

Retro-commissioning Practice and In-depth Analysis: Case Study on A Retail Mall in China

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Background



Organisers:



International Co-owners:



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Challenge: Multi-discipline



Owner



Designer



Government departments



Operator

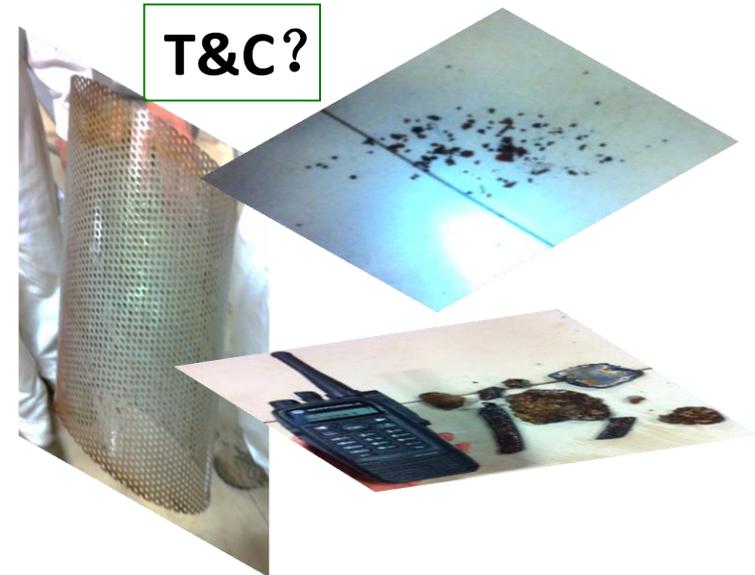
Challenge: Limited Budget and Tight Schedule

Stringent Regulations
 VS.
 “Loose” Implementation

No separate budget for T&C

Tight Schedule

- Owner: Schedule for Opening
- Contractors/Consultants: Eager to leave



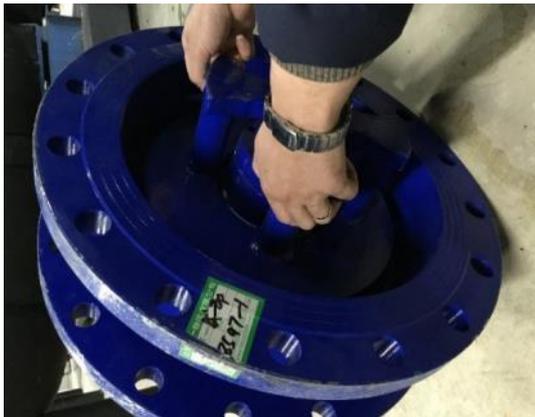
Common Problems

T&C requirements were not fully understood during the design stage

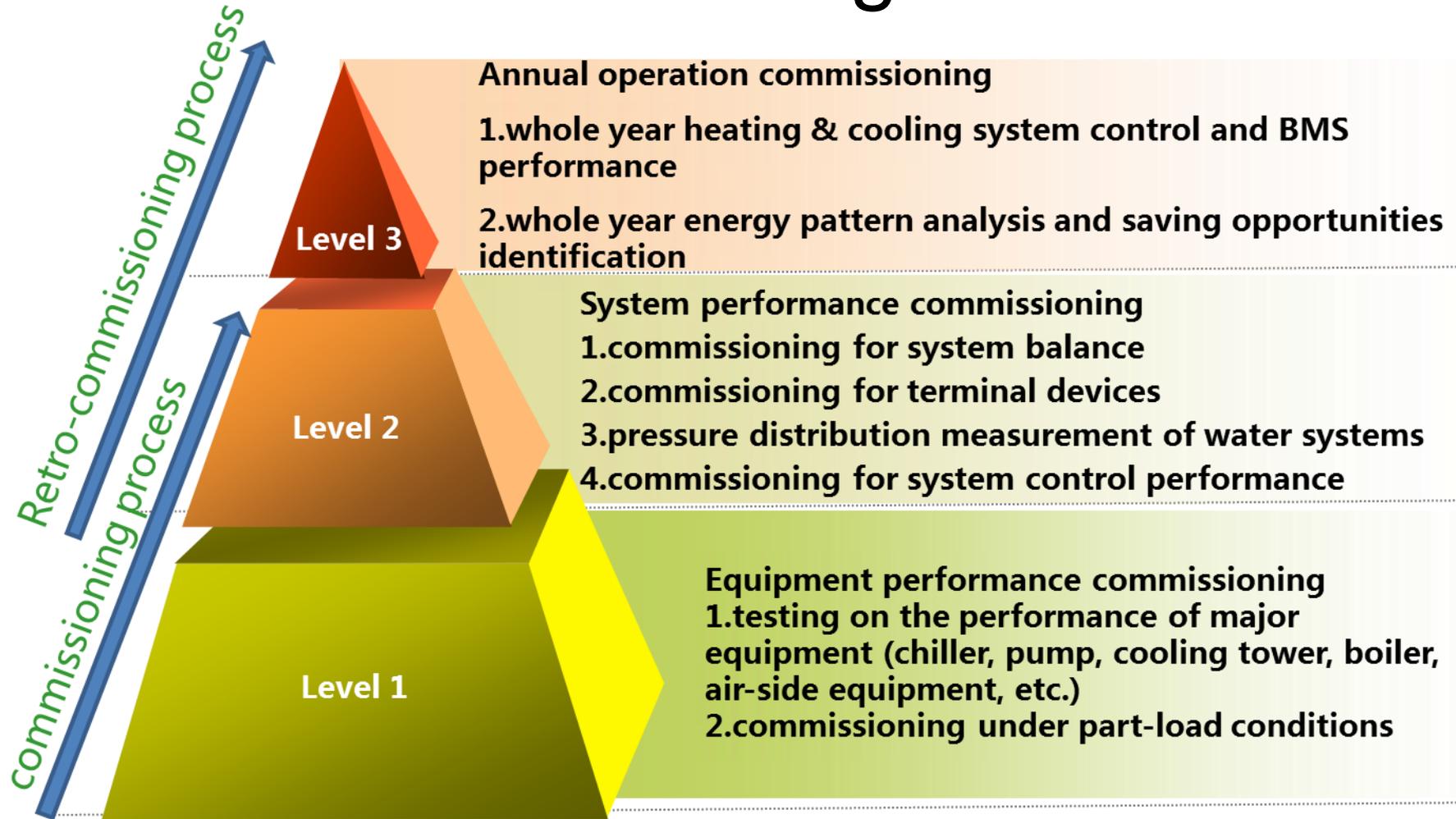
T&C facilities were not installed

No space reserved for T&C

Technical data / catalogues outstanding



Retro-commissioning Process



A Retail Mall: Sino-ocean Taikoo Li Chengdu



Organisers:



International Co-owners:



