Private Public Partnership Energy Efficiency Assessment Program at HAECO Xiamen Facility, China

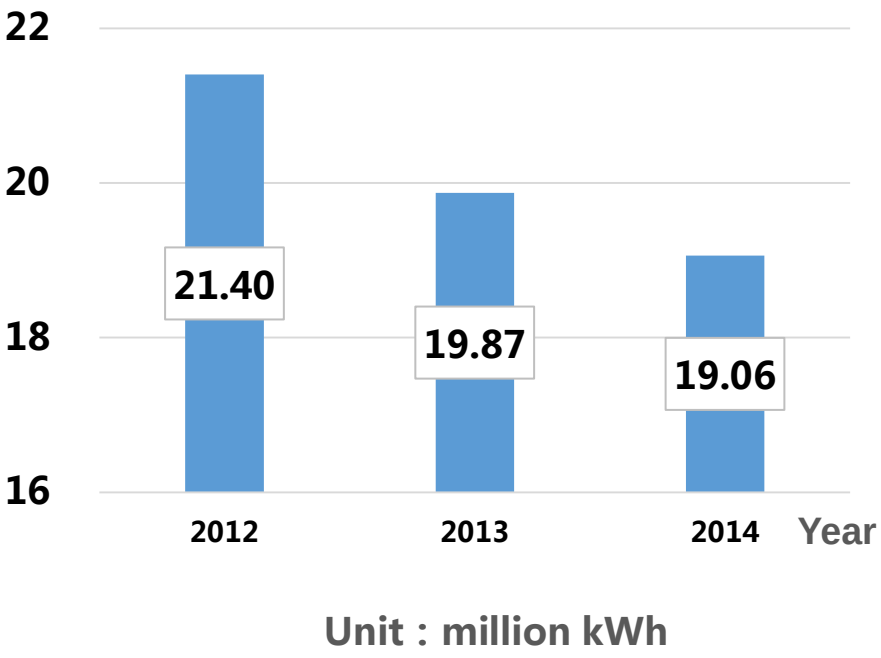
Tsinghua & HAECO Xiamen Team

Tsinghua University was invited to carry out energy audit and give recommendation on HAECO Xiamen energy performance and reduction measures. There are 6 hangars in HAECO Xiamen

