

Commissioning in a LEED & GOBAS Evaluated Green Building

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建筑概况

Building Information

- **地理位置：北京城区**
 - **Location: Downtown Beijing**
- **类型：办公建筑**
 - **Office Building**
- **建筑面积：13,225平方米**
 - **Floor Area: 13,225 m²**
- **结构：9层混凝土结构**
 - **Structure: 9-story Concrete and Masonry Building**



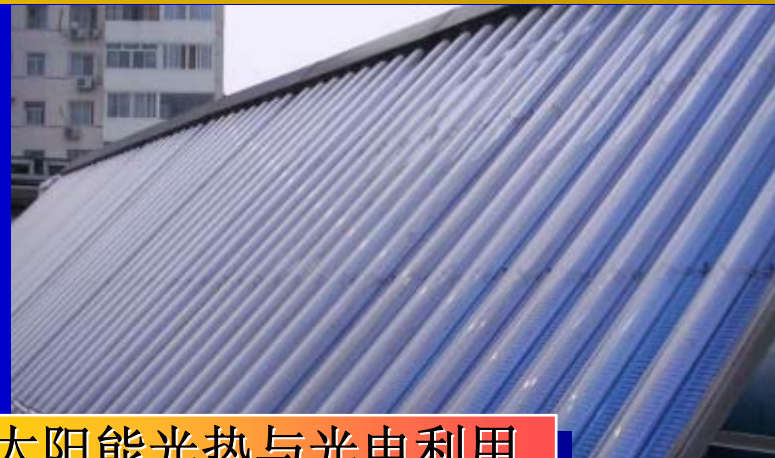


绿色建筑特征

Green Building Features



屋顶花园
Roof Garden



太阳能光热与光电利用
Solar Thermal and Photovoltaic



遮阳与反光板
Shading and Natural Lighting





LEED评估

Evaluated by LEED

■ 评估结果：将获得金（或者银）奖

■ To be certified as: Golden or Silver Level!

是	?	否			
8		11	能源与大气		17分
Y			必要项 1	建筑基本系统运行调试	必需
Y			必要项 2	最低能效性能	必需
Y			必要项 3	降低暖通空调设备使用CFC	必需
X			项目 1.1	优化系统能效性能,用能降低:新建筑20% / 已有建筑10% (费用计)	2
X					
X			项目 1.2	优化系统能效性能,用能降低:新建筑30% / 已有建筑20% (费用计)	2
X					
X			项目 1.3	优化系统能效性能,用能降低:新建筑40% / 已有建筑30% (费用计)	2
X					
		X	项目 1.4	优化系统能效性能,用能降低:新建筑50% / 已有建筑40% (费用计)	2
		X			
		X	项目 1.5	优化系统能效性能,用能降低:新建筑60% / 已有建筑50% (费用计)	2
		X			
		X	项目 2.1	再生能源, 使用5% (费用计)	1
		X	项目 2.2	再生能源, 使用10% (费用计)	1
		X	项目 2.3	再生能源, 使用20% (费用计)	1
		X	项目 3	补充运行调试	1
X			项目 4	防止破坏臭氧	1
		X	项目 5	检验与查核	1
X			项目 6	绿色电力	1

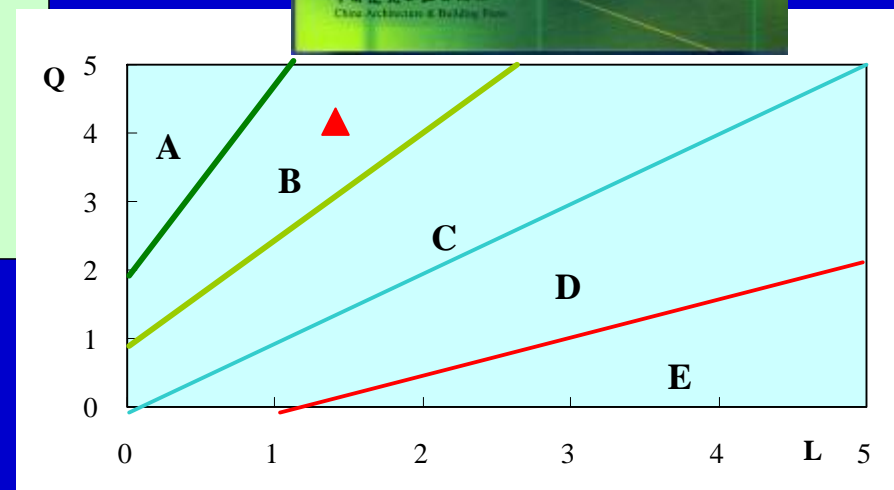
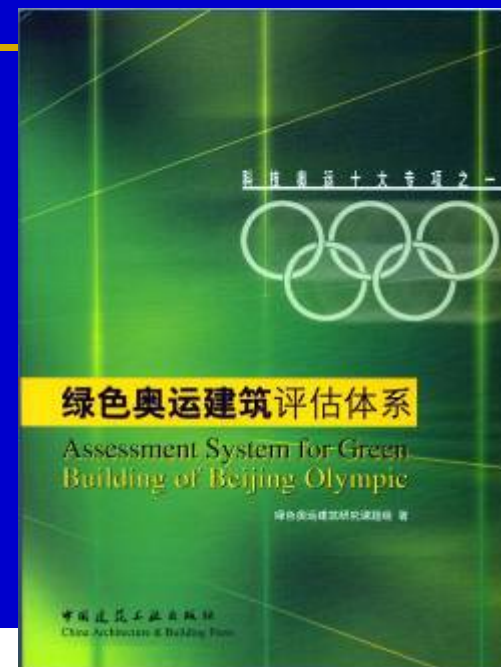
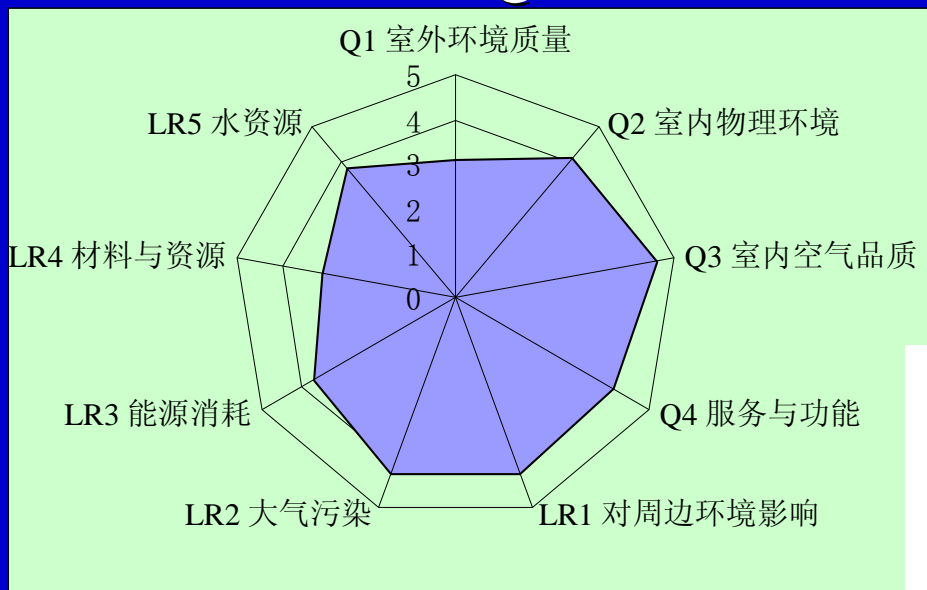