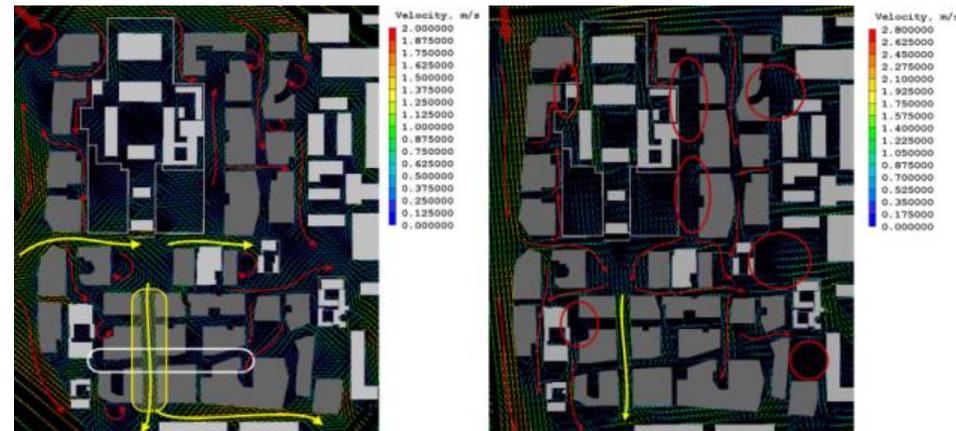
Historical Buildings



- - - Heritage Corridor 历史建筑走廊
- Slow Lane 慢里
- Fast Lane 快里

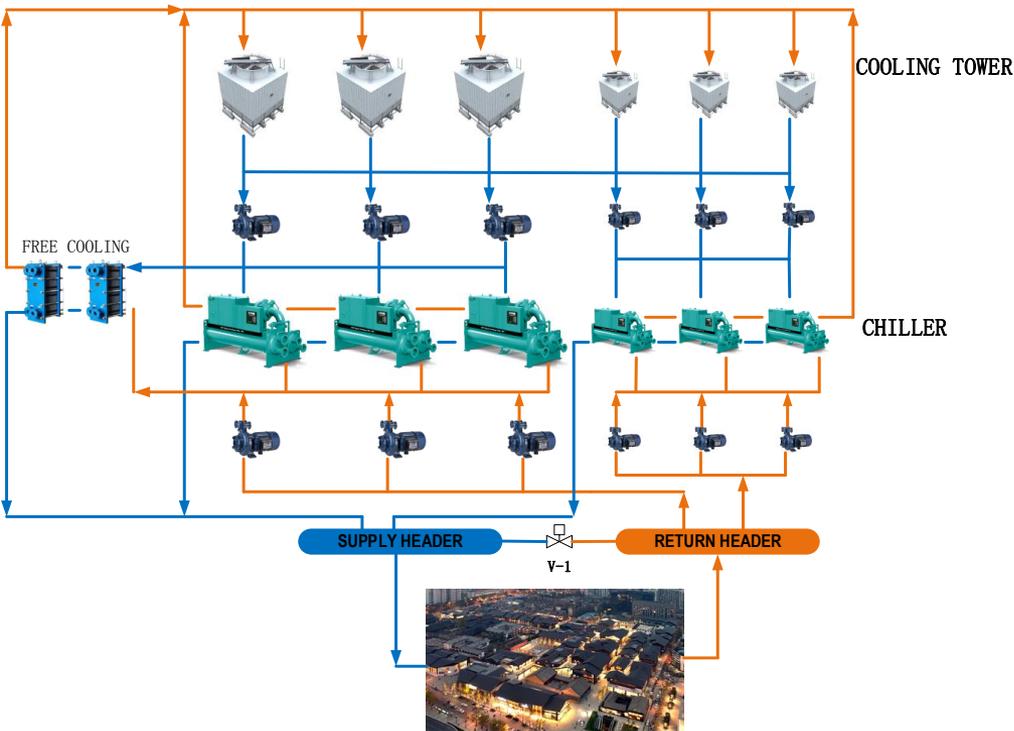
Energy Study During Design

- Whole year heating/cooling load simulation
- Heating/Cooling source: life cycle analysis – central plant/de-central plant/ice storage/tri-gen system
- Jet-fan and CO level control for car-park ventilation
- Primary variable flow chilled water system
- Cooling tower free cooling
- Fresh air free cooling and demand control
- Energy recovery wheel life cycle analysis
- Microclimate analysis

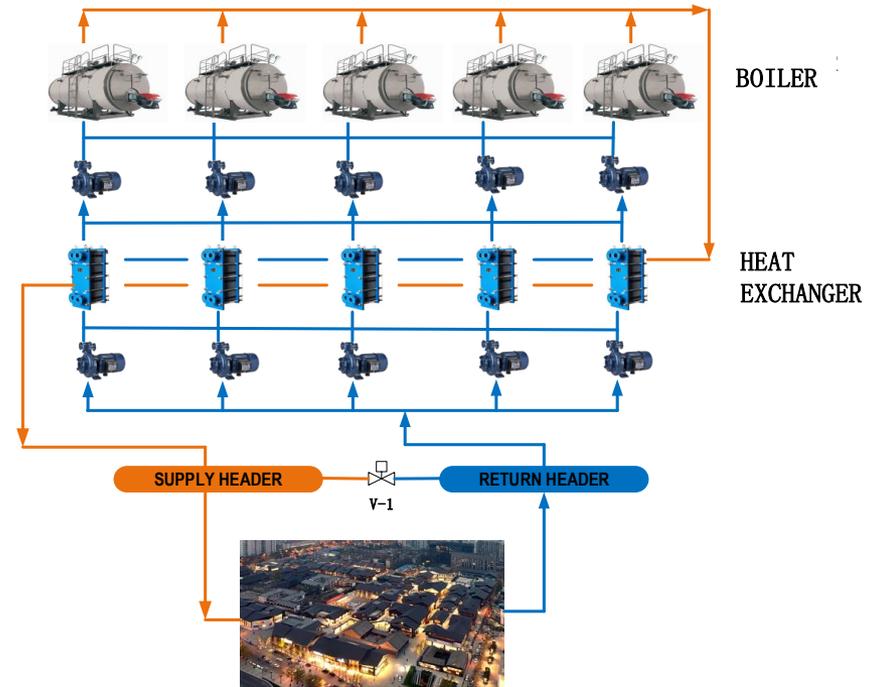


HVAC Systems

• Cooling



• Heating



Level 1: Equipment Performance Commissioning



Organisers:



International Co-owners:



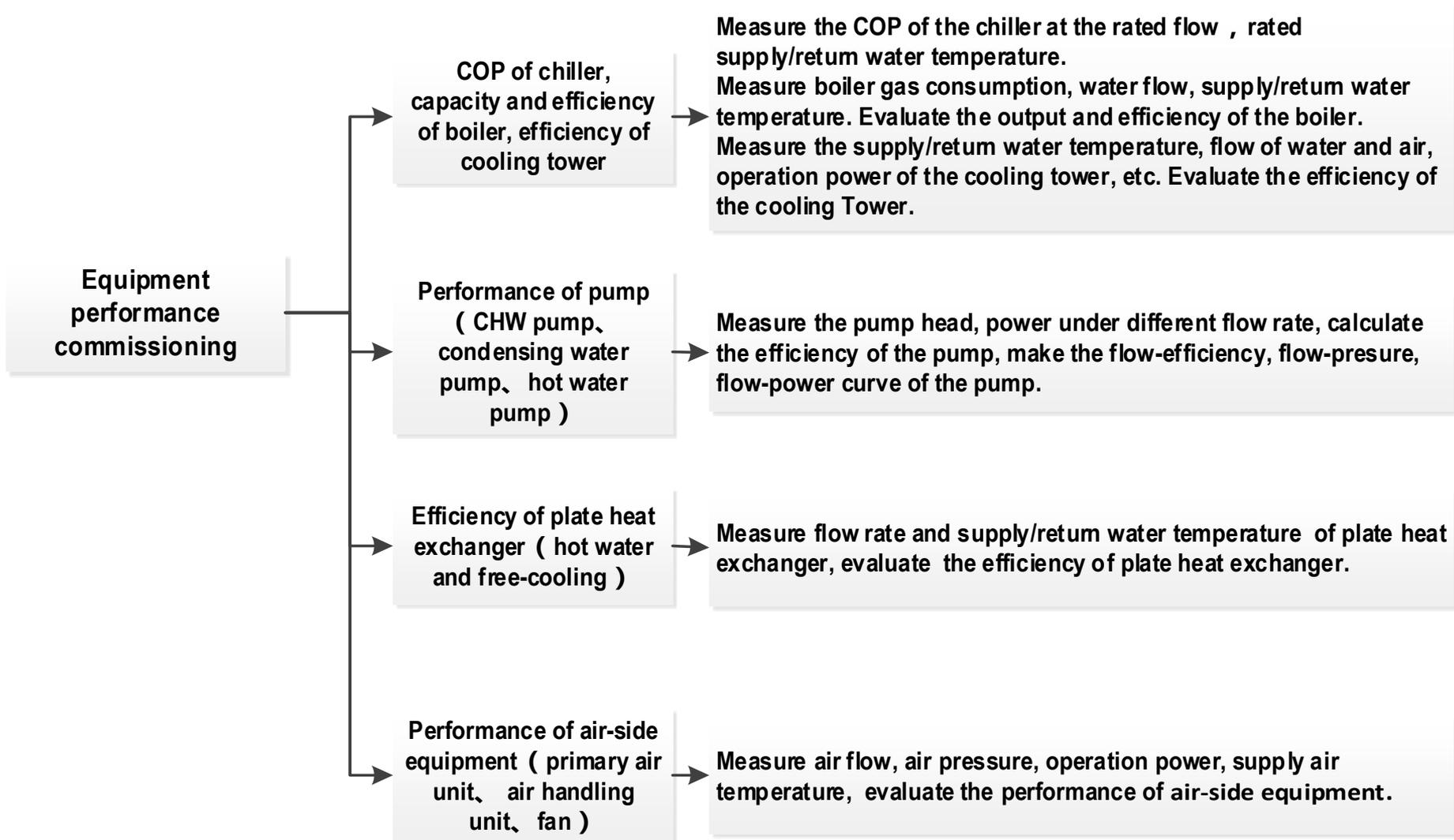
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T&C Stage

Testing object

Testing Parameters and evaluation index



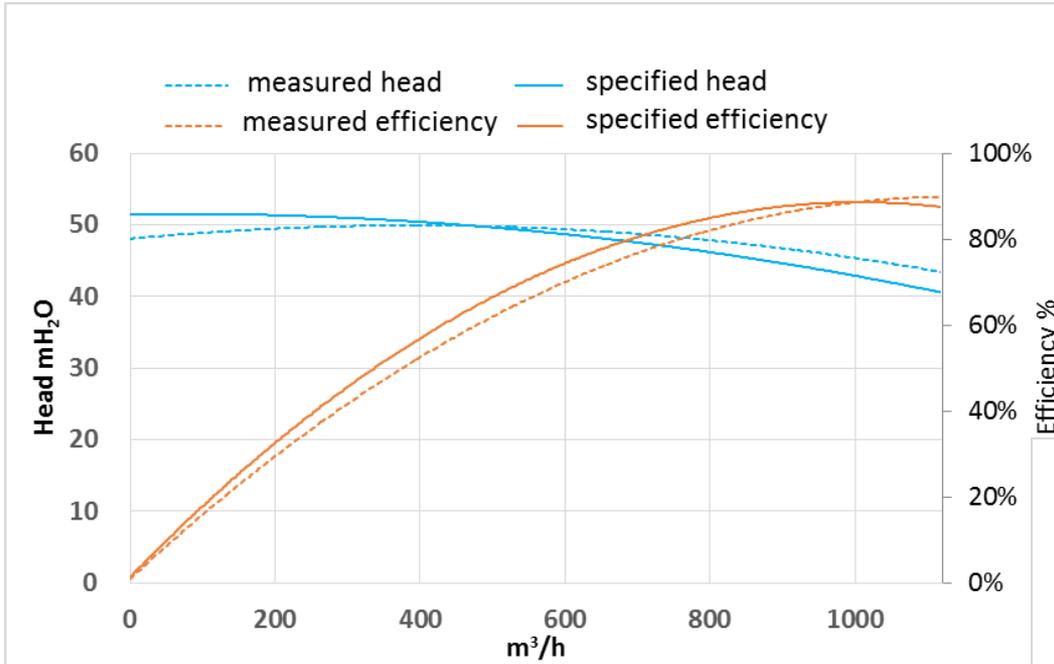
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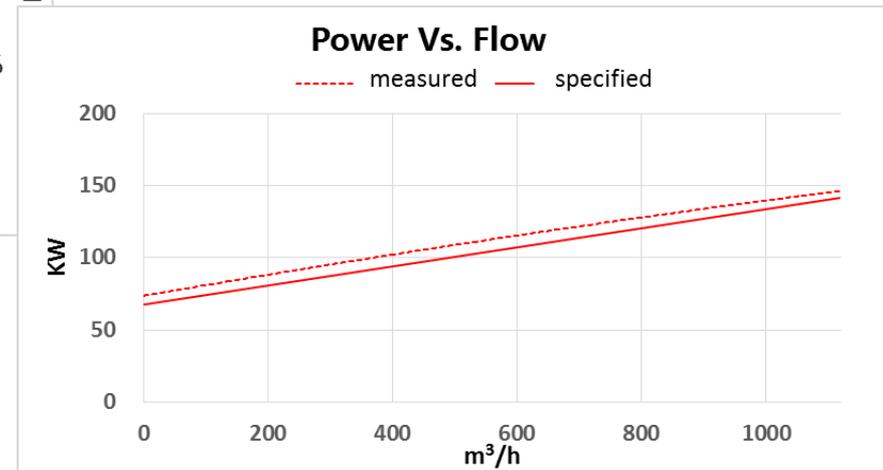
International Co-owners:



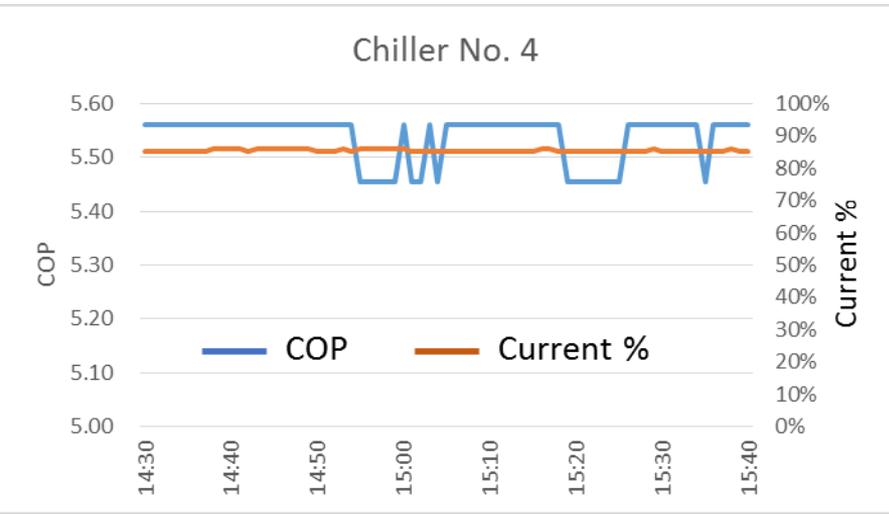
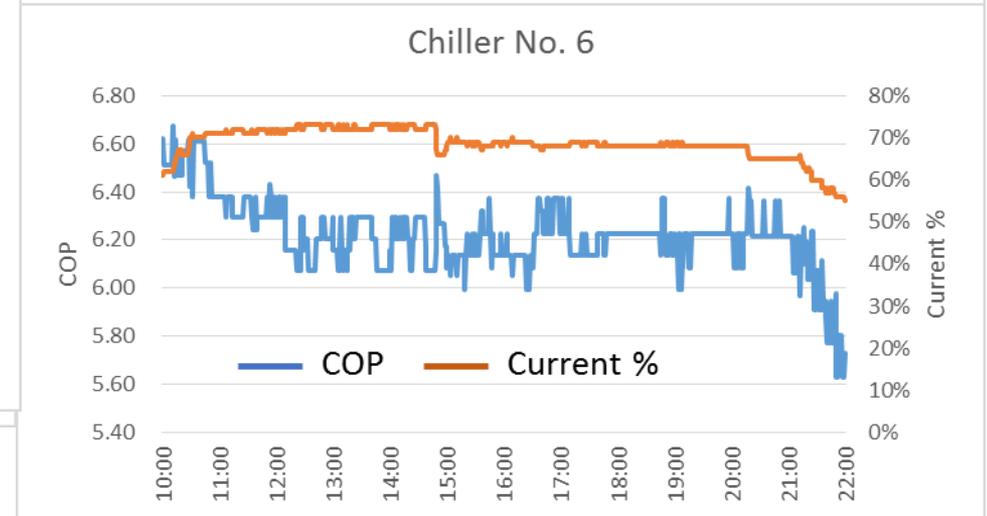
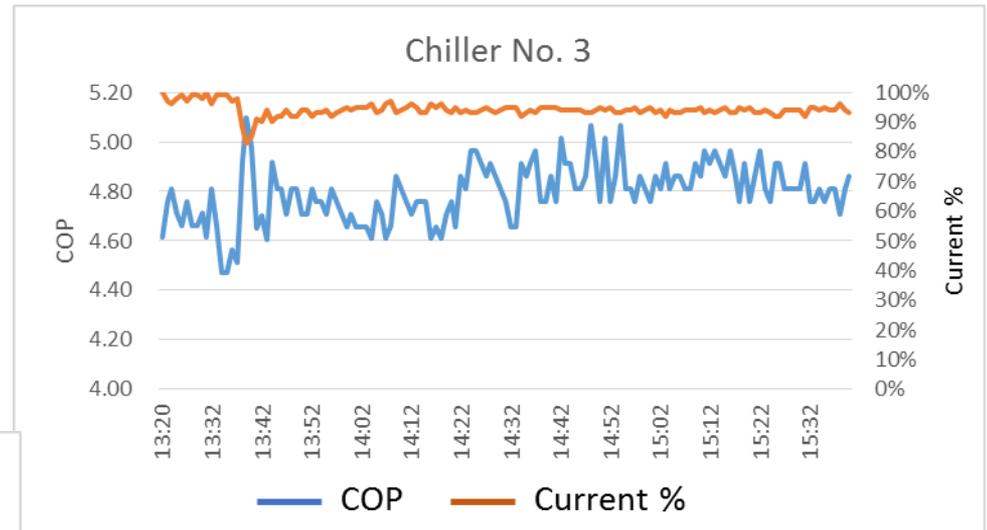
Pumps



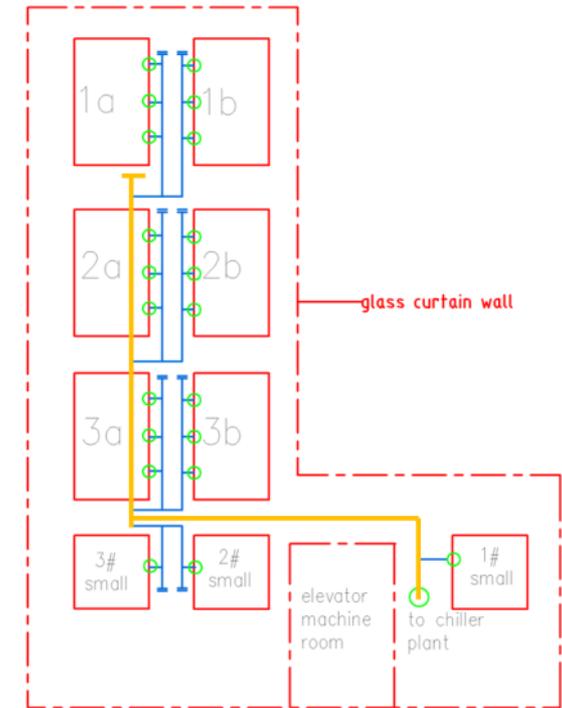
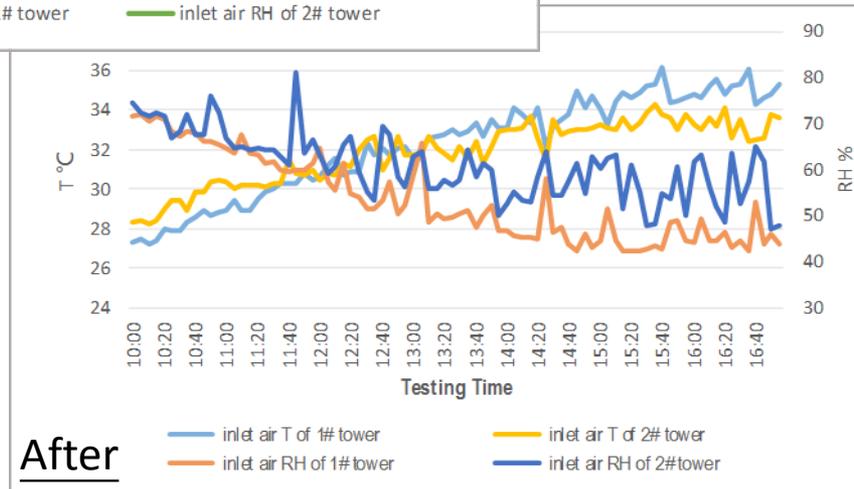
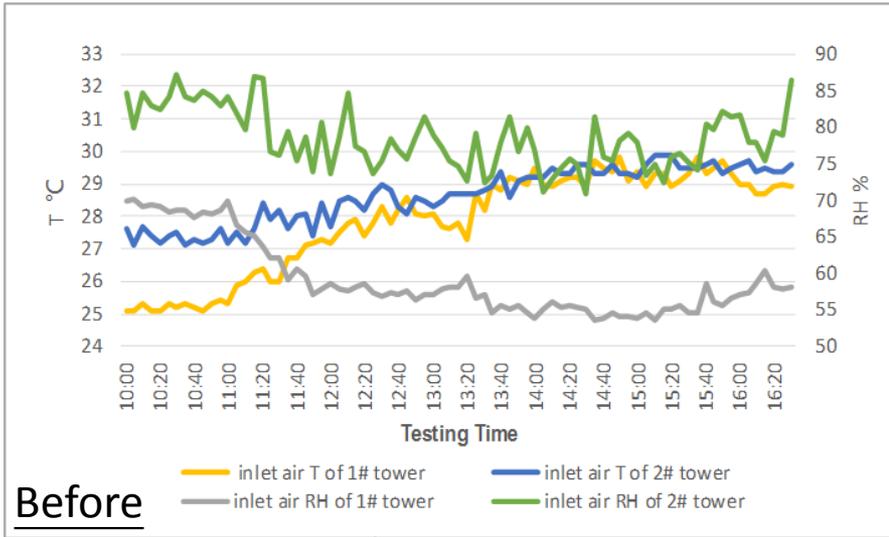
| | Flow | Head | Power | Efficiency |
|-------------|------------------------|----------------------|--------|------------|
| Pump | 1100 m ³ /h | 41 mH ₂ O | 160 kW | 88.8% |