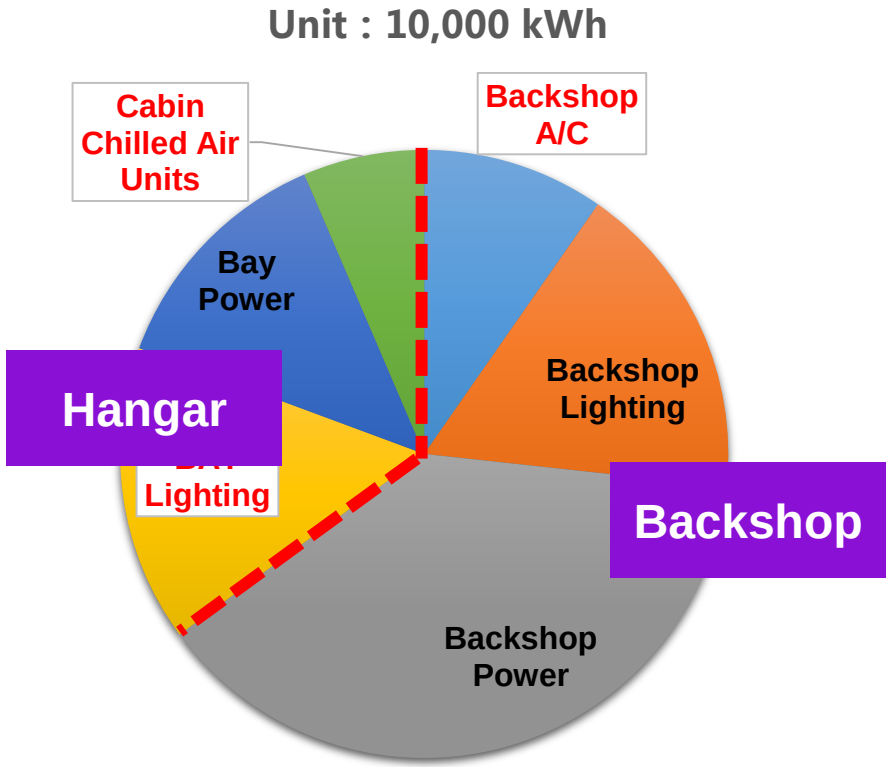
2. Energy Analysis

Total Energy Review : 3 types of energy : Lighting, Power and A/C units

Total Electricity Consumption

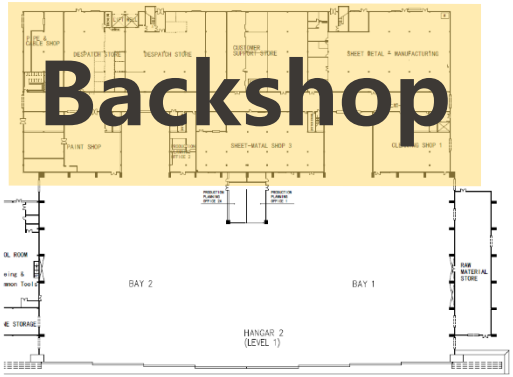


2014 Energy Consumption Percentage



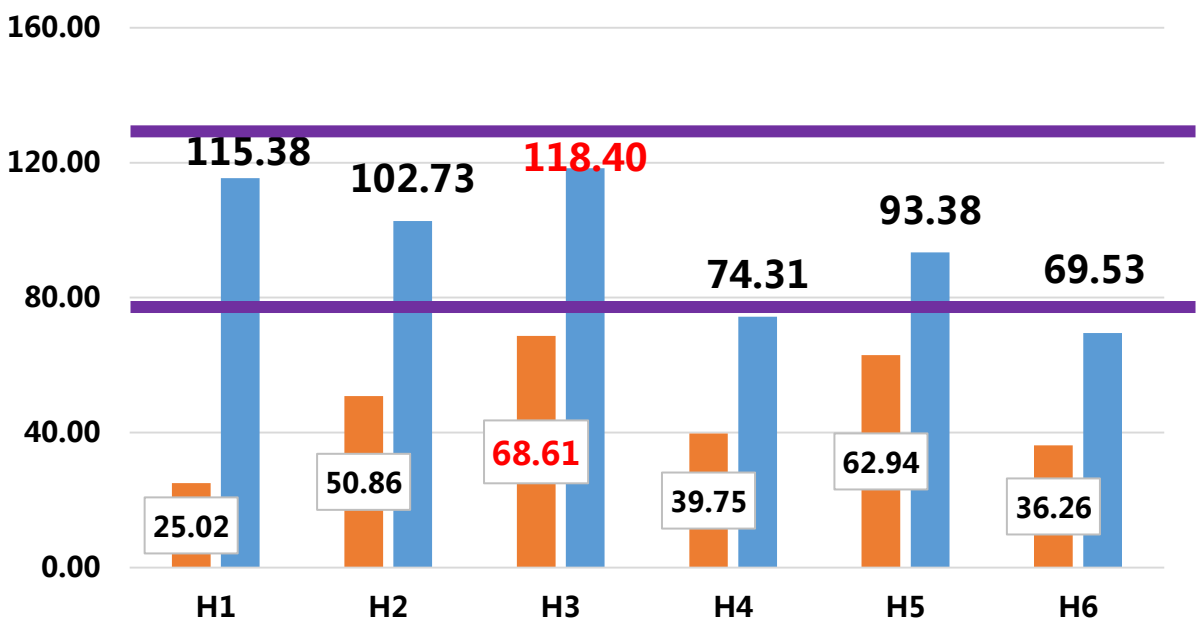
2. Energy Analysis

2.2 Backshop Building Energy Review



2014 Energy Consumption

Unit: kWh/m²·year



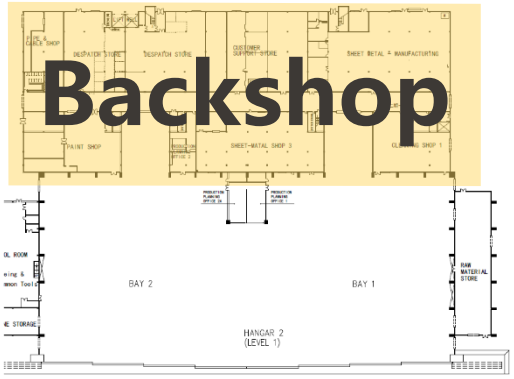
Commercial Office Building 124

Government Building 78

- H3 Bay has consumed **highest** energy.
- **Large potential** in AC.

