

HVAC Commisioning– A Status Report in Taiwan

Dr. K.H. Yang
Fellow ASHRAE

Professor, National Sun Yat-Sen University
Kaohsiung, Taiwan

kh-yang@mail.nsysu.edu.tw

2006.11.

Introduction

- Being located in subtropical area, the weather in Taiwan is constantly hot and humid, with ambient temperature around 35 °C and relative humidity of 85 %, which imposes heavy cooling load to buildings under commercial operation. The power consumption of commercial and residential buildings account for over 14% of total in the whole nation.
- In 2003, the Ministry of the Interior, or MOI ,decided to conduct an overall renovation program for the HVAC systems of existing governmental buildings where it is mandatory to adapt BEMS and conducting system commissioning .
- This program not only constructs an important step in responding to the national movement toward the Green Building concept, but provides a remedial strategy for building energy conservation and CO2

Commissioning Guideline

- Public Projects with total budget sponsored by the government for over 50 million NTD (1.5 million USD) and floor areas over 2,000 m² should be regulated under the Green Building Labeling system where TAB/CX procedure is considered a must..
- All public buildings with central HVAC systems, when under renovation process, should adapt the TAB/CX procedure recommended by the Bureau of Energy of Taiwan to be issued in December 2006.
- The procedure includes regulations under stages in design, installation, functional tests, and performance in conformity with the design intent. This structure has been adapted from the ASHRAE procedure.