GOBAS评估 Evaluated by GOBAS

■ 评估结果：B级绿色建筑

■ Result in Q-L Chart: Level B





评估的局限性

Limitation of Evaluation

- 局限于规划和设计阶段
 - Only in Planning and Design Stages
- 全生命周期评估—全面，周期长，不确定性多
 - Building Life Cycling Evaluation
 - Comprehensive
 - Time-consuming, uncertainty during construction
- 现实—建筑物建成时与设计方案有一定差别
 - Result – Far away from design when accomplished
- 建成真正绿色建筑的一个关键点？
 - Key to reach a real green building construction?



性能诊断和优化 Commissioning

- 广义与狭义概念
 - Generalized or Specialized Concept
- 广义—贯穿建筑物全生命周期的每一个环节
 - BLC Commissioning – in every stage
- 狭义—建成后、投入使用前的系统调试与调节
 - After construction, before facility management
 - Setting, diagnosis, regulation, optimization...
- 对于绿色建筑有特殊的意义—复杂系统、设备
 - Especially to Green Building – Complex, new devices and systems



目标与任务

Goals and activities

- 了解系统建成后的实际运行现状
 - General – learn real performance of the completed systems
- 改正错误，使得设备正确运行
 - Components – diagnosis and make it
- 提出系统合理运行方案
 - System – optimized functioning scheme
- 能耗分析与评估
 - Special interests – energy audit and assessment



方法 Method

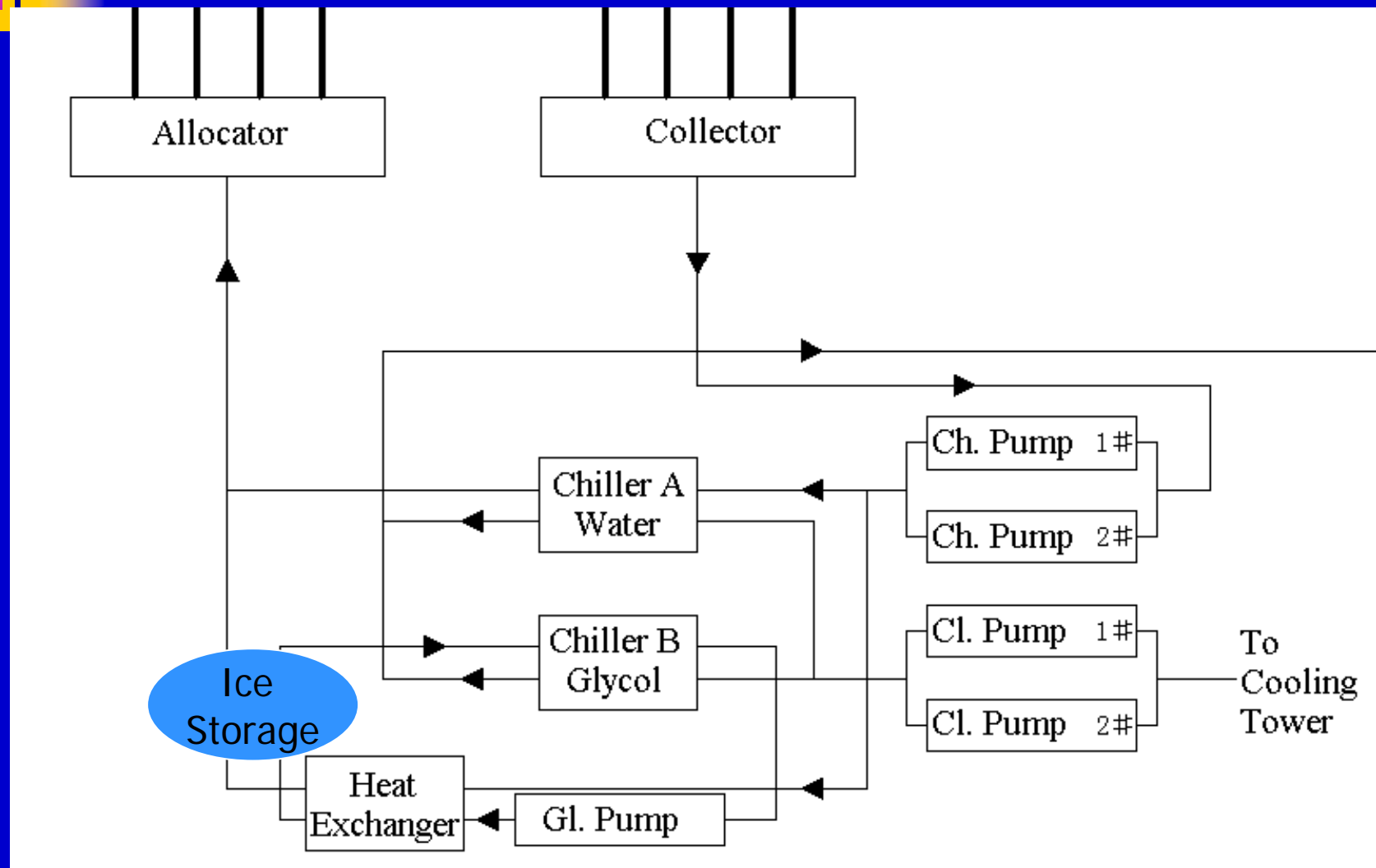
- 四周现场测试与半年连续测量记录相结合
 - On-site spot measurement – 3 weeks
 - Continuously record – 6 months