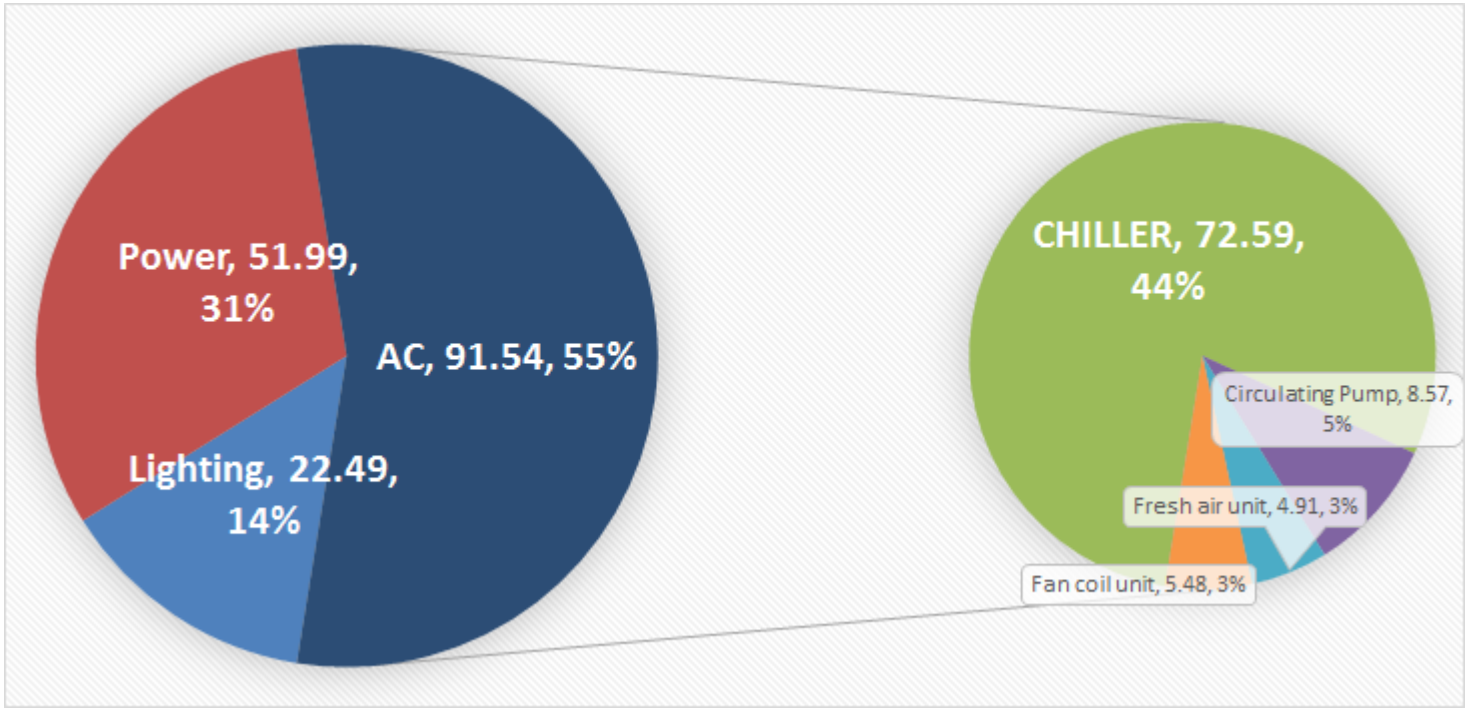
2. Energy Analysis

2.3 H3 Backshop Energy Review



Detailed Energy Analysis of H3

Unit: 10,000 kWh



AC Unit Area Energy

77.39

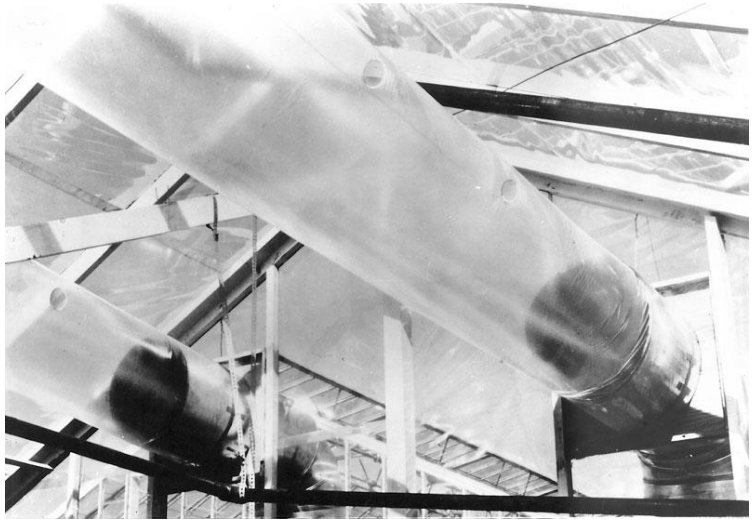
kWh/m²

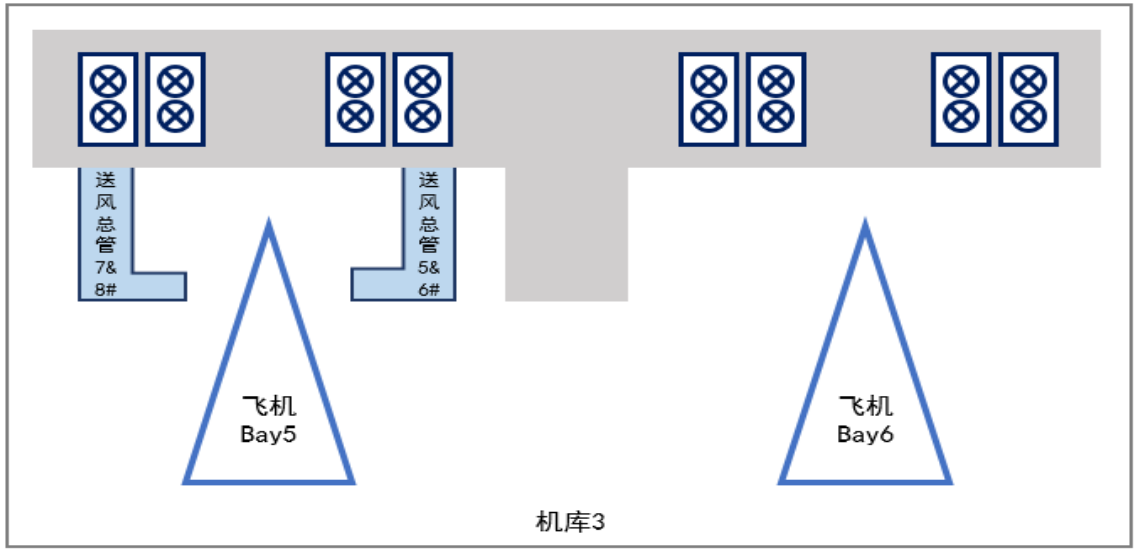
- **H3 AC(Backshop) has consumed 55% of total energy.**
- **Large potential in H3 AC.**