Commissioning Examples

HVAC System Renovation Projects with TAB/CX implemented

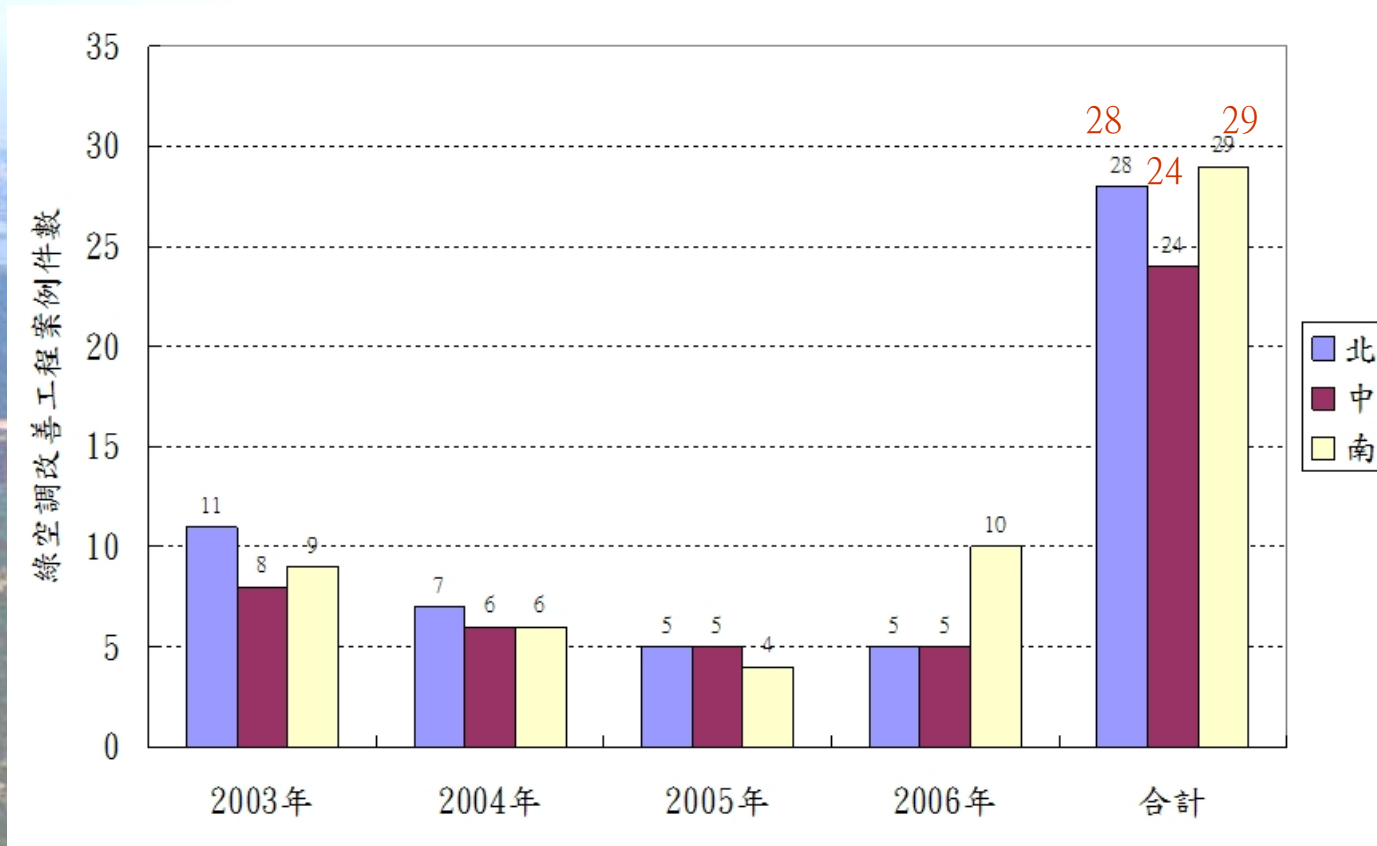


Figure 1 The statistics of the number of projects allocated among the whole country since 2003 to 2006, totalled 81, all with TAB/CX implemented

Allocation of HVAC Renovation projects around the country since 2003-2006, with TAB/CX implemented