系统简介

System Brief

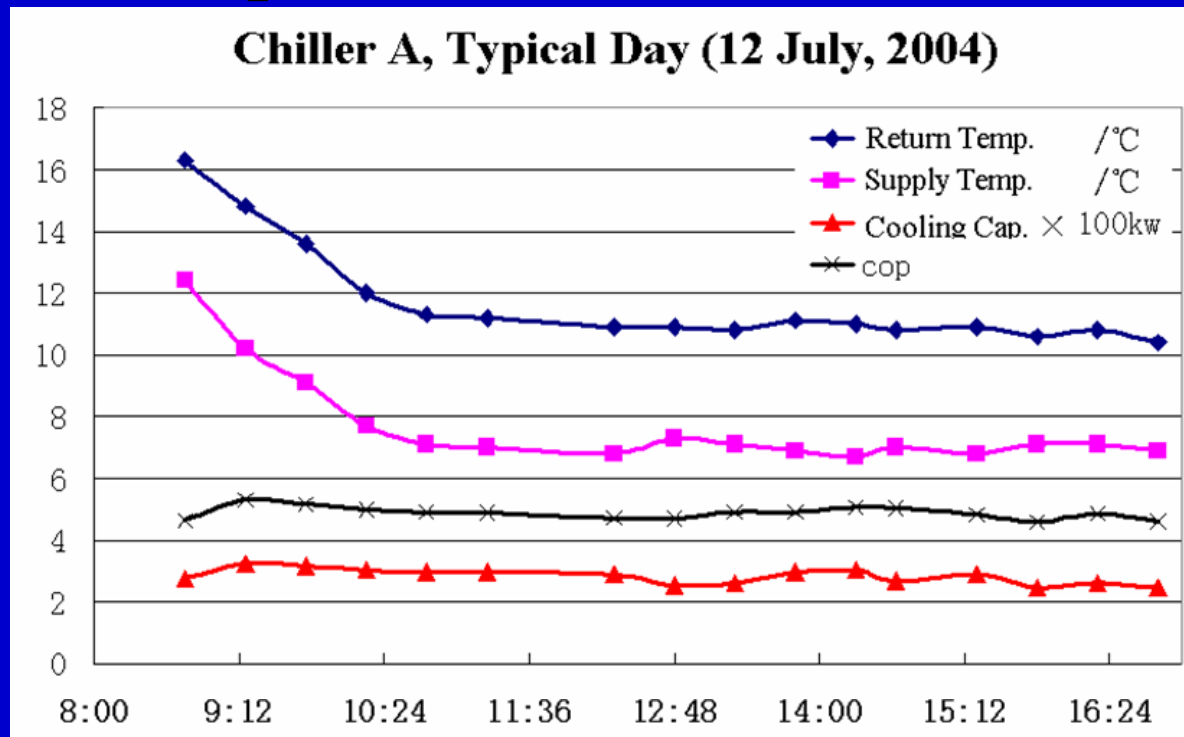




一些结果—优点

Some results - Positives

- 冷冻机效率较高—双压头螺杆机组
 - High performance of chillers – 2-stage Screw Compressor





发现的一些问题

Some problems we found

- 小问题—板换无保温导致热损失
 - Minor problem – Heat loss of the heat exchanger due to no insulation



Heat (kW)	Day 1	Day 2
Glycol Side	310.5	319.9
Water Side	268.9	281.7
Loss	13.4%	11.9%

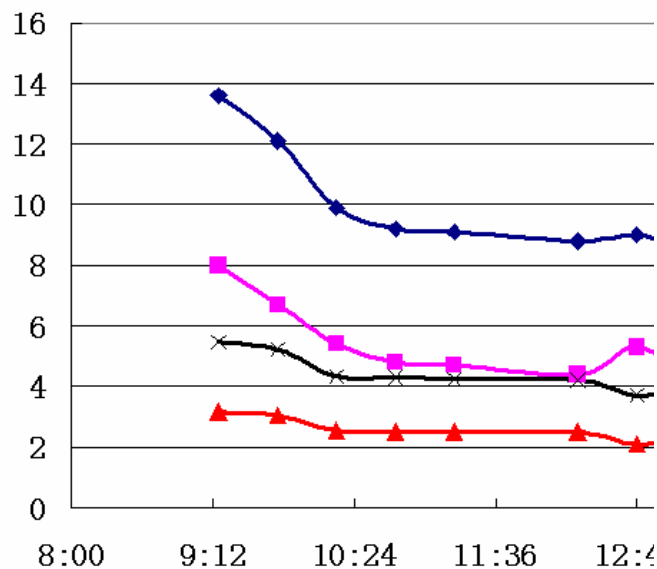


冰蓄冷系统

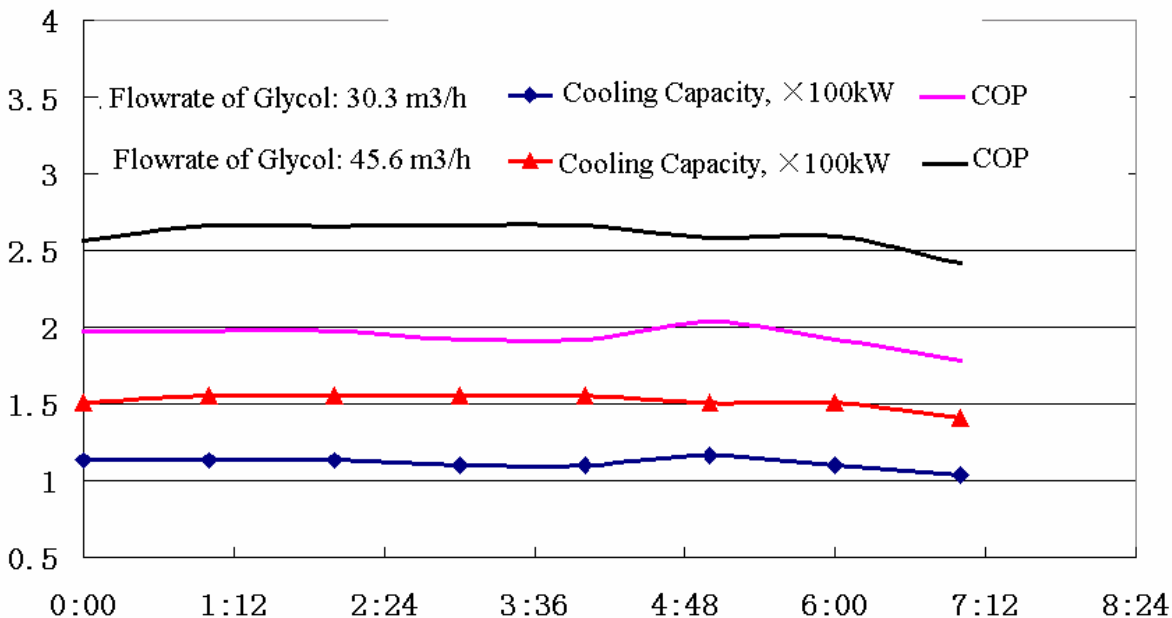
Ice Storage System

- 问题：蓄冰时间过长—冷机选小了还是其它？
- Problem: Extra long time for freezing – undersize of chiller? Or other problems?

