

CASE STUDY

EVACUATED TUBE SOLAR COLLECTOR FOR HOTEL APPLICATIONS



SDC

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Page | 1



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1.0 Introduction:

- a. Project: Development of 1000 rooms 5-Star Hotel, Johor Bahru
- b. Background: The hotel is under development stage. The owner has initially opted for the conventional electric heating system (heat pump) as designed by his consultant. A friend told him to switch to solar hot water system to utilize the free energy from the sun and solar technologies have been improved tremendously with very high efficiencies.
- c. Equipment: Evacuated Tube Solar Collector
Model: SDC SEIDO 10-20
Feature: SPF certified patented "Thermal-Compression Sealing Technology" prevents heat loss and protection from corrosion. Aluminum Nitride Coating ensures more than 92% high solar absorption. Performance tested accordance to EN 12975.
Temp.: Avg. 75°C; highest 99°C
Energy: 11.86 kWh /day /unit
Dimension: 3.60 m²
- d. Other Information:
- | | |
|-----------------------------|------------------------|
| Hotel room | 1,000 (500 each tower) |
| Floors | 27 floors (each tower) |
| Hot water temperature | 60°C |
| Cold water temperature | 26°C |
| Hot water requirement | 20 liter@60°C/shower |
| Occupancy rate | 70% (Resort Hotel) |
| Estimated pax/room | 1.5 |
| Existing Heat pump capacity | 100 kW |

2.0 Energy Consumption Analysis:

$$\begin{aligned} \text{Daily hot water consumption} &= 1000 \times 2 \text{ times} \times 1.5 \text{ person} \times 20 \text{ lit} \\ &= 60,000 \text{ litres} \\ \text{Daily energy consumption} &= \frac{60,000 \times (60^\circ\text{C} - 26^\circ\text{C}) \times 1.15 \times 0.7}{860\text{kcal}} \\ &= 1,909 \text{ kWh} \end{aligned}$$

Proposed Solar Hot Water System Solution

$$\begin{aligned} \text{Sizing of SDC SEIDO 10-20} &= 1,909 \text{ kWh} / 11.86 \text{ kWh} \\ &= \mathbf{160 \text{ units}} \\ \text{Roof space requirement} &= 160 \times 3.60 \times 1.25 \text{ (allowance for piping)} \\ &= 720 \text{ m}^2 \end{aligned}$$

3.0 Operating Cost Comparison:

Solar Hot Water System

$$\begin{aligned} \text{Operation Cost (Solar)} &= 1909 \text{ kWh} \times 0.05^* \times \text{RM}0.397/\text{kWh} \times 365 \text{ days} \\ &= \text{RM } 13,831.18 \text{ per year} \end{aligned}$$

*Note: Hot water circulation pumps are consuming electricity
Estimated 5% electricity consume per day hot water circulation pumps and back-up system due to raining season



Conventional Electrical Heating System

Operation Cost (Heat Pump) = 1909 kWh/3* (COP 3) x RM0.397/kWh x 365 days
 = RM 92,207.88

*Note: Assume Heat Pump COP is 3

Operating Cost Saving per year = RM78,376.70

4.0 Investment Cost:

Description	Evacuated Tube Solar Collector SDC SEIDO 10-20	Conventional Electrical Heating System (Heat Pump)
Investment cost		
Budgetary investment cost	RM890,800.00	RM403,000.00
Additional Investment cost on Evacuated Tube Solar Collectors	RM487,800.00	Nil
Operating cost saving per year		
Saving (RM)	RM78,376.70	Nil
Return of Investment		
Investment Cost Payback Period based on operating cost only	< 6.3 years	Nil
Incentives from Government		
Savings from Capital Allowance @ 25% of Investment Cost	(RM222,700.00)	(100,750.00)
Savings from 100% Investment Tax Allowance @ 25% of Investment Cost	(RM222,700.00)	Nil
Total Adjusted Investment Cost	RM445,400.00	RM302,250.00
Additional Investment cost on Evacuated Tube Solar Collectors	RM143,150.00	Nil
Adjusted Return of Investment		
Investment Cost Payback Period based on operating cost and government incentives	1.83 years	Nil



5.0 Benefits of Evacuated Tube Solar Collector:

a. **Minimum Maintenance**

With non-moving parts, evacuated tube solar collectors need minimum maintenance. Comparatively, the average life span for electric heating element is 2 to 3 years and evacuated tube is 20 to 25 years.

b. **Zero Operation Cost**

Sun is the source of energy with expected life span of 2.5billion years. At the same time, eliminate the risk of increasing electric tariff.

c. **High Performance**

EN 12975 certified high performance evacuated tube solar collector generated more quality energy within the same area in shorter time.

d. **Fast Payback Period**

With the Investment Tax Allowance the payback period is reduced. Investment cost covers the cost of:

- Solar collectors
- Hot water tank with insulation
- Associated pumps
- Distribution piping, accessories and fittings
- Associated control system
- Installation cost
- Plant room / Mechanical room
- Associated electrical wirings and distribution boards.