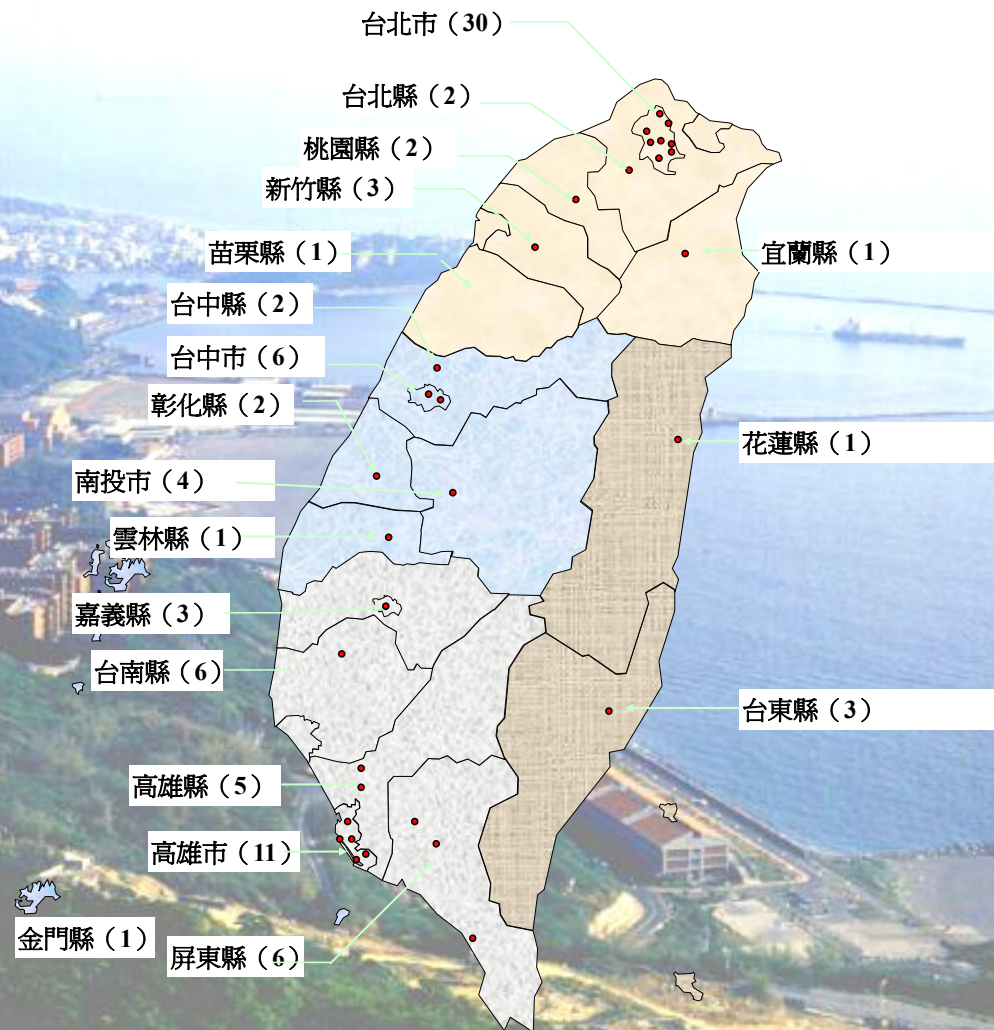
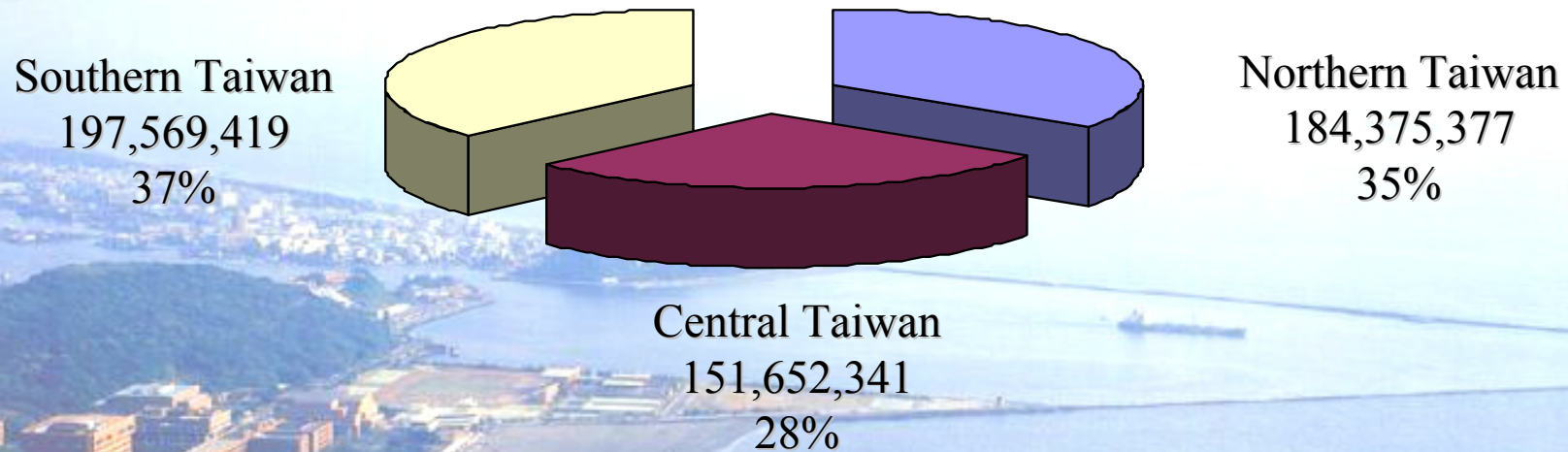


Figure 2 The corresponding budget spent revealing a delicate balance among all 3 areas in Taiwan



	2003 Budget NTD	2004 Budget NTD	2005 Budget NTD	2006 Budget NTD	TOTAL NTD
Northern	85,955,030	29,417,223	34,503,124	34,500,000	184,375,377 (5,755,000 USD)
Central	46,322,634	35,251,148	36,578,559	33,500,000	151,652,341 (4,739,000 USD)
Southern	80,945,336	27,239,489	34,884,594	54,500,000	197,569,419 (6,174,000 USD)
TOTAL	213,223,000	91,907,860	105,966,277	122,500,000	533,597,137 (16,668,000 USD)

Table 1 The Energy Consumption Standard of Chillers, issued by the BOE of Taiwan, 2003-2005 as a Mandatory Guide in HVAC System Selection during the Design Stage