Chiller B, Typical I

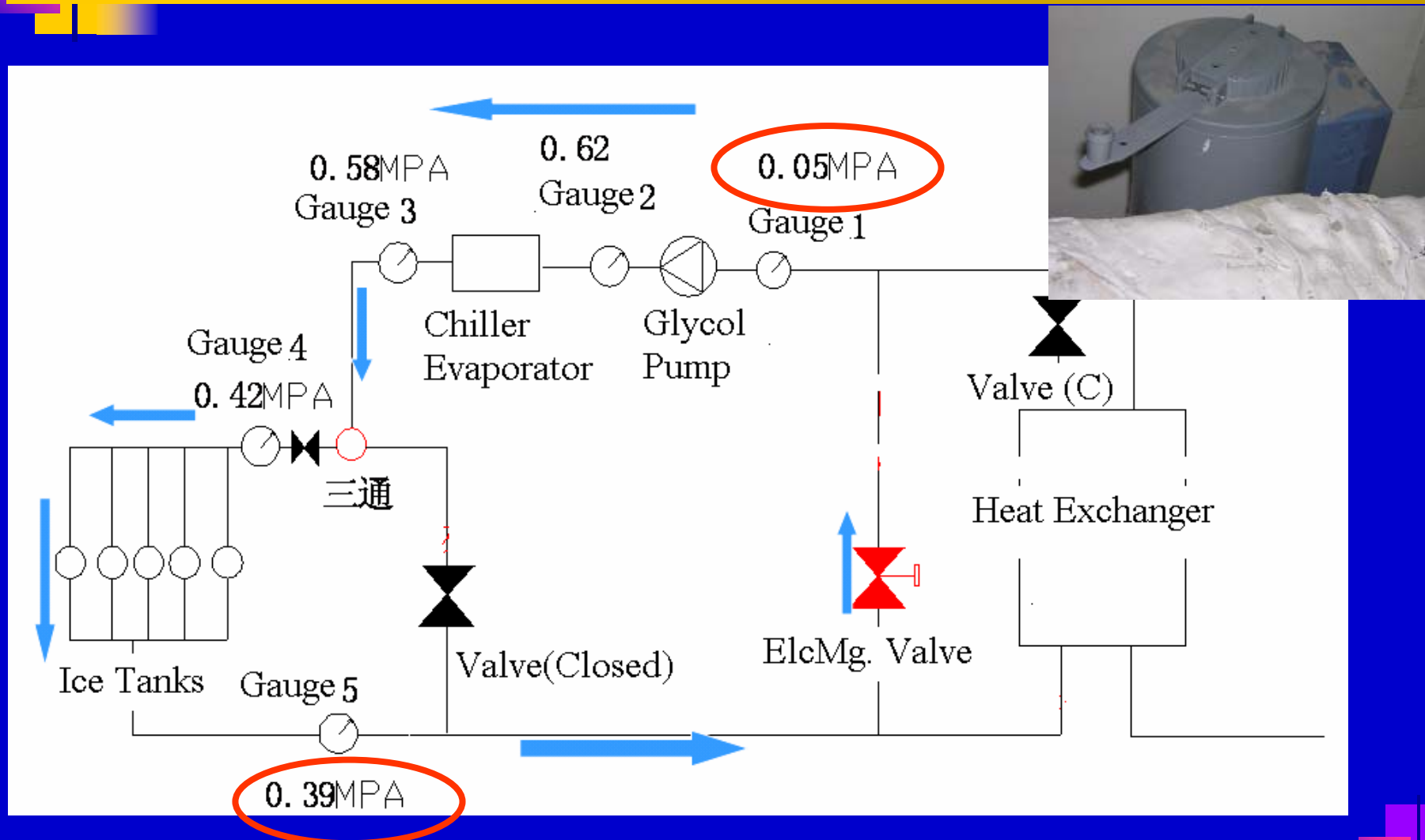


Chiller B, During Freezing



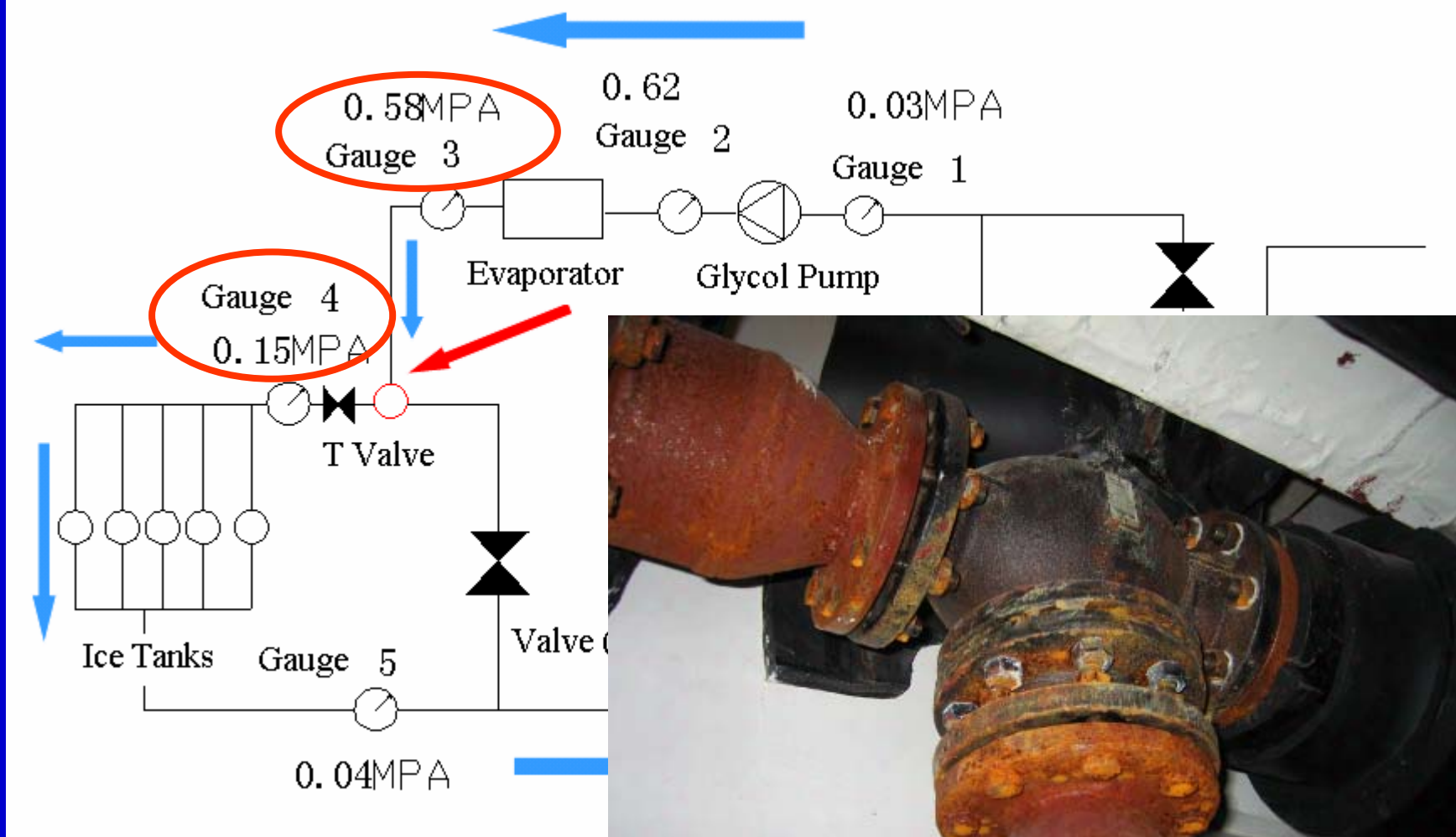


乙二醇管路系统 Piping System of Glycol





乙二醇管路系统 Piping System of Glycol





冷冻水泵和冷却水泵

Pumps for water circulation

- 效率非常低！
 - Very poor efficiency!
- 泵选大了（设计中经常的问题）
 - Oversize of the pumps (common problem in design)

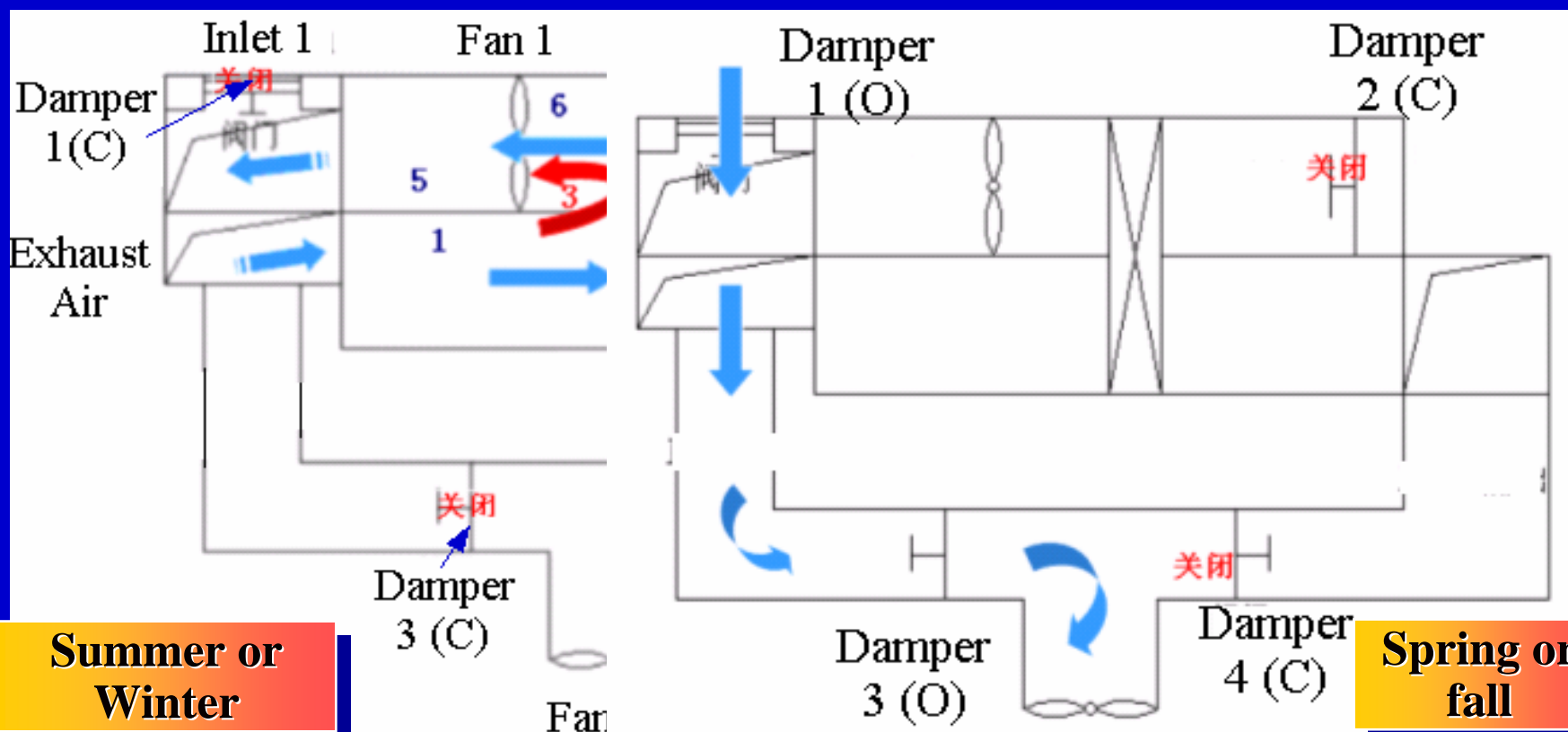
	Flowrate	Current	Pressure head	Power output	Power input	Efficiency
	m ³ /h	A	Mpa	kW	kW	%
Ch. Pump A	61.2	11.1	0.17	2.89	6.34	45.6
Ch. Pump B	59.4	11.2	0.17	2.81	6.4	43.8
Average	60.3	11.15	0.17	2.85	6.37	44.7
Cl. Pump A	55	16.1	0.17	2.6	9.2	28.2
Cl. Pump B	63.4	16.2	0.17	2.99	9.26	32.4
Average	59.2	16.15	0.17	2.795	9.23	30.3
Glycol pump	54.6	20.2	0.48	7.28	11.54	63.1