Chillers



Cooling Towers



Level 2: System Performance Commissioning



Organisers:



International Co-owners:



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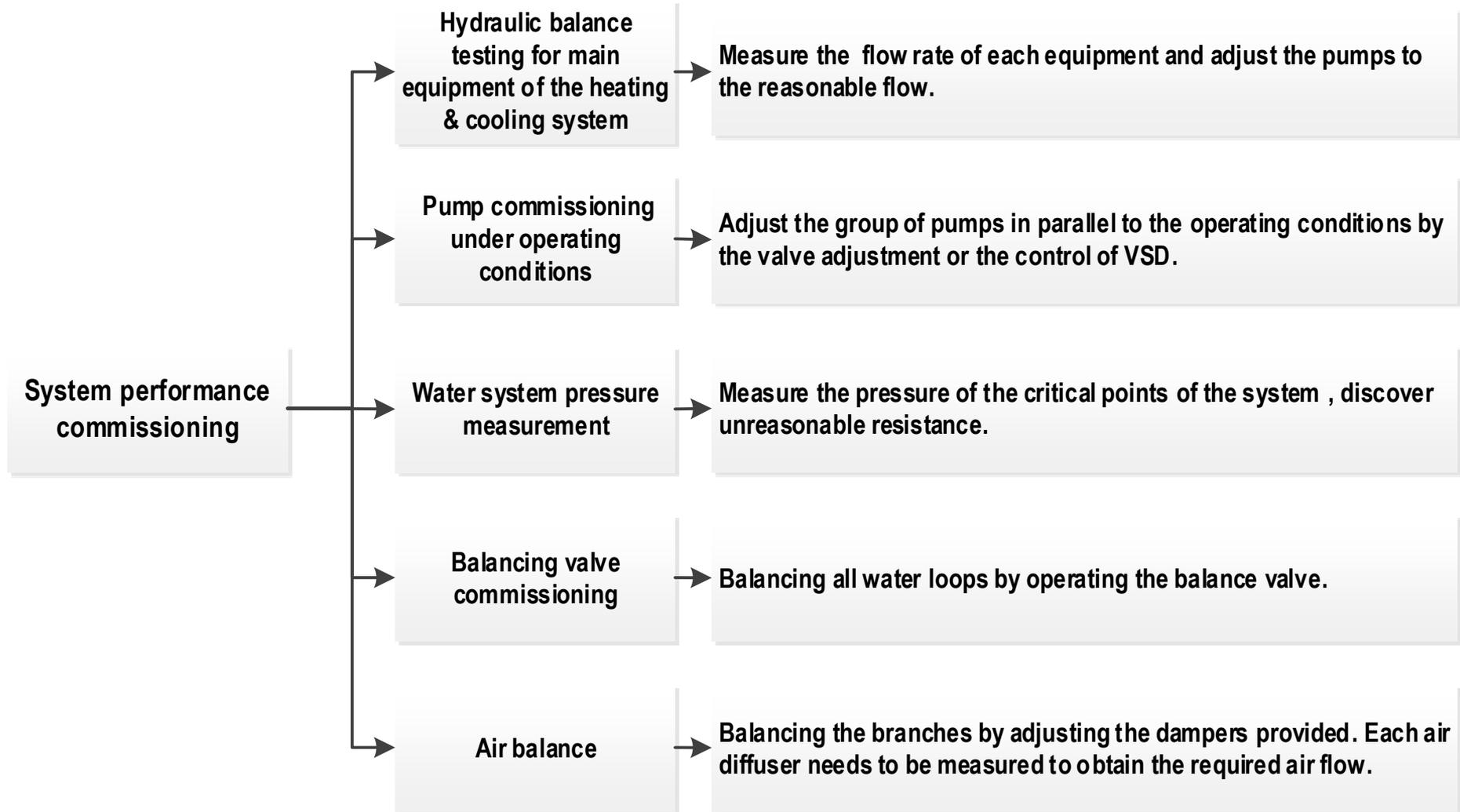