執行階段		第一階段		第二階段		
實施日期		民國九十二年一月一日		民國九十四年一月一日		
型式	冷卻能力等級	能源效率比值 (EER) kcal/h · w	性能系數 (COP)	能源效率比值 (EER) kcal/h · w	性能系數 (COP)	
水冷式	容積式壓縮機	<150RT	3.50	4.07	3.83	4.45
		≥150RT ≤500RT	3.60	4.19	4.21	4.90
		>500RT	4.00	4.65	4.73	5.50
	離心式壓縮機	<150RT	4.30	5.00	4.30	5.00
		≥150RT ≤300RT	4.77	5.55	4.77	5.55
		>300RT	4.77	5.55	5.25	6.10
氣冷式	全機種	2.40	2.79	2.40	2.79	

Results and Outcome of the Program in 2003~2005

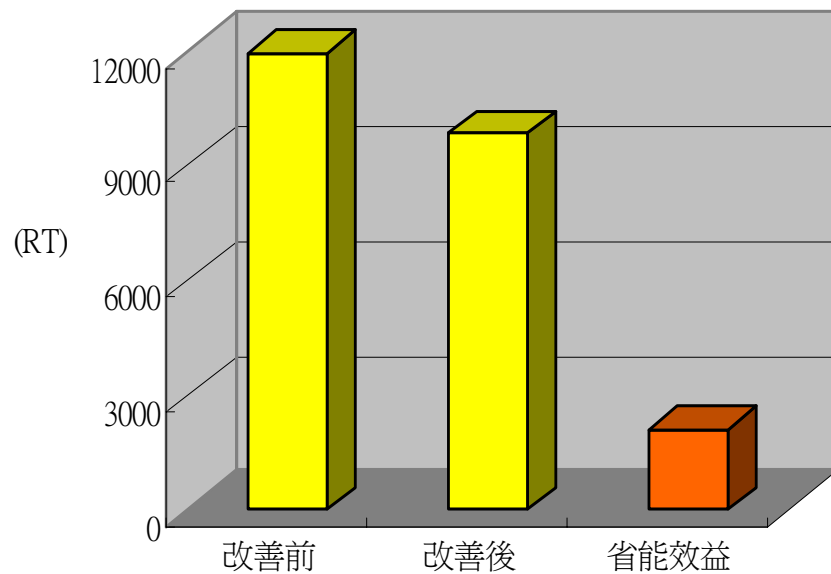
- Figure 1 shows the statistics of the number of projects allocated among the whole country since 2003 to 2005, with the corresponding budget spent as shown in figure 2 revealing a delicate balance among all 3 areas.
- The renovation program results in reduction of oversized chiller capacity of 2,120 RT, or accounts for 21% of the total cooling capacity, with 44% energy saving effects.

TAB/CX Results

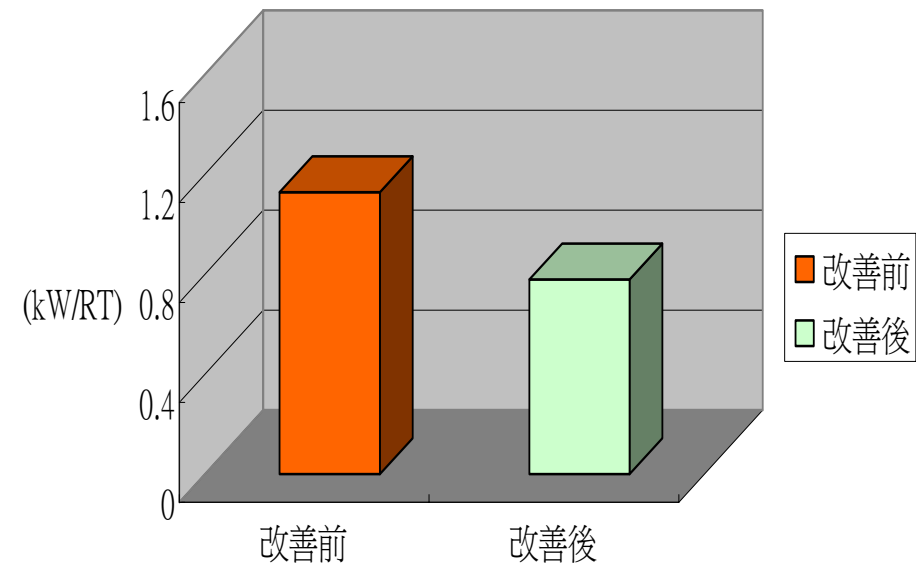
- The Green HVAC Concept

Oversize reduction reached 2120 RT, or 21% of total tonnage,
with energy efficiency of chillers increases 44%