Findings

Cabin Chilled Air Units

Cabin chilled air units



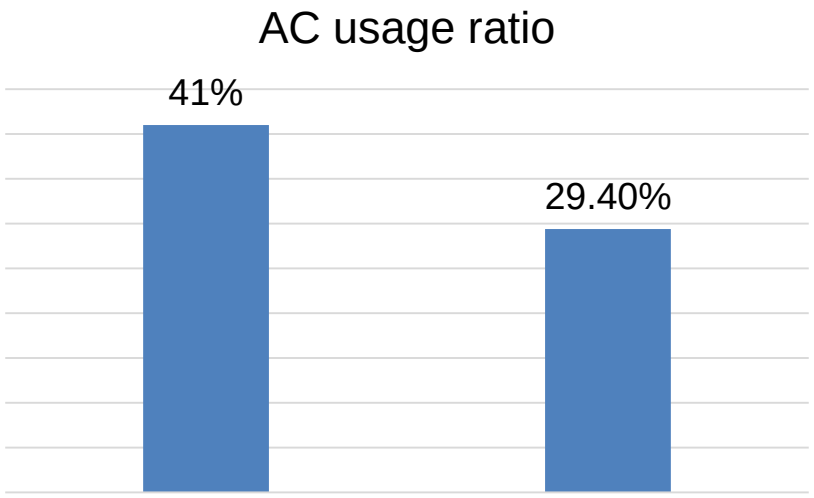


Chiller number	Measured COP*
5	3.2
6	2.9

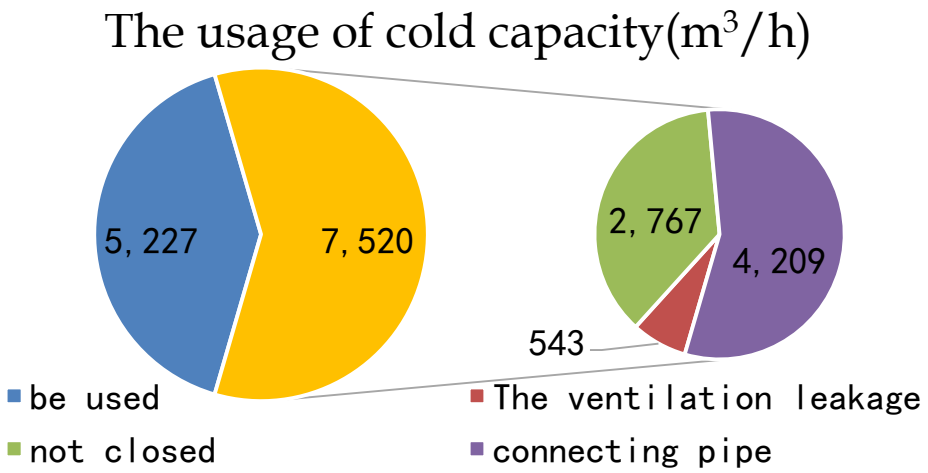
COP* coefficient of performance

- Low chiller efficiency
- Some fans are not working
- Fans are switched without considering the need, causing unnecessary waste

Cabin Chilled Air Units



- Supply exceeding demand

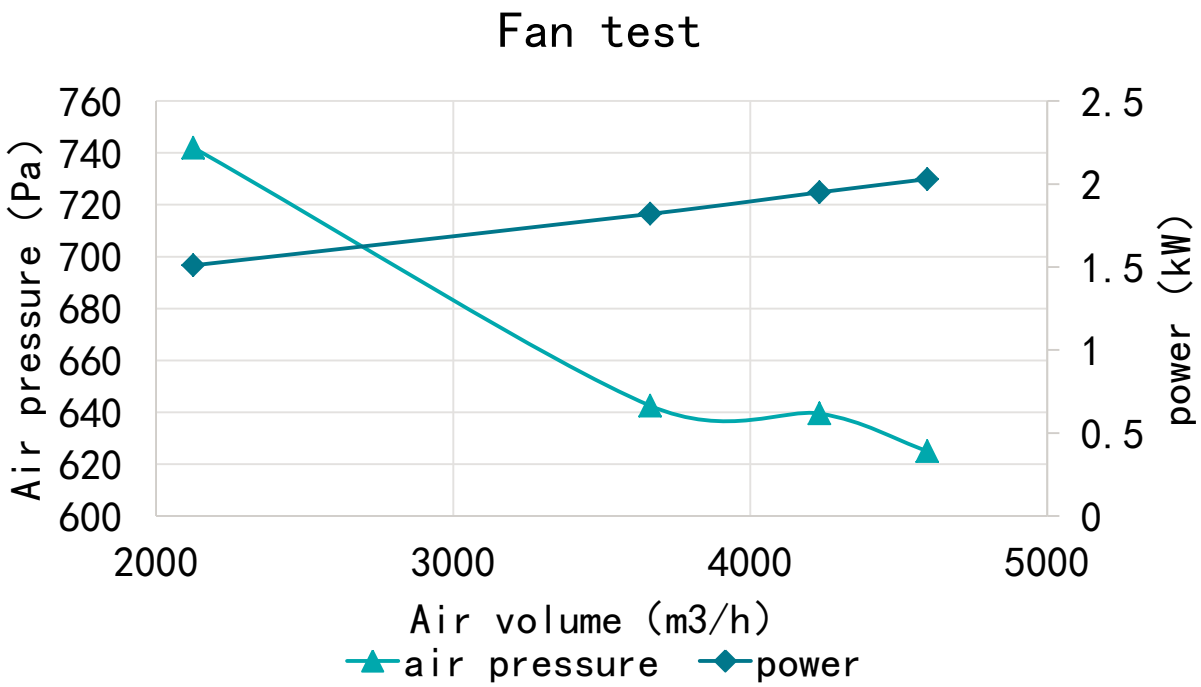


Wastage on;

