

CASE STUDY

SOLAR AIR CONDITIONING



SDC
Solar District Cooling

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Your Partner In Renewable Energy

1.0 Introduction:

- a. Project: Ikkhasas Office Building
 b. Location: Bukit Puchong Industrial Park
 c. Background: Whole building consists of 4 storeys. Ground floor common area (main lobby, lift lobby and VIP room) is served by solar air-conditioning system. This system is the "First" installation in Malaysia.
 d. Equipment: Absorption Chiller
 Model: Sanyo LCC-E01
 Capacity: 30RT
 Feature: Market leader with advanced technology in Li-Br absorption chiller, complying JIS B 8622-2002.

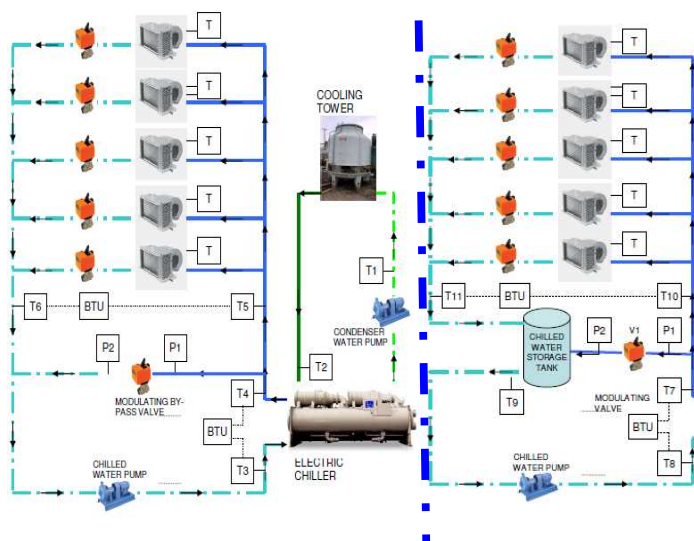
Sunda Evacuated Tube
 Model: SDC SEIDO 1-16
 Feature: SPF certified patented "Thermal-Compression Sealing Technology" prevents heat loss and protect from corrosion. Aluminum Nitride Coating ensures more than 92% high solar absorption. Performance tested accordance to EN 12975.

Other associated equipment e.g.: pumps, cooling tower, hot and chilled water storage tanks.

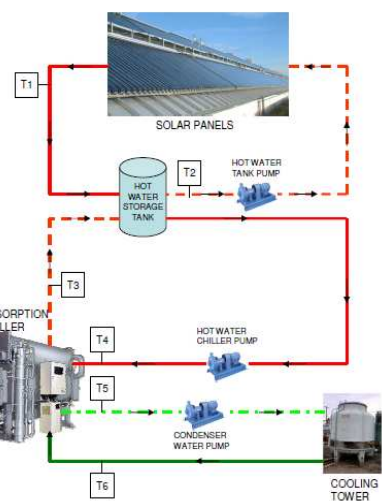
2.0 System Schematic:

The followings are schematics for conventional type, electric driven chiller system vs. using solar energy drive absorption chiller.

Conventional Air-Conditioning System



Solar Air-Conditioning System



3.0 Energy Consumption Analysis

Typically, air-conditioning system consumes 50~60% of total building electricity, hence energy saving on air-conditioning system become necessity. By harvesting the solar energy to generate hot water, the absorption chiller can produce chilled water as low as 6°C. Thus, the renewable energy eliminates the most important operating cost for the conventional compression cycle. The following is energy consumption comparison between conventional and solar air conditioning system, which already in operation.

Conventional Air-Conditioning System		
Description	Power Consumption, kW / Remark	
Area to served: approx. 6,000ft ²		
Cooling capacity required: 30RT		
Equipment:		
a. Electric Chiller:	24.0	Reciprocating, 30RT; Based on 0.8kW/RT
b. CHW Pump:	2.7	72usgpm@ 82ft; Eff. = 55%
c. CDW Pump:	2.2	90usgpm@ 65.6ft; Eff. = 67%
d. Cooling Tower:	0.75	40HRT
Total Energy Consume	29.65 kW	

Solar Air-Conditioning System		
Description	Power Consumption, kW / Remark	
Area to served: approx. 6,000ft ²		
Cooling capacity required: 30RT		
Equipment:		
a. Absorption Chiller:	1.3	Absorption, 30RT; For abs. & ref. pump only
b. CHW Pump:	3.2	84usgpm@ 82ft; Eff. = 55%
c. CDW Pump:	4.0	162usgpm@ 65.6ft; Eff. = 67%
d. Cooling Tower:	1.1	70HRT
e. HW Pump:	2.1	114usgpm@ 49.2ft; Eff. = 68%
f. Solar HW Pump:	1.5	42usgpm@ 98.4ft; Eff. = 70%
Total Energy Consume	13.20 kW	

4.0 Operating Cost Saving:

Despite the solar energy is zero cost, the accessories e.g. pumps still consume minimum electricity. The following table summarizes the saving:-

Description	Unit	Conventional System	Solar System	Operational Saving* (RM)
Daily Power Consumption	kW	266.90	118.80	148.10
Year 1- Electricity Cost	RM/yr	38,674.00	17,214.00	21,460.00
5 years - Electricity Cost	RM/5 yr	192,276.00	87,808.00	104,468.00
10 years - Electricity Cost	RM/10 yr	399,615.00	180,096.00	219,519.00

*Note:

1. Based on 9am to 6pm, 9 working hours
2. Electricity based on TNB Tariff B (Low voltage) for commercial building, RM0.397/kWh
3. Forecast annual electricity price increase of 1%

5.0 Capital Investment:

The capital investment of the solar cooling system varies according to individual building design or available roof space area. The following table summarizes the CAPEX:-

Description	Conventional System (RM)	Solar Cooling System (RM)
Equipment (Chiller, Pumps, Piping, Cooling Tower)	195,000.00	300,000.00
Evacuated Tube Collectors (SDC Seido 1-16)	-	350,000.00
Associated builder, automation, mechanical and electrical works	250,000.00	250,000.00
Tax Incentives	NIL	(225,000.00)
- Investment tax allowance	(111,250.00)	(225,000.00)
- Capital allowance		
Total Cost of Ownership	333,750.00	450,000.00

$$\begin{aligned}
 \text{Return Of Investment (ROI)} &= \text{Additional Investment / Operation Saving} \\
 &= (450,000 - 333,750) / 21,460.00 \\
 &= 5.4 \text{ years}
 \end{aligned}$$

6.0 Benefits of Using Solar Air-Conditioning:

a. Lower Operation Cost

The solar powered chilled water system provides zero energy cost comparing to electric driven chillers. The operation cost saving becomes enormously huge especially with the unpredictable increasing of electricity charges.

b. Investment Tax Allowance

Under the promotion of Investment Act 1986 to generate energy using renewable energy resources, companies are eligible of full exemption from income tax of 100% on qualifying capital expenditure. Return of Investment is less than 6 years.

c. Free Domestic Hot Water System

The hot water for shower, washing and kitchen usage for the whole building will be free as it is a by-product from the solar air-conditioning system.