冰水主機容量



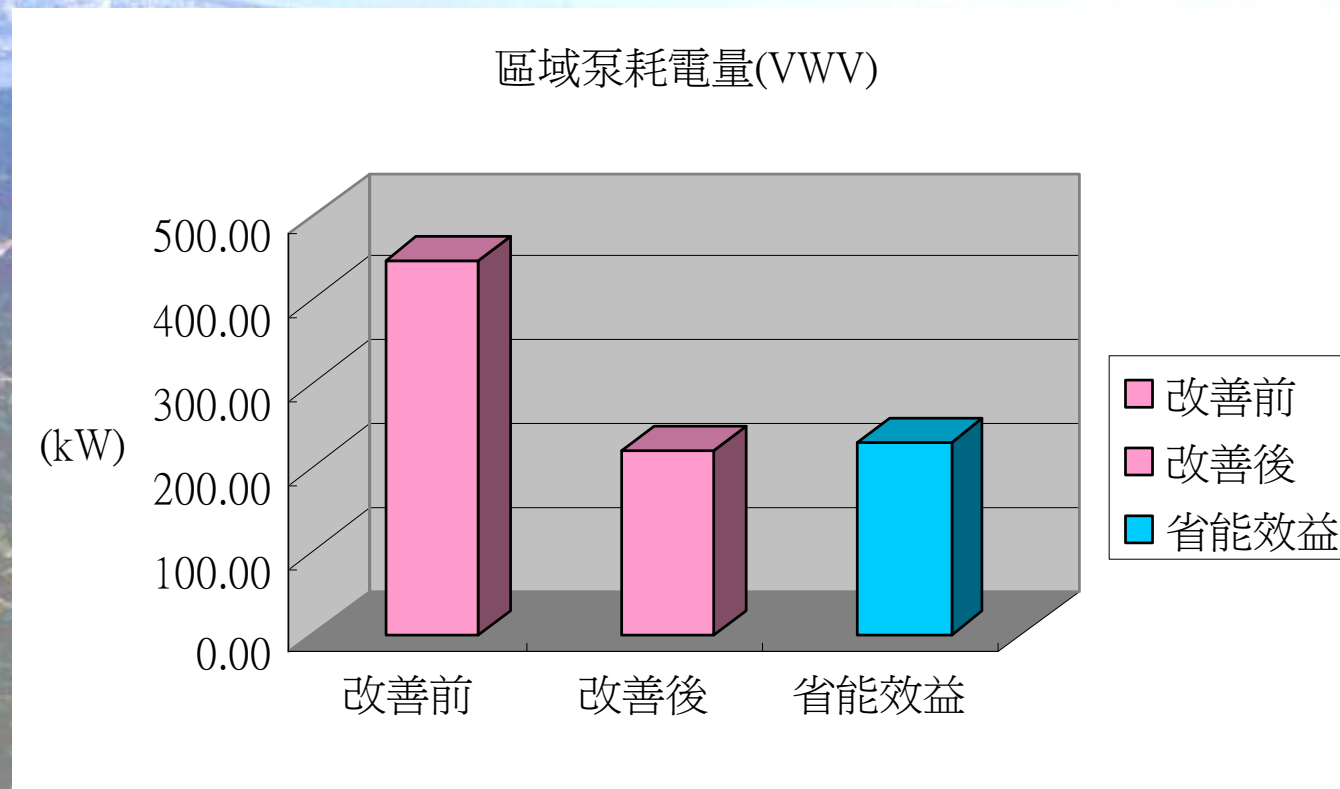
冰水主機運轉耗電量



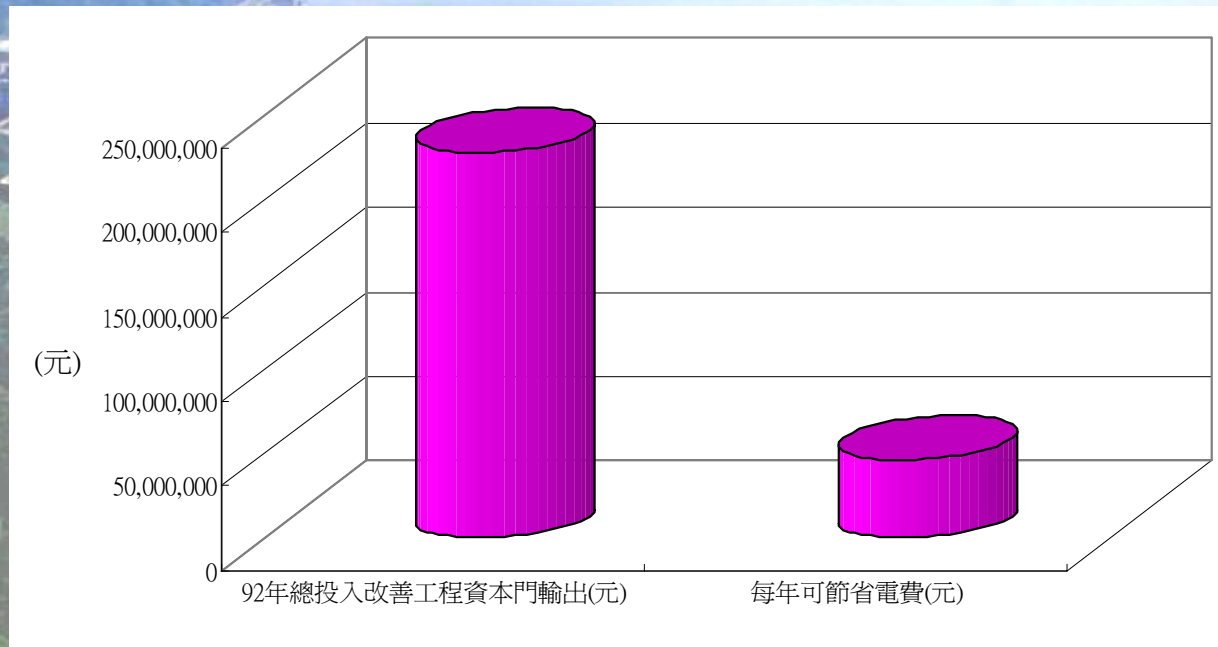


VWV and VAV systems were adapted widely, with energy savings of 40% to 60%.

