SETatWork Good Practice
High Efficiency Chiller

Setting	
Country	Thailand
Location	Sriracha, Chonburi Province
Project start date	September, 2004
Project end date	January, 2005
Technology keywords	Building
Host sector	Hospital

Technical summary of the project

Objective of the project	To save energy by replacing old chillers with high efficiency chillers and also to reduce maintenance cost.

Project description

Phyathai hospital is located in Sriracha town, Chonburi province, about 120 km. east of Bangkok.

Energy audit was done at the hospital in 2003. Total energy consumption was about 4,195,000 kWh and cost about 10,884,000 Baht in 2003. Average electricity cost was 2.60 Baht/kWh. The hospital has 5 air-cooled reciprocating chillers (each 210 TR-ton of refrigeration) and they had been in operation for 10 years. Two chillers were in operation and 3 chillers could not operate properly. It was found that the existing air-cooled chillers have a very low efficiency in a range of 1.66-2.17 kW/TR. Efficiency of a new air-cooled chiller is about 1.1-1.18 kW/TR. The maintenance costs were also high, about 500,000 Baht/year/unit. From the energy audit report, the chillers consumed about 2.06 million kWh/year (operated 24 hours/day and 365 days/year) or about 5.63 million Baht/year or about 50% of total energy consumption. Figures A and B show the schematic diagram and a photo of the existing air-cooled chillers.

From the existing conditions, the hospital decided to replace the worn out chillers. The hospital's energy consultant, Innovation Technology Co., Ltd., proposed and compared 3 options for consideration. Those are:

- First, replace with the same type of air-cooled chillers with an efficiency of 1.18 kW/TR;
- Second, replace with water-cooled screw chiller with an efficiency of 0.65 kW/TR and; and
- Third, overhaul the existing 4 chillers.

From the study, replacement with water-cooled screw chiller gave a highest energy savings of 3.48 million Baht/year as compared with 2.41 and 1.49 million Baht for new air-cooled chillers and overhauling of the existing chillers, respectively as shown in Table A. Figures C and D show schematic diagram and a photo of the new water-cooled chillers.

TABLE A: COMPARISON OF 3 OPTIONS FOR CHILLER REPLACEMENT

Option No.	Measure	Qty.	Est. Energy Consumption (kWh/year)	Investment (Baht)	Net Cost Saving* (Baht)	Payback (Year)	IRR %
1	New air-cooled reciprocating chillers	2	1,503,072	5,600,000	2,405,700	2.33	43.05
2	New water-cooled screw chillers	2	840,470	8,000,000	3,478,400	2.30	43.62
3	Overhaul the existing chillers	4	1,759,680	4,000,000	1,488,500	2.69	36.77

* Net cost including energy, operating and maintenance costs.

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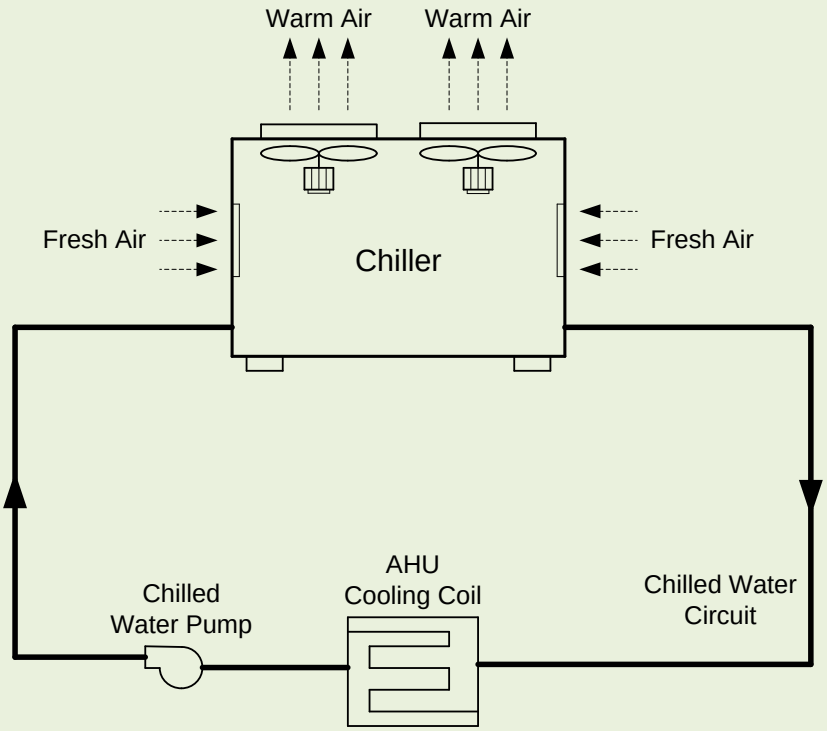