重要节能设备—转轮回收

Enthalpy Wheel for Heat Recovery

- 设计的很好，进口设备
 - Well designed, imported from Sweden

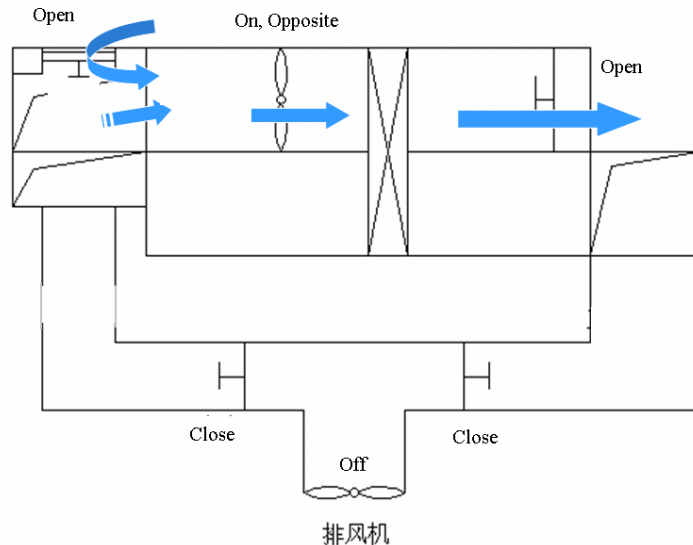




安装完成后

When Installation Accomplished

- 转轮无法正常运行：
 - Not functioned due to:
- 风阀开启/关闭位置错误；无法电动控制调节
 - Dampers in wrong position





效果 Results

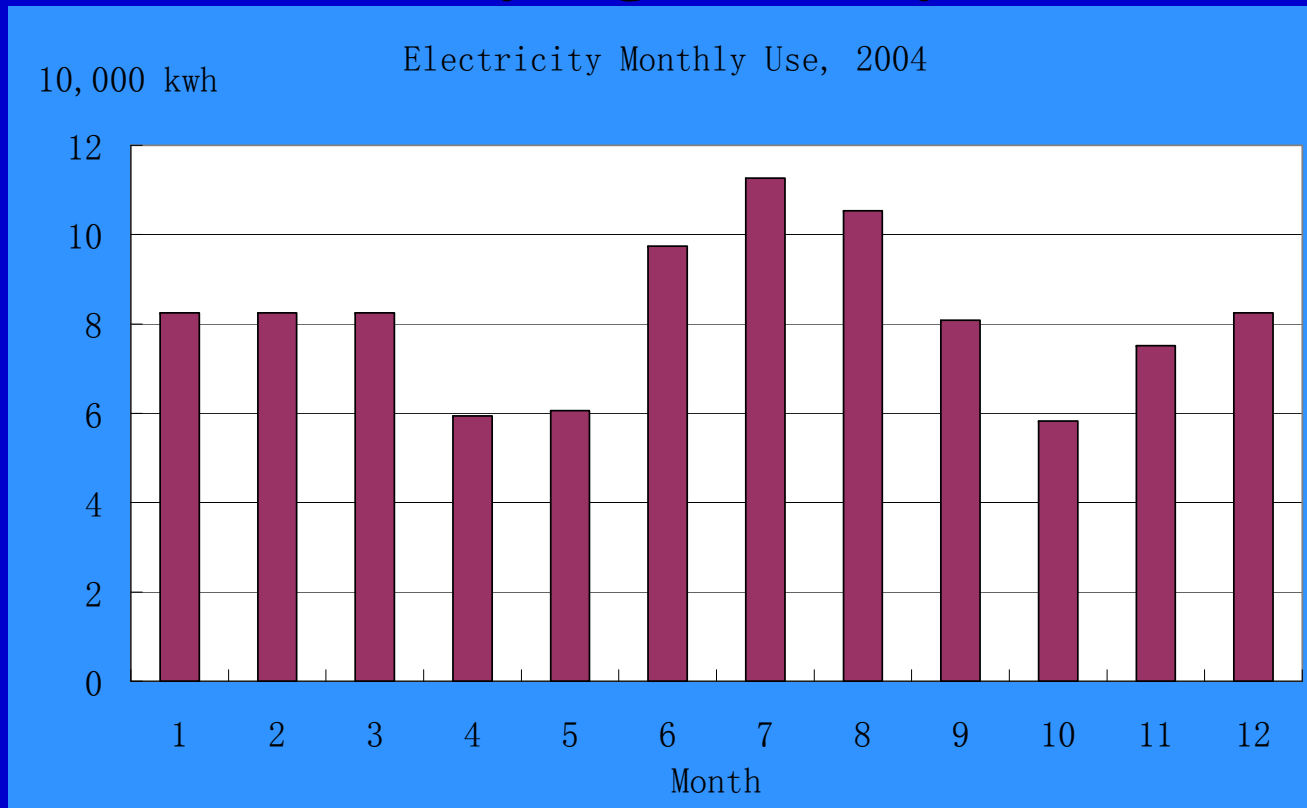
- 甲方要求施工方根据测试结果逐项进行改正
 - Building owner asked installers to correct their faults according to commissioning results



