)</td>
</tr>
<tr>
<td>Age (Yrs)</td>
<td>25</td>
<td>41</td>
<td>24</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>IFA (sqm)</td>
<td>~20,000</td>
<td>~36,000</td>
<td>~150,000</td>
<td>~4,500</td>
<td>~45,000</td>
</tr>
<tr>
<td>Chiller</td>
<td>4x320TR Water-Cooled (new)</td>
<td>4x180TR Water-cooled 4x190TR Air-cooled (new)</td>
<td>7x1000TR Water-cooled 2x400TR Air-cooled(Night)</td>
<td>1x150TR Air-cooled 1x150TR Air-cooled (new)</td>
<td>4x400TR Air-cooled</td>
</tr>
<tr>
<td>Cooling Tower</td>
<td>4</td>
<td>4</td>
<td>6+2</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Control</td>
<td>Differential Pressure Bypass</td>
<td>Differential Pressure Bypass</td>
<td>Differential Pressure Bypass</td>
<td>Differential Pressure Bypass</td>
<td>Differential Pressure Bypass</td>
</tr>
<tr>
<td>Pumps</td>
<td>4+1</td>
<td>Water-cooled: 4 Air-cooled: 4+1</td>
<td>7+2 4+2 (Office Tower)</td>
<td>2+1</td>
<td>4+1</td>
</tr>
<tr>
<td>Features</td>
<td>Variable Speed Chiller</td>
<td>140TR Heat Pump for hot water</td>
<td>Heat Exchanger for high rise office tower</td>
<td>natural ventilation allowed</td>
<td>Fresh air treated by FCU</td>
</tr>
</tbody>
</table>
Availability of data/information is limited
## First Batch - Saving Summary

<table>
<thead>
<tr>
<th>Suggested Re-tuning Work</th>
<th>Bldg A</th>
<th>Bldg B</th>
<th>Bldg C</th>
<th>Bldg D</th>
<th>Bldg E</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal Floor Area (m²)</strong></td>
<td>36,218</td>
<td>4,485</td>
<td>150,000</td>
<td>45,000</td>
<td>20,349</td>
</tr>
<tr>
<td><strong>Chillers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change chiller sequencing to achieve higher overall COP</td>
<td>5-6%</td>
<td>&lt;1 year</td>
<td>3-5%</td>
<td>&lt;1 year</td>
<td>3-5%</td>
</tr>
<tr>
<td>Increase chilled water supply temperature</td>
<td>1-3%</td>
<td>&lt;1 year</td>
<td>1-3%</td>
<td>&lt;1 year</td>
<td>1-3%</td>
</tr>
<tr>
<td>Max. demand shedding</td>
<td>0-1%</td>
<td>&lt;1 year</td>
<td>0-1%</td>
<td>&lt;1 year</td>
<td>0-1%</td>
</tr>
<tr>
<td><strong>Pumps (chilled water flow)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase bypass valve differential pressure setting</td>
<td>1-3%</td>
<td>&lt;1 year</td>
<td>1-3%</td>
<td>&lt;1 year</td>
<td>1-3%</td>
</tr>
<tr>
<td>Reduce system differential pressure setting</td>
<td>1-3%</td>
<td>&lt;1 year</td>
<td>3-5%</td>
<td>&lt;1 year</td>
<td>3-5%</td>
</tr>
<tr>
<td>Install VSD on the existing chilled water pumps</td>
<td>N/A</td>
<td>3-5%</td>
<td>3-5%</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td><strong>Cooling towers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling tower optimization</td>
<td>N/A</td>
<td>N/A</td>
<td>1-3%</td>
<td>N/A</td>
<td>1-3%</td>
</tr>
</tbody>
</table>
Feedback from participants
Results of Feedback Survey

Participant's knowledge gain on their HVAC System

- Backgroud Plant Information
- Demand/Loading Profile
- Electricity Consumption Profile
- Actual System Performance
- Key Parameters for system control
- Control logic of system
- System performance forecasting

- Before ACT-Shop
- After ACT-Shop

Maximum gain

Participant's knowledge gain on Retro-commissioning

- Datalogging
- Regular calibration of instrument
- Regular re-tunning of system control settings
- BMS Application
- Performance Evaluation
- Continuous system improvement

- Before ACT-Shop
- After ACT-Shop
Feedback

• Contents of “ACT-Shop” rated “Absolutely Necessary” by Participants:
  1. Interpretation of analysis results 73%
  2. Preliminary system diagnosis 64%
  3. System performance forecasting technique 64%

• Overall Satisfaction of the Programme:
  100% Satisfied to very satisfied

Extra time spent on ACT-Shop at work

- Less than 10%: 36%
- 20%: 64%
- 30%
- More than 40%: 18%

Programme duration suggested by Participants

- 3 months: 64%
- 6 months: 18%
- 1 year: 18%
- More than 1 year
Looking ahead

A main stream practice for the industry
In the pipeline
Active Training

Target Participants
- Building Managers / Engineers / Operators
- Service / Product Providers / Contractors

Mode of training - Semi-ACT-Shop
- Go through the essential process of retro-commissioning
- Use real data from participants’ buildings

Participants are expected to:
- Have in-depth knowledge/skills and know how retro-commissioning works
- Lead in-house team / service provider to carry out retro-commissioning
- Provide Specification & requirements to service providers when contract out the process
Extending

Leveraging on commercial values
- Merging technology with people
- Hotels and FM managed buildings
- Creating value and edge for Facility management companies
- Include services/product providers for ACT-Shop and training
- Linking available incentive schemes

Accelerating
THANK YOU!