- Ventilation system leakage
- Aircraft doors are not closed
- Connecting pipe leak

Cabin Chilled Air Units

Fan test



Problem Found

1. Closed all valves, large amount of air is leaked.
2. Fan power is too large

Corrective Suggestion

1. Use frequency inverting fan
2. Use more small fan instead of large fan

Cabin Chilled Air Units

Air-conditioning vehicle test

- high chiller efficiency ---- 5.3
- Too cold, discomfort feeling

- Mobile air-conditioning unit has high cooling capacity
- Proposal: Increasing proportion of mobile air-conditioning unit

Cabin Chilled Air Units

Recommendation

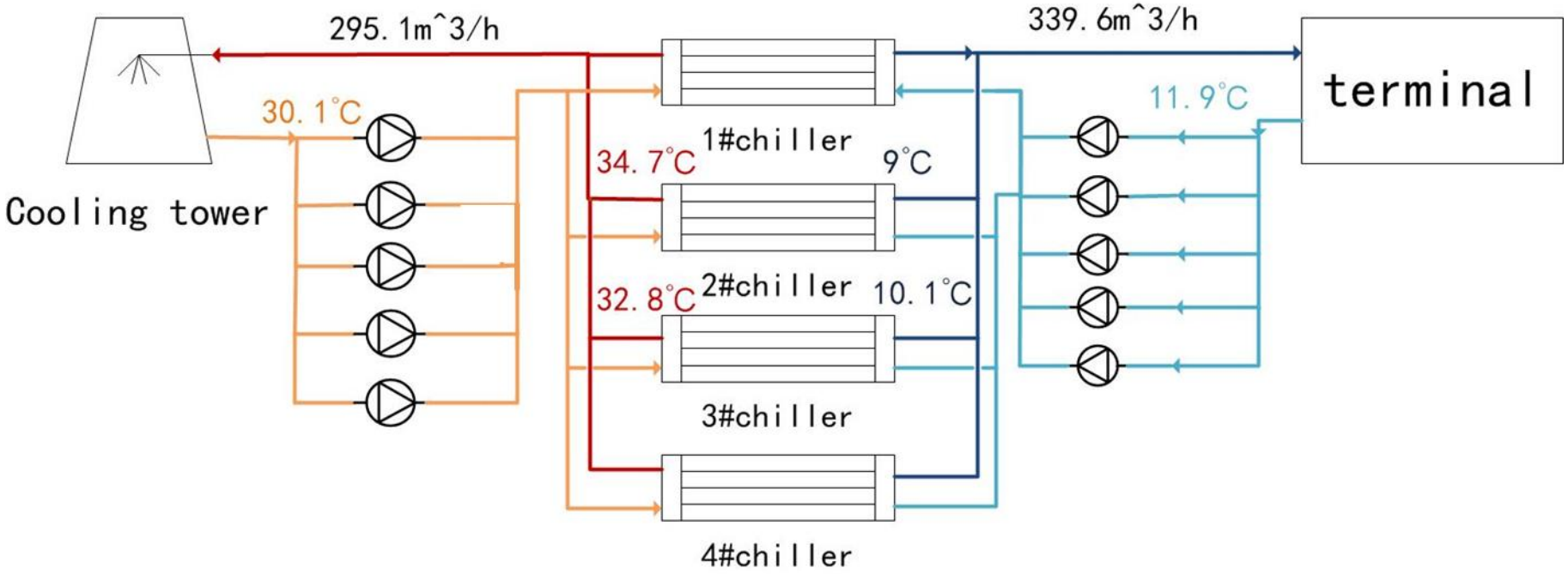
- Low chiller efficient and usage
  - ✓ Chiller and wind pipe controlling
- Large fan energy consumption
  - ✓ Using frequency inverting fan or more small fans
- The waste of cold wind
  - ✓ Increasing proportion of mobile air-conditioning unit
  - ✓ Strengthen management of the valves