建筑电耗统计

Building Electricity Use Audit

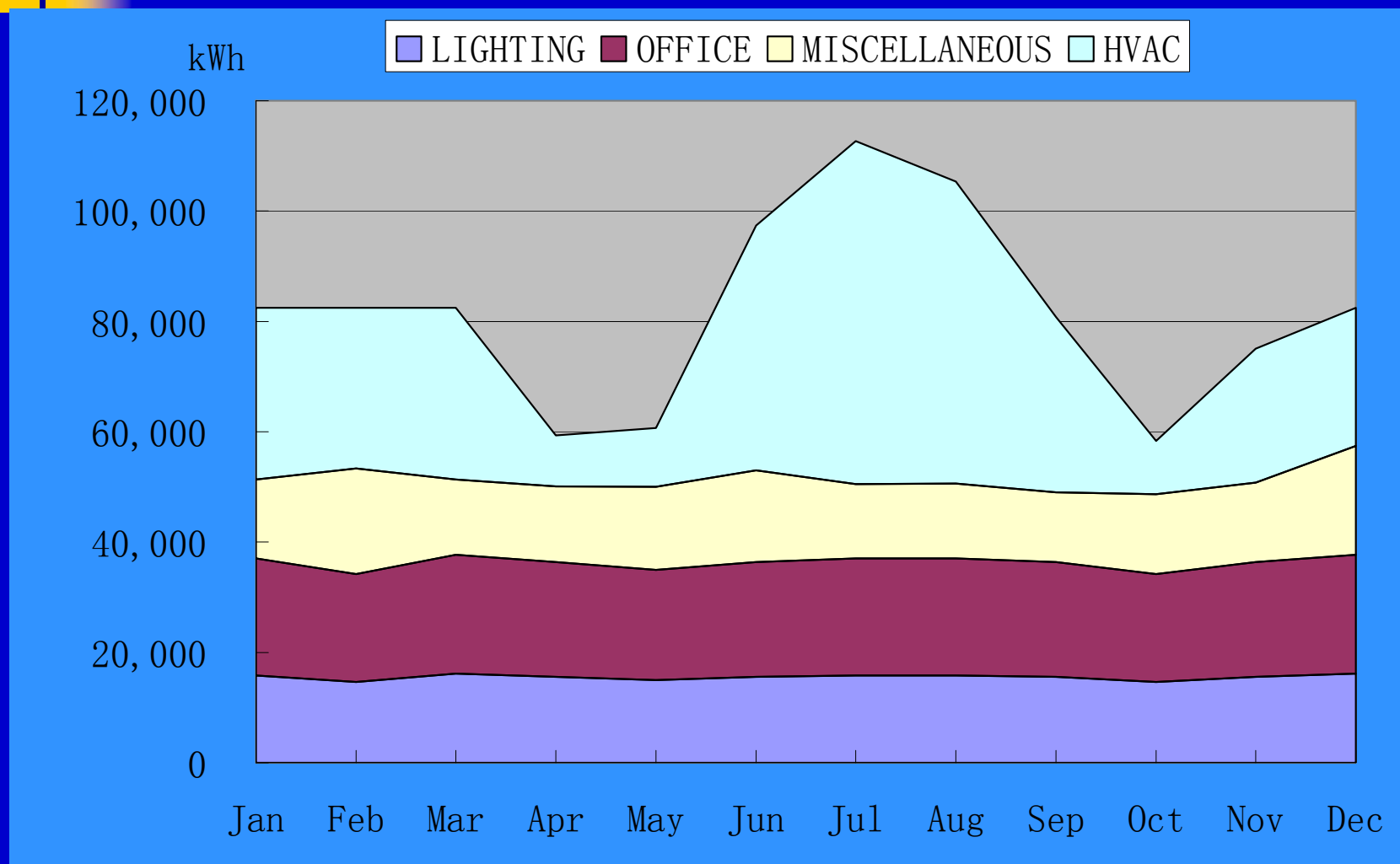
- 数据来源：值班每日记录，月度电费帐单
- Data source: daily log, monthly bill





建筑逐月电耗分类统计

Electricity End-use Split, monthly

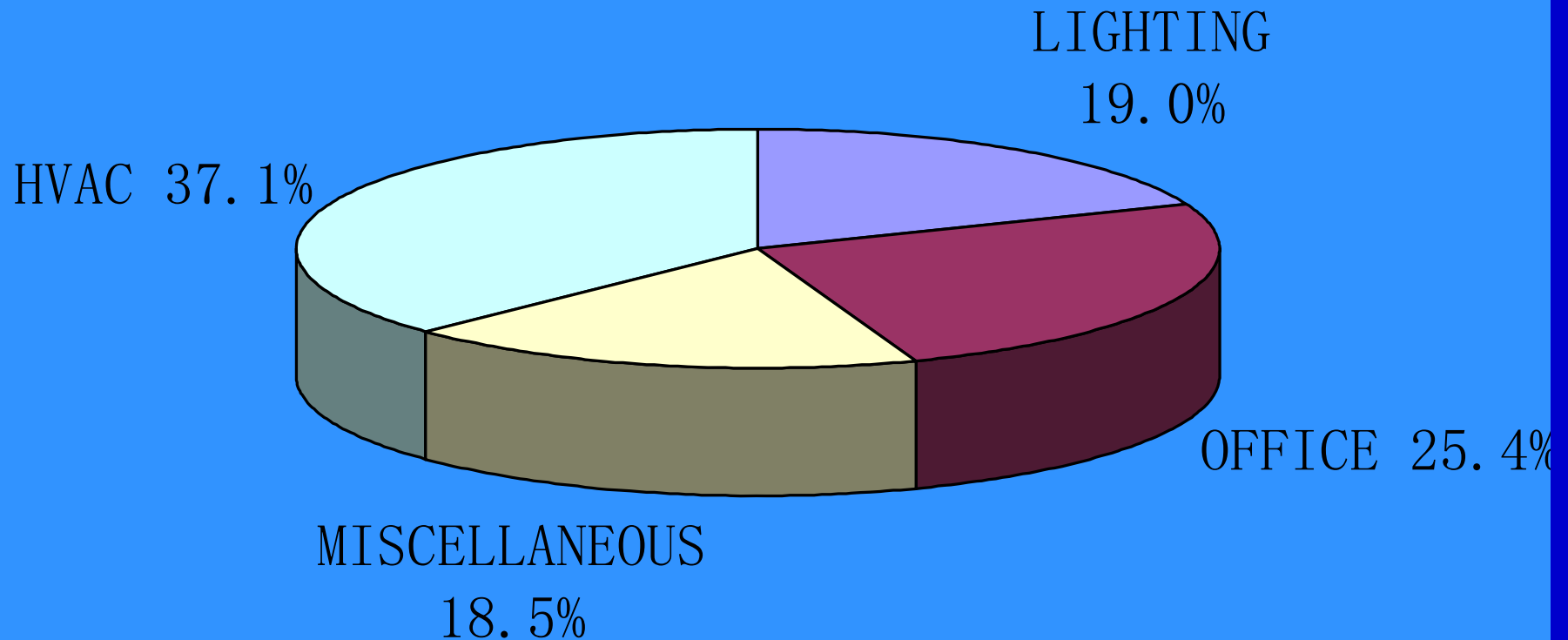




建筑全年累计电耗分类统计

Electricity End-use Split, year

Year Electricity Consumption End-use Split





电耗状况与节能潜力

Electricity Use Status and Potential Saving

- 建筑全年总用电量：980,000度
 - Totally Annual EU: 980,000kWh
- 单位面积年耗电量：74.1度/平米-年，远远低于北京同类建筑电耗（125~200kWh/m²-y）
 - EU per floor area: 74.1kWh/m²-y (average EU in similar building in Beijing: 125~200 kWh/m²-y)
- 进一步的节能潜力集中于暖通空调系统一季节性高峰（电价也最高）
 - Further energy saving: HVAC system
 - Seasonal peak demand, economically