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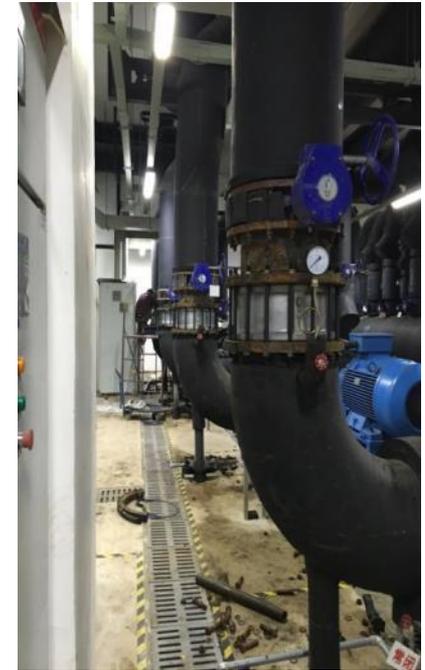
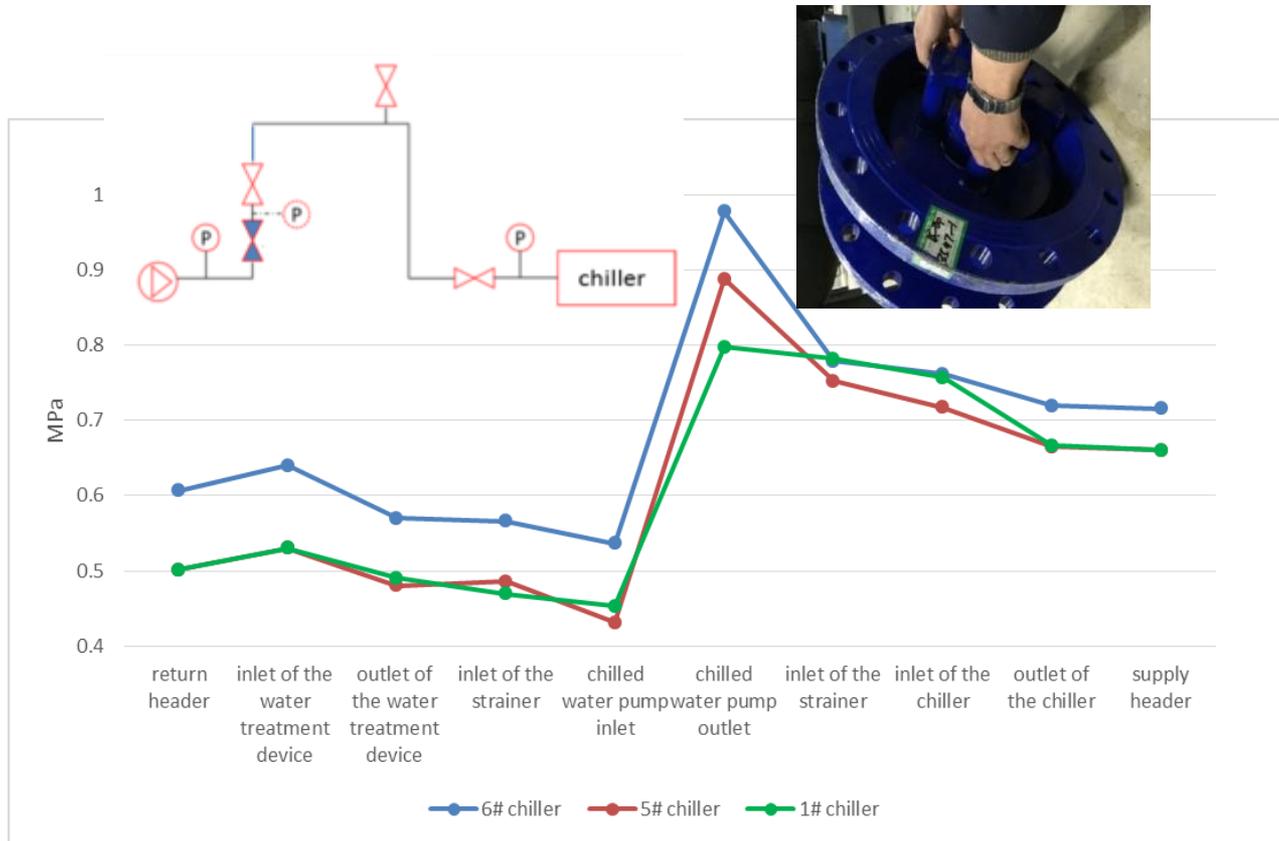
T&C Stage

Testing object

Testing Parameters and evaluation index



Unreasonable Resistance



Free Cooling

| | Design Parameters | Trial Free Cooling Operation | Trial Chiller Operation |
|---------------------------------|-------------------|------------------------------|-------------------------|
| Outlet Temperature (°C) | 11.0 | 9.8 | |
| Inlet Temperature (°C) | 8.0 | 9.2 | |
| Flow rate (m ³ /h) | 1432.0 | 1393.0 | |
| Cooling Load (kW) | 4996.2 | 1021.1 | 1021.1 |
| Chiller (kW) | 0 | 0 | 145.9 |
| Cooling Tower (kW) | 88.6 | 88.6 | 45.0 |
| Pump (kW) | 229.9 | 229.9 | 15.0 |
| System COP | 15.7 | 3.2 | 5.0 |

Level 3: Dynamic Operation Commissioning



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T&C Stage

Object

Testing Parameters and evaluation index

combination

Annual system operation commissioning and reconstruction

Heating & cooling system control

Check the strategy ,interface, functionality, accuracy of sensor.

BMS system

Check the completeness of the user control strategy, interface and control function. Check the accuracy of sensors and the realization of control function.

Efficiency operation strategy for heating & cooling system

Research on outlet chilled water temperature setting, operation strategy of cooling tower, pressure differential of chilled water setting, collocation of large & small chillers, etc.

Efficiency operation strategy for air-side System

Research on operating strategy of primary air unit, air handling unit and fine-tune the set-points.

Energy-saving reconstruction

Executing energy-saving reconstruction of equipments and systems by In-depth operation data mining.