FIGURE A: SCHEMATIC DIAGRAM OF AIR-COOLED CHILLER

FIGURE B: PREVIOUS AIR-COOLED CHILLERS

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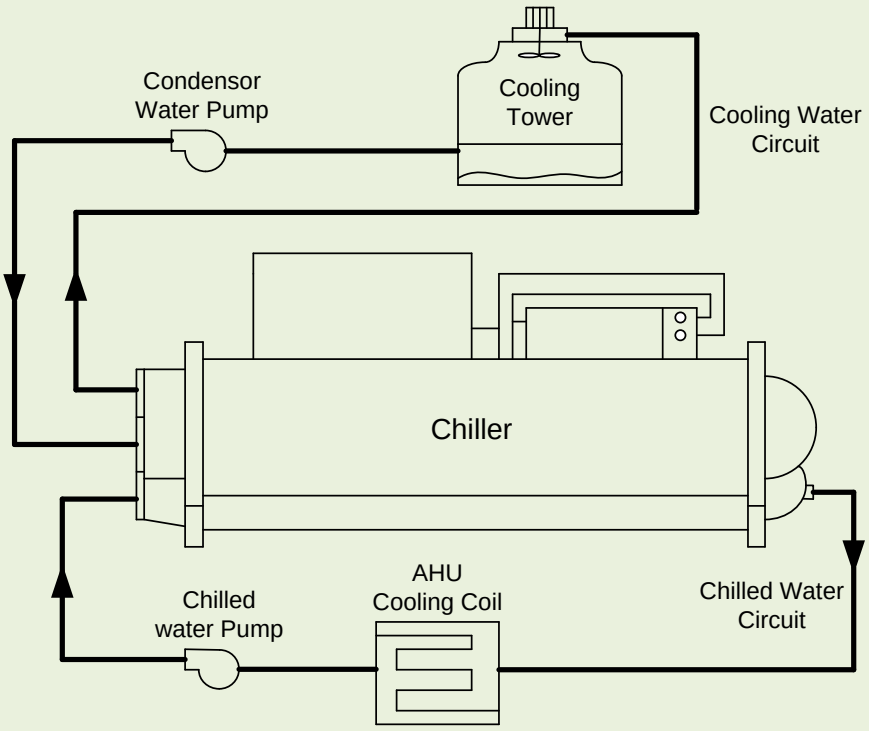

FIGURE C: SCHEMATIC DIAGRAM OF WATER-COOLED CHILLER

FIGURE D: NEW WATER-COOLED CHILLERS

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The investment cost for water-cooled screw chillers was higher than other options because it required additional equipment such as cooling towers (to cool refrigerant at the condenser), water treatment system, etc. However, it gave a higher energy savings and quicker payback period than the other 2 options.

Power consumption of the new water-cooled screw chillers was about 0.65 kW/TR (at full load) or a reduction of 1.01 kW/TR (1.66-0.65). Energy consumption was expected to be about 840,470 kWh/year or about 60% reduction. Efficiency of the system was done by measuring chilled water flow rate (m3/hr.) with ultrasonic flow meter and power consumption (kW) with power meter. Then, the results were calculated to find kW/TR. For monthly monitoring, the hospital records energy consumption from kWh meters and compare with old records before the new chillers were installed.

Environmental and social benefits	
(Estimate of) Greenhouse Gases abated (in metric tons of CO_2-equivalent)	Annual: 621 ton CO_2/year (0.509 tCO_2/MWh-source: "Study on Electricity Sector Baselines in Thailand", ERM 2005), based on the saving of 1.22 million kWh/year or 1,220 MWh. Up to and including 2012: 4,347 tCO_2-equivalent Up to a period of 10 years: 6,210 tCO_2-equivalent Up to a period of 15 years: 9,315 tCO_2-equivalent
Number of reduction units (EAU, CER, ERU, AAU)	
Socio-economic aspects What social and economic effects can be attributed to the project and which would not have occurred in a comparable situation without that project?	This project helps saving energy and reducing CO_2 emission.
Methodology used (if applicable: approved baseline methodology or study done – refer to this; and monitoring organisation)	

Economic data	
Capital costs	Total cost was about 8.0 million Baht (US$ 228,570). This included 5.0 million Baht (US$ 142,857) for chillers and 3.0 million Baht (US$ 85,714) for cooling towers, pumps, piping, civil work, consulting fee, etc.
Financing scheme	By owner
Financing organisation (if third party)	None

Project developer	
Name of the project developer	Innovation Technology Co., Ltd.
E-mail and/or web address	bandhit_ng@hotmail.com, karjornpong_s@geodesign.co.th
Contact person	Mr. Bandhit Ngamwatthanasilp (Managing Director) and Mr. Karjornpong Sutthisopha-arporn (Director)

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Host organisation	
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Technology provider	
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