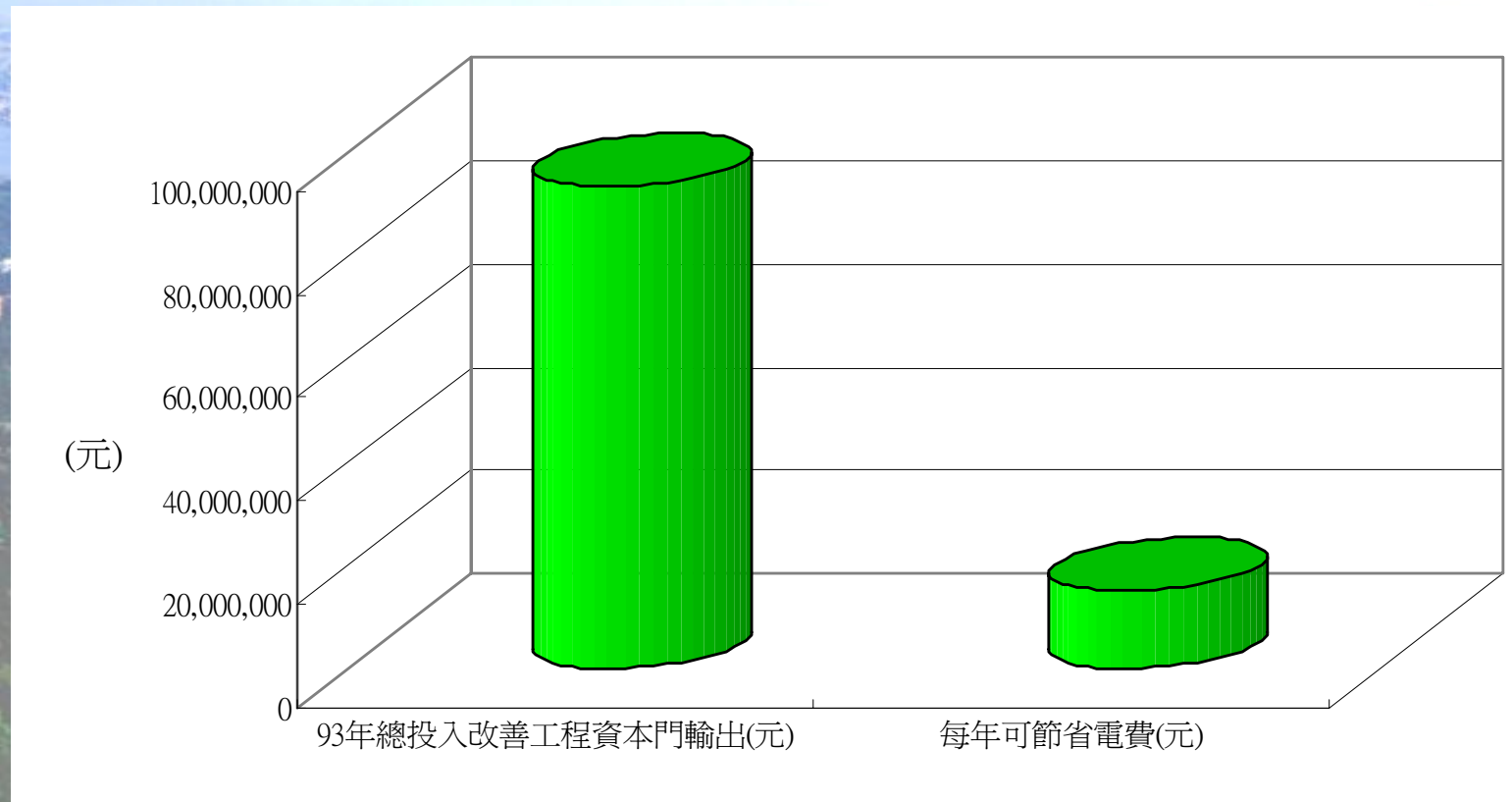
VWV system saved 228 KW, while 19.7 KW was saved for the VAV system



Economic assessment—For example, 228,000,000NTD was spent in 2003, with operational cost savings of 46,273,465 NTD, the payback year is around 5.2 .



Similarly, for the year of 2004, the payback period is around 6.3 years.



現場測試記錄表 (※驗收必要表格)