➢ Total energy saved : 1.08 million kWh per year accounted for 75%

Water Cooled Air-conditioning System

Operating strategy

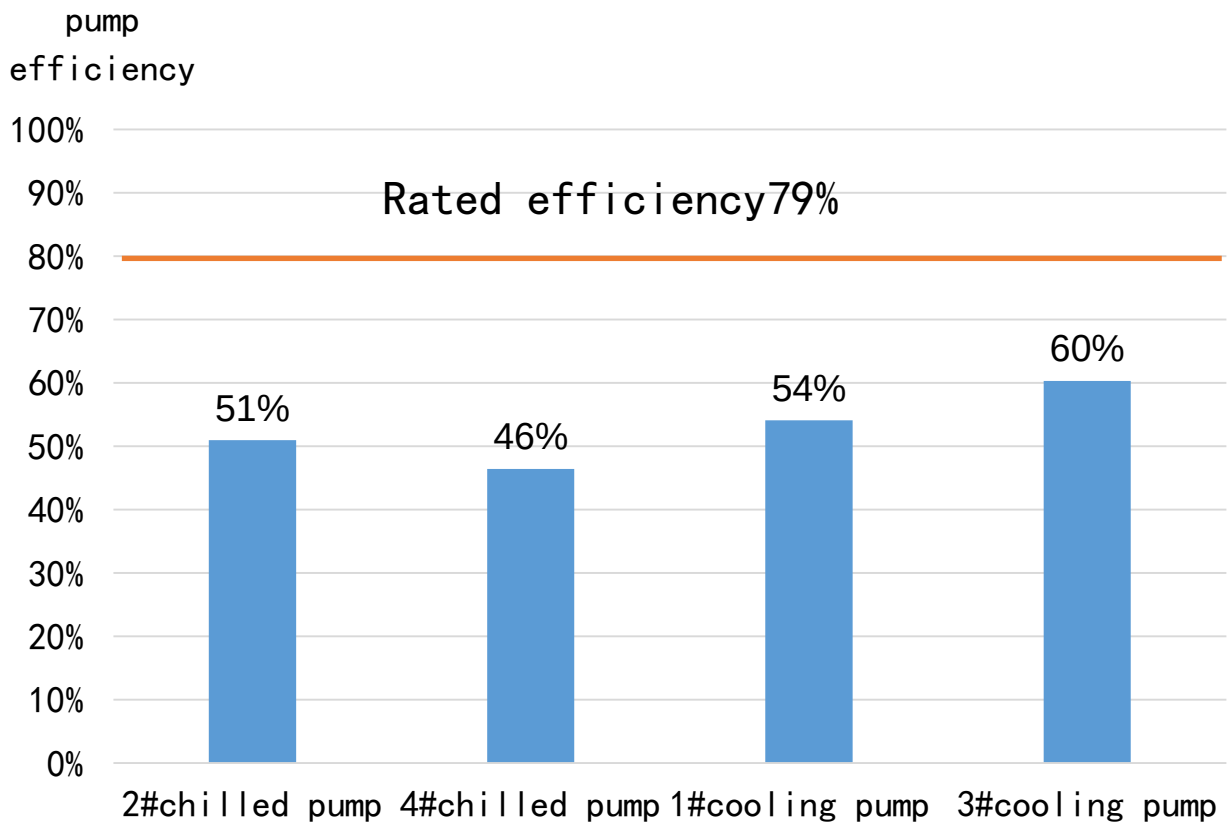
- No. 2 & 3 chiller run at 40% cooling capacity
- 2 cooling water pumps and 2 chiller water pumps run at low load
- Low ΔT of chilled water system (2.9℃), causing large flow and energy consumption



Water Cooled Air-conditioning System

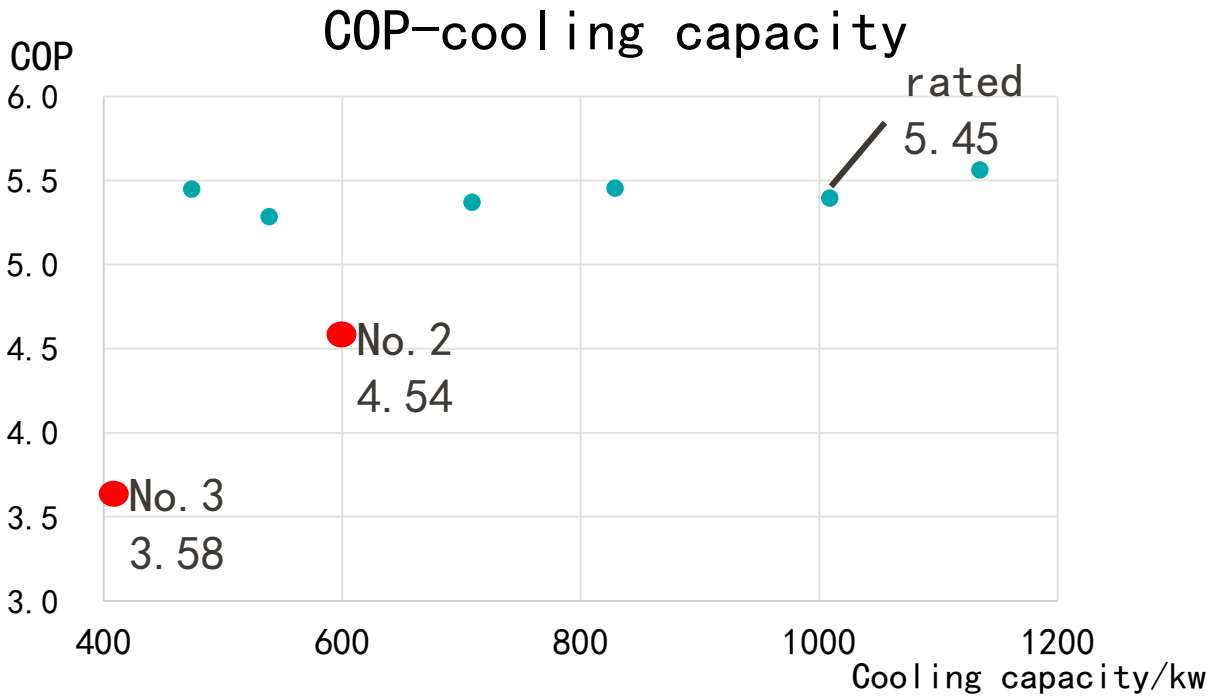
Operating strategy

- Oversizing design and improper operating strategy of pumps
- System runs at a low efficiency state



