

CASE STUDY

EVACUATED TUBE SOLAR COLLECTOR OR ELECTRIC HEATER



SDC

Solar District Cooling

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1.0 Introduction:

- a. Project: Replacement of electric boiler for hotel, Kuala Lumpur
- b. Background: The hotel operates more than 25 years. The owner wanted to renovate and decided to change his aged electric boiler. A friend told to switch to solar hot water because he has large roof space and solar technologies have been improved tremendously.
- 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 | 140 |
| Floors | 6 floors |
| Hot water temperature | 60°C |
| Cold water temperature | 26°C |
| Hot water requirement | 20 liter@60°C/shower |
| Occupancy rate | 90% |
| Estimated pax/room | 1.5 |

2.0 Energy Consumption Analysis:

$$\begin{aligned} \text{Daily hot water consumption} &= 140 \times 2 \text{ times} \times 1.5 \text{ person} \times 20 \text{ lit} \\ &= 8400 \text{ litres or } 1,848 \text{ gallon} \\ \text{Daily electricity consumption} &= V \times C \times \Delta T \times 10 \text{ lb/gal} \\ &= 1,848 \text{ gal} \times 1 \text{ btu/lb}^\circ\text{F} \times 61.2^\circ\text{F} \times 10 \text{ lb/gal} \\ &= 1,130,976 \text{ Btu or } 331.5 \text{ kWh} \\ \text{Total energy consumption} &= 331.5 \text{ kWh} \times 1.15 \text{ (15\% losses in distribution)} \\ &= 381.0 \text{ kWh} \end{aligned}$$

Option #1

$$\begin{aligned} \text{Sizing of SDC SEIDO 10-20} &= 381 \text{ kWh} / 11.86 \text{ kWh} \\ &= 32 \text{ units} \\ \text{Roof space} &= 32 \times 3.60 \times 1.3 \text{ (allowance for piping)} \\ &= 150 \text{ m}^2 \end{aligned}$$

Option #2

$$\begin{aligned} \text{Sizing of electric boiler} &= 381 \text{ kWh} / 3 \text{ h} \\ &= 63 \text{ kW} \\ \text{Floor space} &= \text{direct replacement} \end{aligned}$$



3.0 Operating Cost Comparison:

Option #1

Operation Cost (Solar) = 381 kWh x 0.1* x RM0.40/kWh x 365 days
 = RM 5,562.60

Option #2

Operation Cost (Elec. Boiler) = 381 kWh x RM0.40/kWh x 365 days
 = RM 55,626

*Note: Hot water pumps are consuming electricity
 Estimated 10% electricity consume per day due to raining season

4.0 Investment Cost:

Description	Evacuated Tube Solar Collector SDC SEIDO 10-20	Electric Boiler
Investment cost		
Budgetary investment cost	RM192,000.00	RM70,000.00
Additional Investment cost on Evacuated Tube Solar Collectors	RM122,000.00	Nil
Operating cost saving per year		
Saving (RM)	RM50,063.40	Nil
Return of Investment		
Investment Cost Payback Period based on operating cost only	< 2.5 years	Nil
Incentives from Government		
Savings from Capital Allowance @ 25% of Investment Cost	(RM48,000.00)	Nil
Savings from 100% Investment Tax Allowance @ 25% of Investment Cost	(RM48,000.00)	Nil
Total Adjusted Investment Cost	RM96,000.00	RM70,000.00
Additional Investment cost on Evacuated Tube Solar Collectors	RM26,000.00	Nil
Adjusted Return of Investment		
Investment Cost Payback Period based on operating cost and government incentives	0.5 year	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 about ½ years. 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.