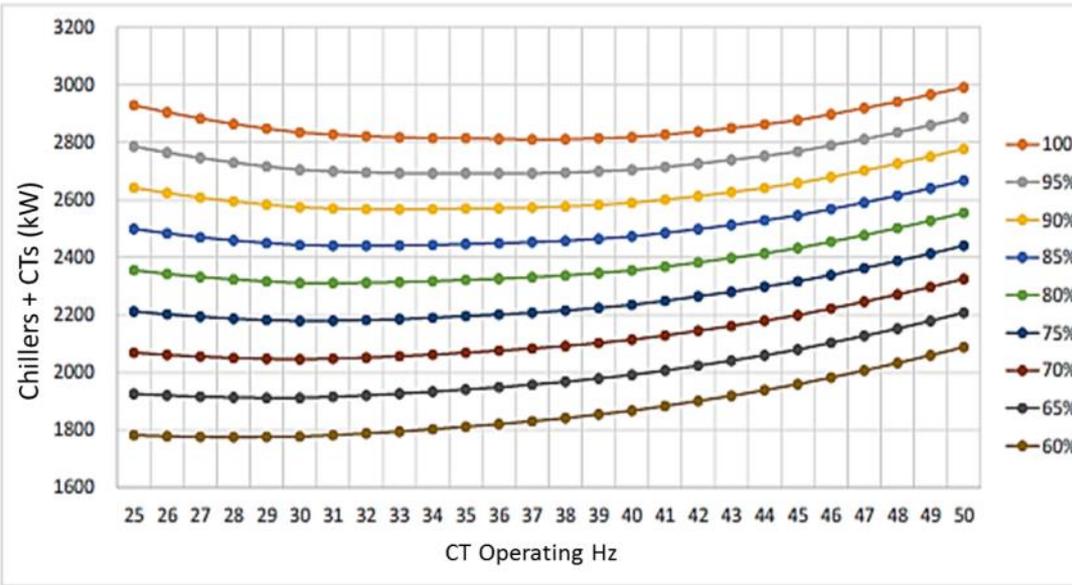
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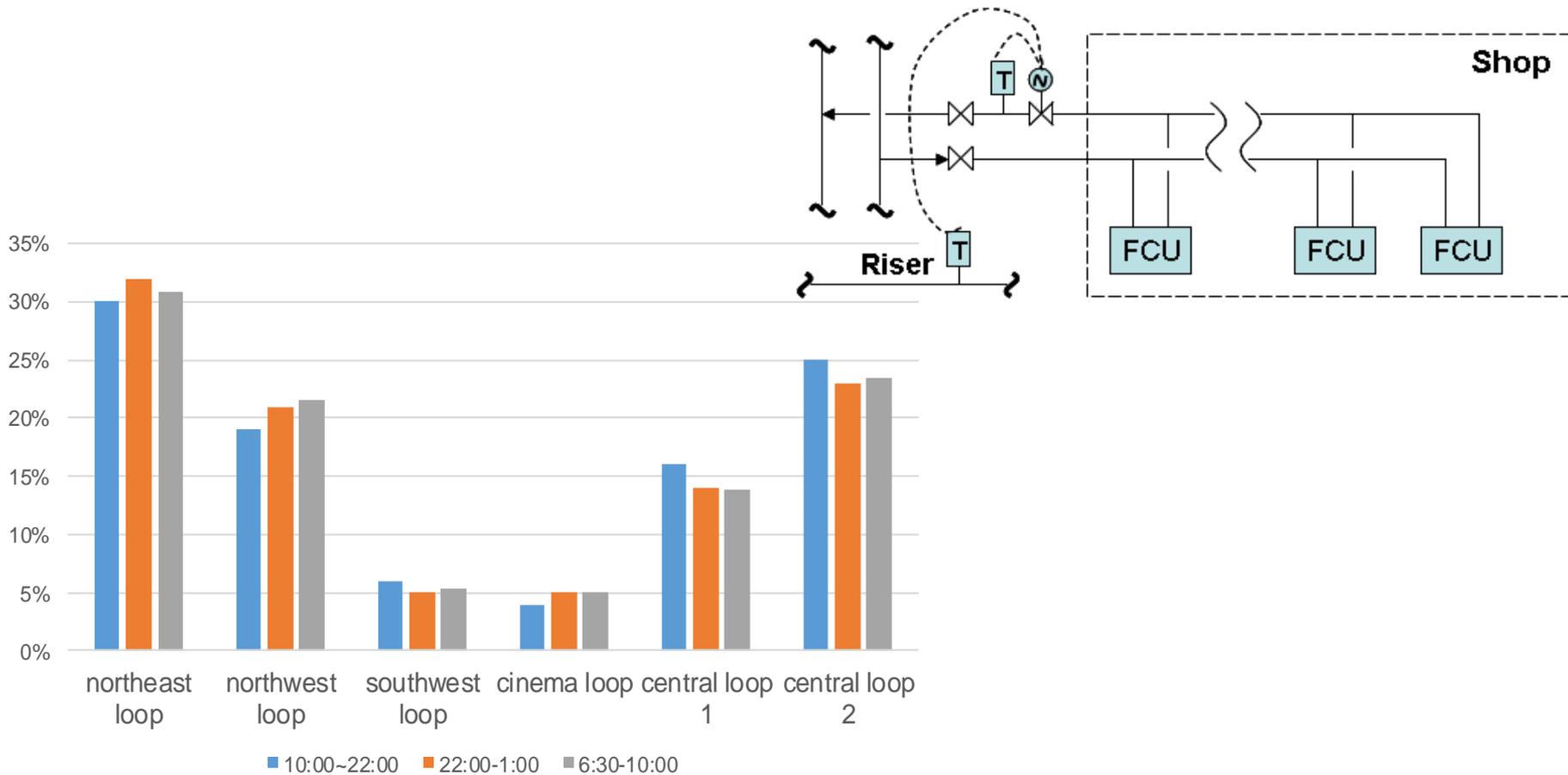


Chiller Sequencing Control



| Chillers ON | | Cooling Towers ON | | CT Operating Hz |
|---------------|-------------|-------------------|----------|-----------------|
| Small Chiller | Big Chiller | Big CT | Small CT | |
| 1 | 0 | 0 | 3 | 25 |
| 2 | 0 | 1 | 3 | 25 |
| 3 | 0 | 2 | 3 | 25 |
| 0 | 1 | 6 | 0 | 25 |
| 1 | 1 | 6 | 3 | 25 |
| 2 | 1 | 6 | 3 | 25 |
| 3 | 1 | 6 | 3 | 31 |
| 0 | 2 | 6 | 3 | 31 |
| 1 | 2 | 6 | 3 | 31 |
| 2 | 2 | 6 | 3 | 31 |
| 0 | 3 | 6 | 3 | 35 |

BMS Function of Control Valves



Conclusion



Organisers:



International Co-owners:

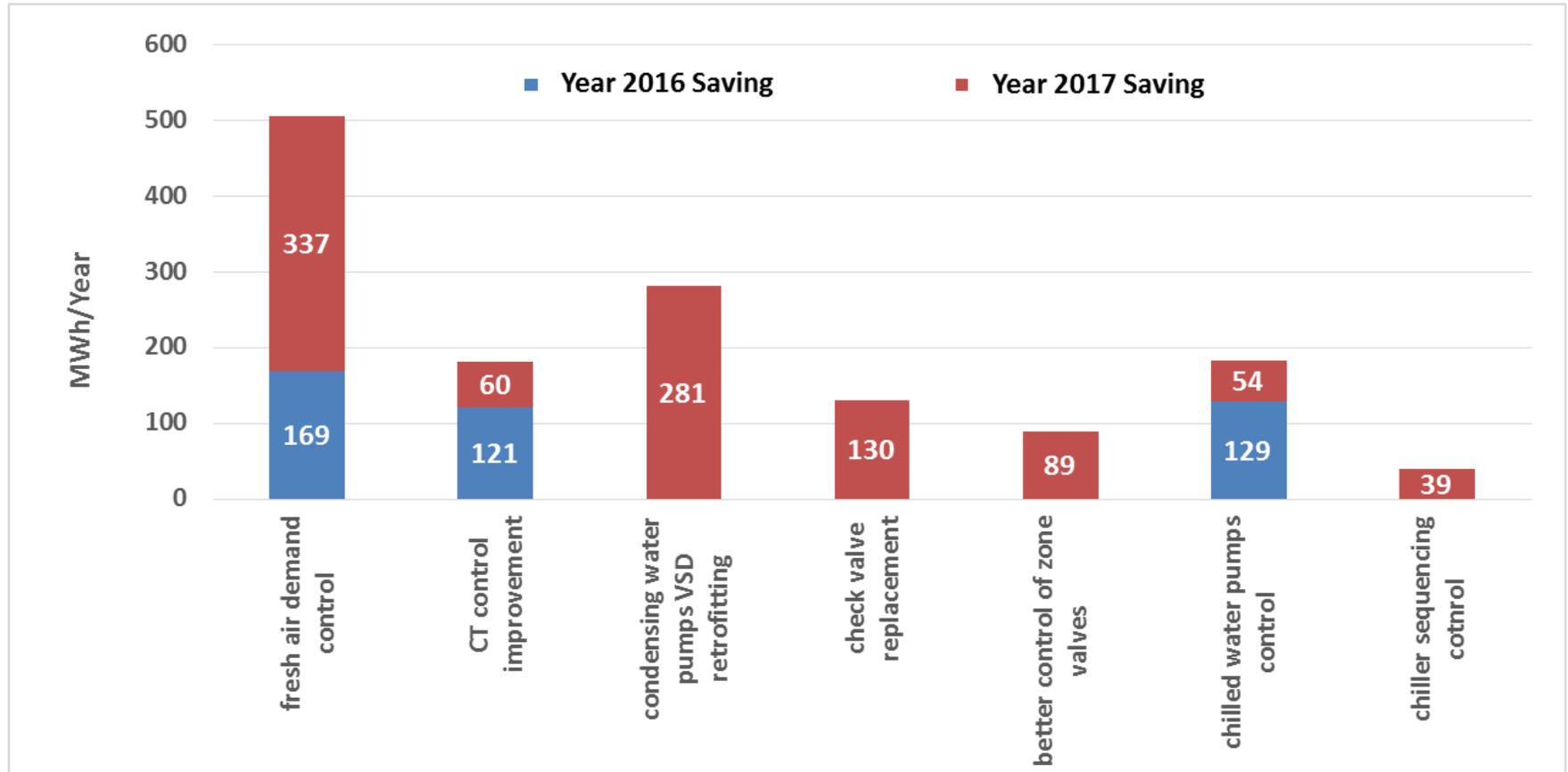


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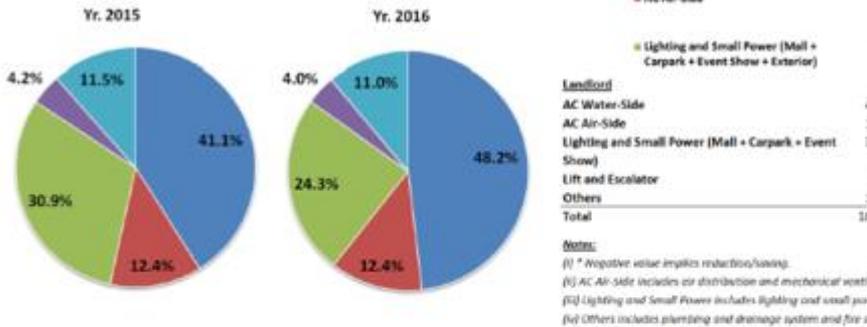
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Energy Saving

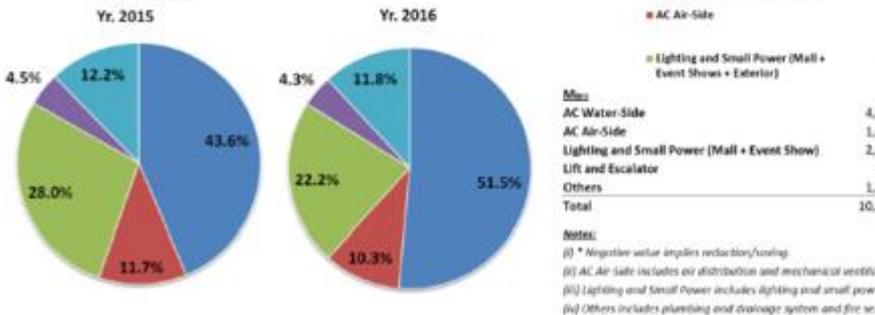


Big Data Analysis

2. Total Electricity Consumption Breakdown (a) Total



(b) Mall

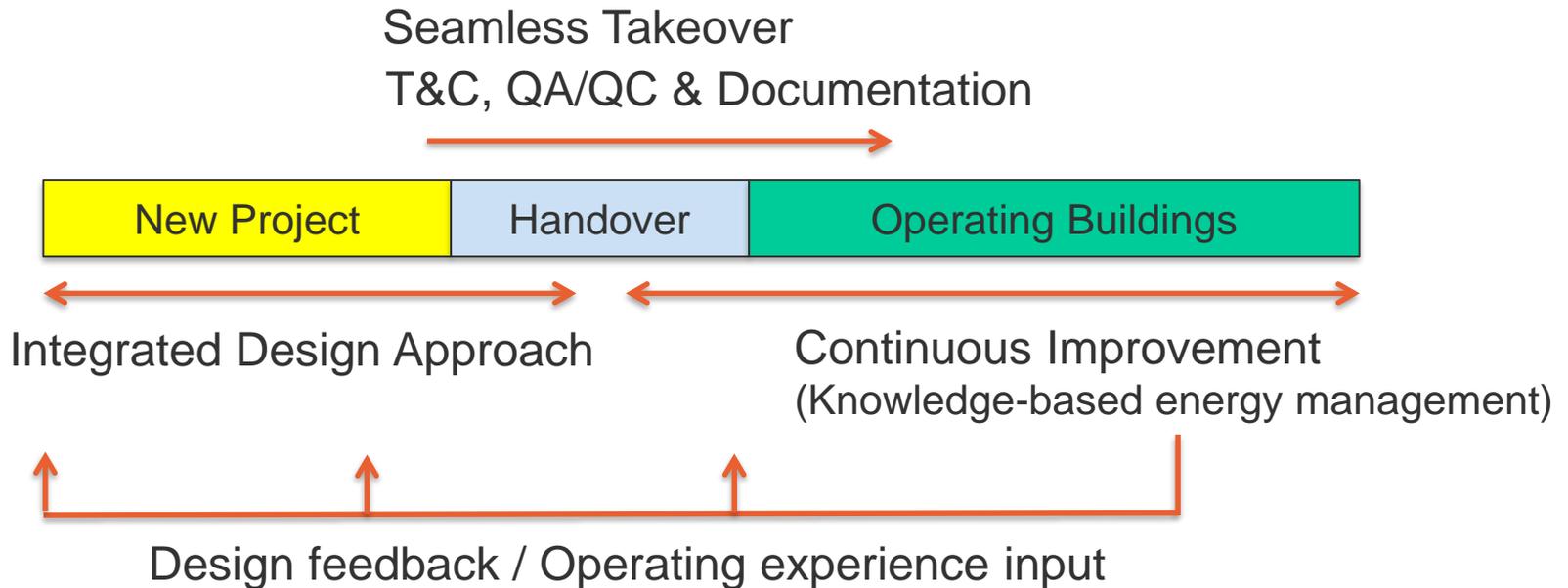


4. Electricity Consumption Breakdown for Each Portfolio



Life Cycle Management

Adopt a holistic standard process in managing the life cycle of the building



Thank you



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