Water Cooled Air-conditioning System

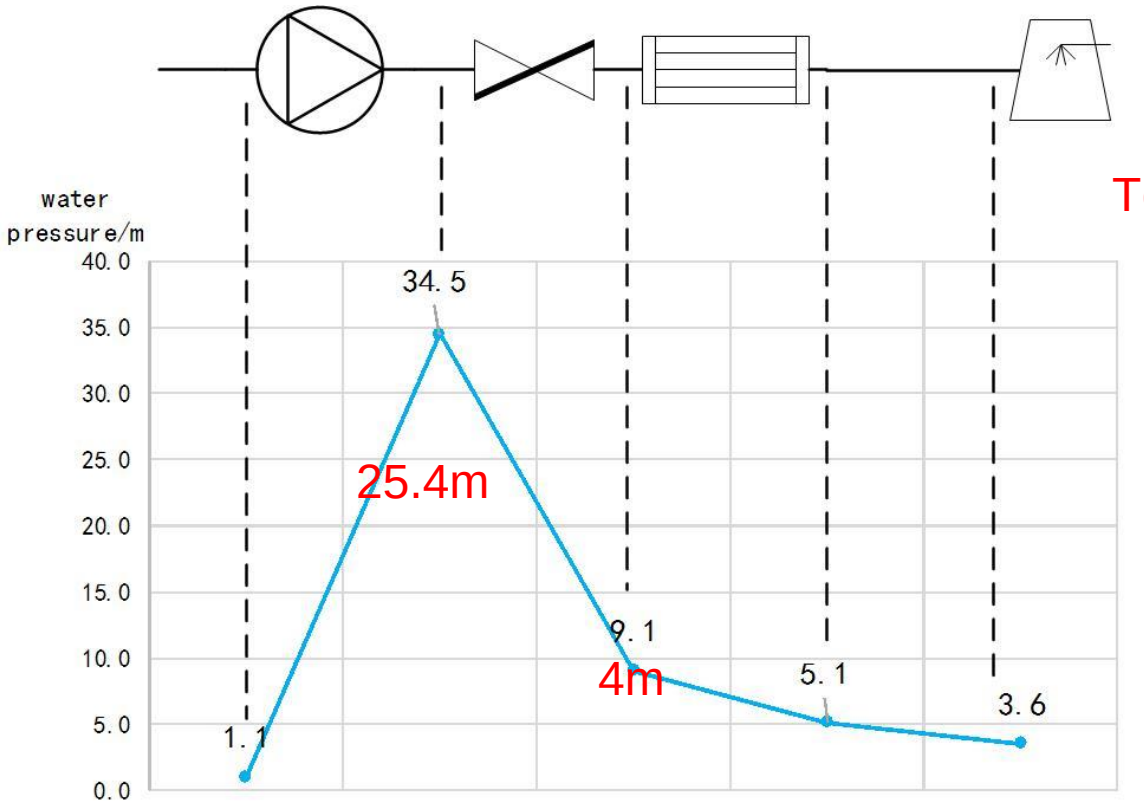
Chiller's coefficient of performance (COP)



No. 2 & 3 chiller runs at 40% cooling capacity

Water Cooled Air-conditioning System

Cooling water system



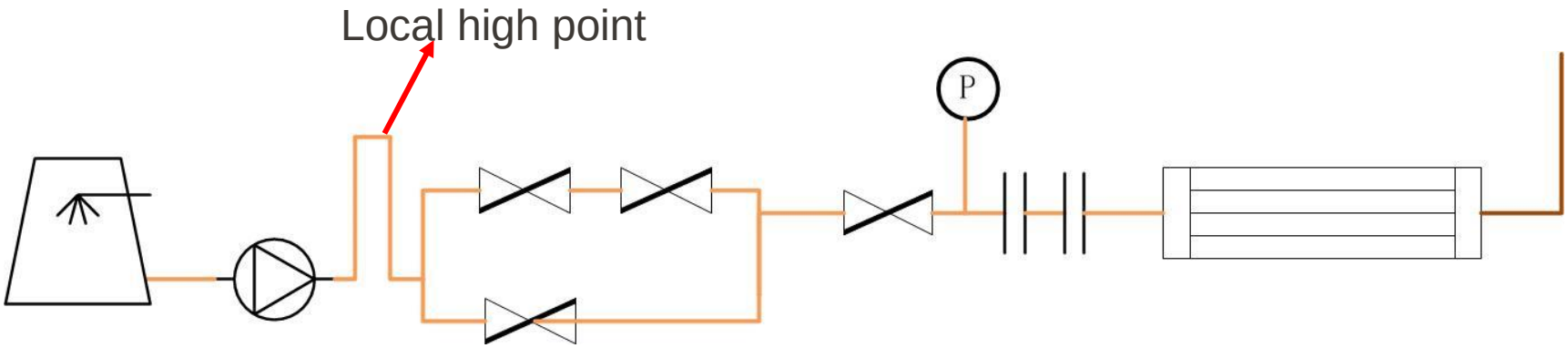
Too much water pressure drop!

Cause:
High energy consumption
Low efficiency

Water Cooled Air-conditioning System

Cooling water system

Analysis of causes:



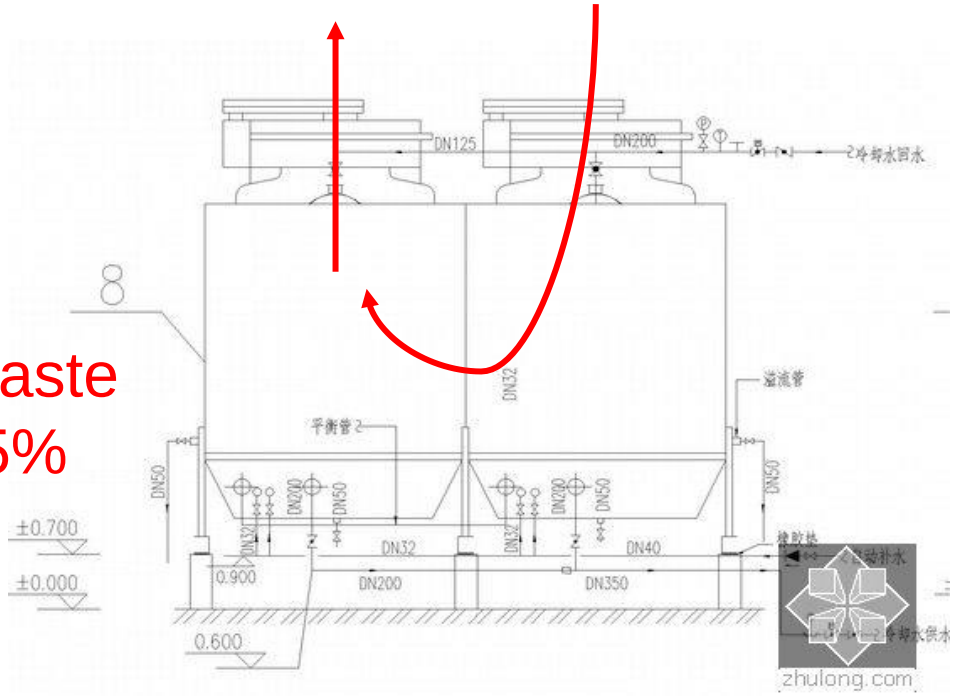
Air stuck in local high point and Condenser. Affecting heat transfer

Solutions:
Install vent valve

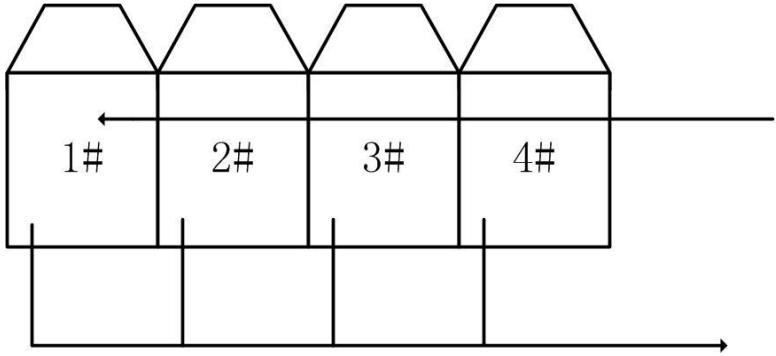
Water Cooled Air-conditioning System

Cooling tower

Operate 3 cooling towers



Waste
25%



efficiency	74%

Suggestion:
Run 4 cooling towers with frequency inverter

Lighting

- **Lighting of Bay**

- Test: Ceiling Lamp & Natural Lighting
- Conclusion:
  - Ceiling Lamp wouldn't improve the adverse lighting area
  - Natural Lighting have significant impact on the total light environment

If use natural lighting from 1000-1500 hr can save

81.6 **Lighting of Bay1-12**

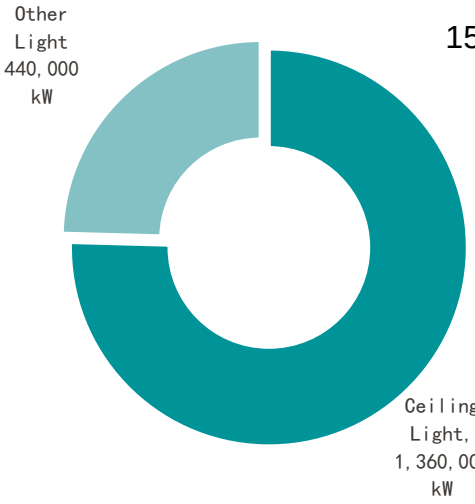
10^4 kWh per year

Lux level at 1430 hr Bay 5 door open, light off

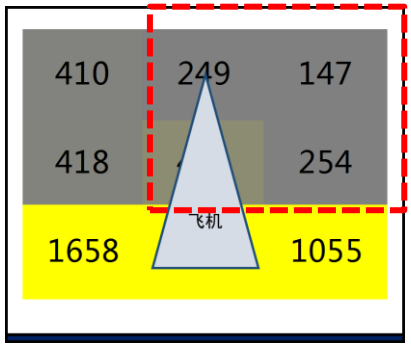
511	753	612
1121	821	1370
1750	1703	3590

Lux level at 1430 hr Bay 5 door open, light on

662	752	712
1106	1557	2340
2560	3780	3110



1500 hr Bay 6 door closed, light on



Mixed Lighting for Bay > **500** lux

Learning from this PPP Exercise

It is a very good process & practical experience that our facilities maintenance staff could learnt from the highest and practical academic, research institute from TsingHua University.

GM Operation HX Xiamen

Tsinghua University

We could applied our knowledge and practise our improvement works, with the collaboration works from HAECO Xiamen facilities staff, we can fix the problem and see the result, it is mutual benefit for both parties.

PhD Tsinghua student

Now : Visiting Lecturer in Maryland University, USA

NEXT STEP

- Sharing the result to the other group companies
- Enlarge the study scale and transfer the experience to Swire group companies (Swire group holds HAECO)
- Roll out this cooperation model to other Swire group companies such as Swire Coca-Cola
- Swire Properties set up research fund with TsingHua University to continue the energy study

THANK YOU !