★注意：「測試調整」不可能一次完成，承包商需先自行調整妥當後，再會同業主及技師核驗。未填妥數值或未在OK 處打 號者，視同不合格。

項次	項目	動力中心BF (*第一次測試)									醫院BF	動力中心BF (*第二次測試)									醫院BF
		①3"φ	②5"φ	③5"φ	④4"φ	⑤4"φ	⑥6"φ	⑦6"φ	⑧1.5"	⑨1.5"		①3"φ	②5"φ	③5"φ	④4"φ	⑤4"φ	⑥6"φ	⑦6"φ	⑧1.5"	⑨1.5"	
1.	流量值 Lpm ※開CP1及CP3泵 ※負載測2通閥全開	設計值	800	1500	1700	1500	1500	4000	4000	150	125	800	1500	1700	1500	1500	4000	4000	150	125	
		實測值																			
		刻度																			
2.	@設計Lpm之 壓力表kg/cm ²	位置	CP1冰水泵(額定 Amp)			CP3冷卻泵(額定 Amp)			蒸發器	冷凝器	CP2冰水備用泵(額定 Amp)			CP4冷卻備用泵(額定 Amp)							
		壓力值	y型入	入	出	y型入	入	出	入	出	y型入	入	出	y型入	入	出					
3.	壓差值	流量Lpm	@6000	@5000	@4000	@3500	@3250	@3000	閥體動作	註1：逐漸關小①~④，記錄左列Lpm時之△P。											
		△P,kpa							OK <input type="checkbox"/>	註2：@3000Lpm之壓差值為之控制設定值。											
4.	CT1冷卻塔風扇變速測試	a. 高速(4P)：_____ Amp。 b. 低速(8P)：_____ Amp (註：≤28°C時，低速運轉，≥30°C時，高速運轉)																			
5.	CT2冷卻塔風扇變速測試	a. 高速(4P)：_____ Amp。 b. 低速(8P)：_____ Amp (註：≤28°C時，低速運轉，≥30°C時，高速運轉)																			
6.	CT3冷卻塔風扇變速測試	a. 高速(4P)：_____ Amp。 b. 低速(8P)：_____ Amp (註：≤28°C時，低速運轉，≥30°C時，高速運轉)																			
7.	電腦操作順序測試	a.開機：CT3 → P5 → CP3 → CH3, OK <input type="checkbox"/> b.停機：CH3 → P5 → CT3 → CP3, OK <input type="checkbox"/>																			
8.	手動開、關機測試	a.開機：CT3 → P5 → CP3 → CH3, OK <input type="checkbox"/> b.停機：CH3 → P5 → CT3 → CP3, OK <input type="checkbox"/>																			
9.	本地監控、列印測試	動力中心： <input type="checkbox"/> kw, <input type="checkbox"/> kwh, <input type="checkbox"/> RT, <input type="checkbox"/> kw/RT, <input type="checkbox"/> Lpm, <input type="checkbox"/> T1, <input type="checkbox"/> T2, <input type="checkbox"/> T3, <input type="checkbox"/> T4。負載比 <input type="checkbox"/> ※附列印表																			
10.	遠端監控、列印測試	凱達： <input type="checkbox"/> kw, <input type="checkbox"/> kwh, <input type="checkbox"/> RT, <input type="checkbox"/> kw/RT, <input type="checkbox"/> Lpm, <input type="checkbox"/> T1, <input type="checkbox"/> T2, <input type="checkbox"/> T3, <input type="checkbox"/> T4。負載比 <input type="checkbox"/> ※附列印表																			
11.	冰水機出廠測試報告	製造商：_____ RT≥150RT, _____ kw/RT≤0.79kw/RT (※附測試報告)。 OK <input type="checkbox"/>																			
		第二單位：_____ RT≥150RT, _____ kw/RT≤0.79kw/RT (※附測試報告)。 OK <input type="checkbox"/>																			

判定與備註： 核驗日期： 年 月 日

(本表為樣張，將依個案調整)

核驗人員： 業主代表： _____ 。 承包商： _____ 。 技師： _____ 。

修正內容 REVISION DESCRIPTION	業主同意 APP'D	繪圖 DRAWN	審核 CHECKED	比例 SCALE	NO	工程名稱 PROJECT DESCRIPTION	圖名 SHEET CONTENT	圖號號 JOB NO.
1		設計 DESIGNED	何宗岳	單位 UNIT		凱達冷凍空調技師事務所 高雄市左營區德威街106號 TEL: 07-567-1766 FAX: 07-567-2055 Email: sales.tempace@msa.hinet.net	空調系統節能改善工程 現場測試記錄表	張數
2		核對 CHECKED	何宗岳	日期 DATE				圖號
3		核對 APPROVED						工程地點 SITE

CONCLUSIONS

1. TAB/CX procedure has been mandatory since 2003 in public projects with central HVAC systems.
2. With 81 public projects completed and 16.6 million USD well spent, the TAB/CX procedure is adapted well with successful results in Taiwan.
3. A national-scale formal TAB/CX Guideline to be issued by the Bureau of Energy of Taiwan by the end of year 2006.
4. To regulate in 4 steps:
 - (1) Design
 - (2) Installation
 - (3) Functional Tests
 - (4) Operational conformity with the design intent
5. Paving the way to ESCO M&V .Procedure in Taiwan

Thank you very much !

Danke Schoen !!

どうも，有難う御座いました！

多謝！！多謝！！有閒來迫迫呷海產！！

簡報結束，敬請指教！

Dr. K.H. Yang

(07)5252000 #4217

E-mail : kh-yang@mail.nsysu.edu.tw