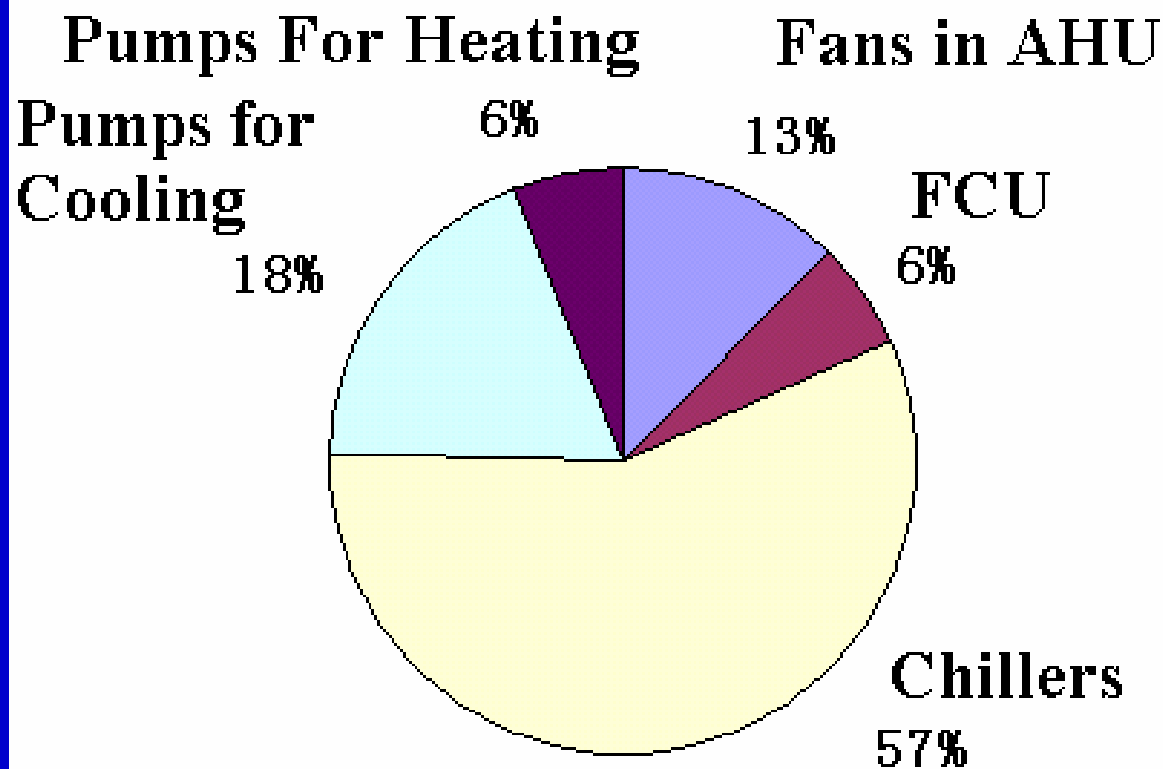
HVAC系统电力装机容量分类统计

HVAC System Electricity Capacity Split

ESL-IC-06-11-321



Equipment Electricity Capacity Split



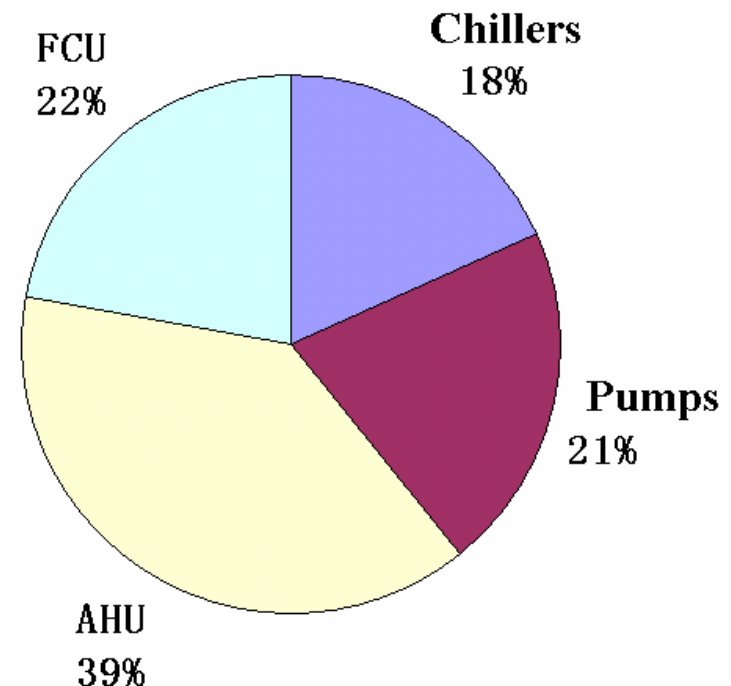


全年累计电耗分类统计

HVAC System Electricity Use Split, Year

- AHU中的风机电耗大—24小时连续运行
 - AHU: 24-h continuously functioned
- 水泵电耗大—效率低
 - Pumps: Low efficiency
- 冰蓄冷—尚未全面运行
 - Ice Storage: not fully functioned yet

HVAC System Electricity Use Split





结论：与评估比较

Conclusion: Compare to evaluation

- 绿色建筑评估—能够评价、得到一个好的设计
 - Evaluation – To assess and get a good design
- 性能诊断与优化—空白，更困难，产生实际节能效果，更多关注和努力
 - Commissioning
 - Bridge the gap between design / construction and long-term use of building
 - More difficult
 - Solve problem and lead to energy saving in reality
 - Pay more attention and efforts on it



结论：正在开展的工作

Conclusion: Ongoing Works

- 对新建大型公共建筑节能实施全过程严格审查
 - BLC Commissioning to large scale commercial building – strictly
- 规划，设计，建设，调试，运行管理
 - Planning, design, construction, regulation, management
- 大型办公楼、高级酒店、大型商场等—高电耗密度，潜力大
 - High level offices buildings, hotels, malls, etc. – high EU density, large saving potential



谢谢！ Thank you for your attention!

November, 2006