SolarBeam™ Concentrator Thermal Efficiency Review

Thermal Comparison with Solar Collector Panel Technology

Solartron Energy White Paper

SOLARTRON ENERGY SYSTEMS INC.

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SolarBeam™ Concentrator Technology

The SolarBeam™ Concentrator is the world's first parabolic solar dish to achieve SRCC certification (SRCC 600 Standard) and achieve high thermal efficiencies compared with other concentrated solar parabolic technologies. The SolarBeam Concentrator achieves peak 11.5 kW of thermal heat per hour by collecting the sun's radiation from a 15.8 m2 (160 sq.ft) surface area and focusing the energy on a 25x25cm (10x10") absorber.

The SolarBeam™ Concentrator was designed as a low maintenance hybrid system capable of providing temperatures up to 93 degrees Celsius* for the following application:

- Process Heating
- Cooling with Adsorption / Absorption chillers
- Future electricity production with CPV cell technology

The SolarBeam™ can be installed as a single system or in a solar array for large energy production.

The SolarBeam™ has been tested in the harsh, cold Canadian winters with minimal performance loss. The SolarBeam was engineered with state-of-the-art components and electronics to handle any weather condition including high ambient temperature, snow load and easy snow removal.

In the following section you will find the performance review of the SolarBeam and two other systems based strictly on SRCC data for operating delta temperature of: 0, 10, 30, 50, and 60 degree Celsius.

Although the SolarBeam is capable of achieving temperatures above 100 degrees Celsius, the Solar Beam would require having an onsite stationary engineer to manage the system and the SolarBeam would not be able to be used with adsorption / absorption chillers or CPV technology.

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Comparison Data

The comparison was based on data for the SolarBeam Concentrator and SRCC reports for Heliodyne and Viessmann.

- The Heliodyne model #GOBI 406 002 is a glazed flat plate collector.
- The Viessmann model # Vitisol 300T SP3 3m2 is an evacuated tube collector.

The performance analysis was based on SRCC data and the efficiency was calculated by changing the delta T: 0, 10, 30, 50, 60 degrees Celsius.

SolarBeam™		**Heliodyne**		**Viessmann MFG**	
Solar Collector Area	15.8	Solar Collector Area	15.8	Solar Collector Area	15.8
G Solar Radiation	1000	G Solar Radiation	1000	G Solar Radiation	1000
F Collector Efficiency	0.73	F Collector Efficiency	0.768	F Collector Efficiency	0.509
Kθb(θ)	1	Slope	4.03	Slope	1.09
K1 Factor	1	K1 Factor	1	K1 Factor	1
Delta T	Various	Delta T	Various	Delta T	Various
Efficiency	Various	Efficiency	Various	Efficiency	Various
C1	0.733	Q (Power in W)	8313.96	Q (Power in W)	7008.88
C2	0.0204	SRCC #	2006006A	SRCC #	2005020B
C3	0				
C4	0				
C5	0				
C6	0.085				

The following equation was used for the thermal performance of the SolarBeam collector as per SRCC requirements:

Q / A = F'(τα)en Kϑb(ϑ) Gb + F'(τα)en Kϑd Gd -c6 u G - c1 (tm-ta) - c2 (tm-ta)2 – c5 dtm/dt*

Efficiencies for non-concentrating collectors were calculated using the formula below:

*Efficiency = F Collector Efficiency – (Slope*Delta T)/G Solar Radiation*

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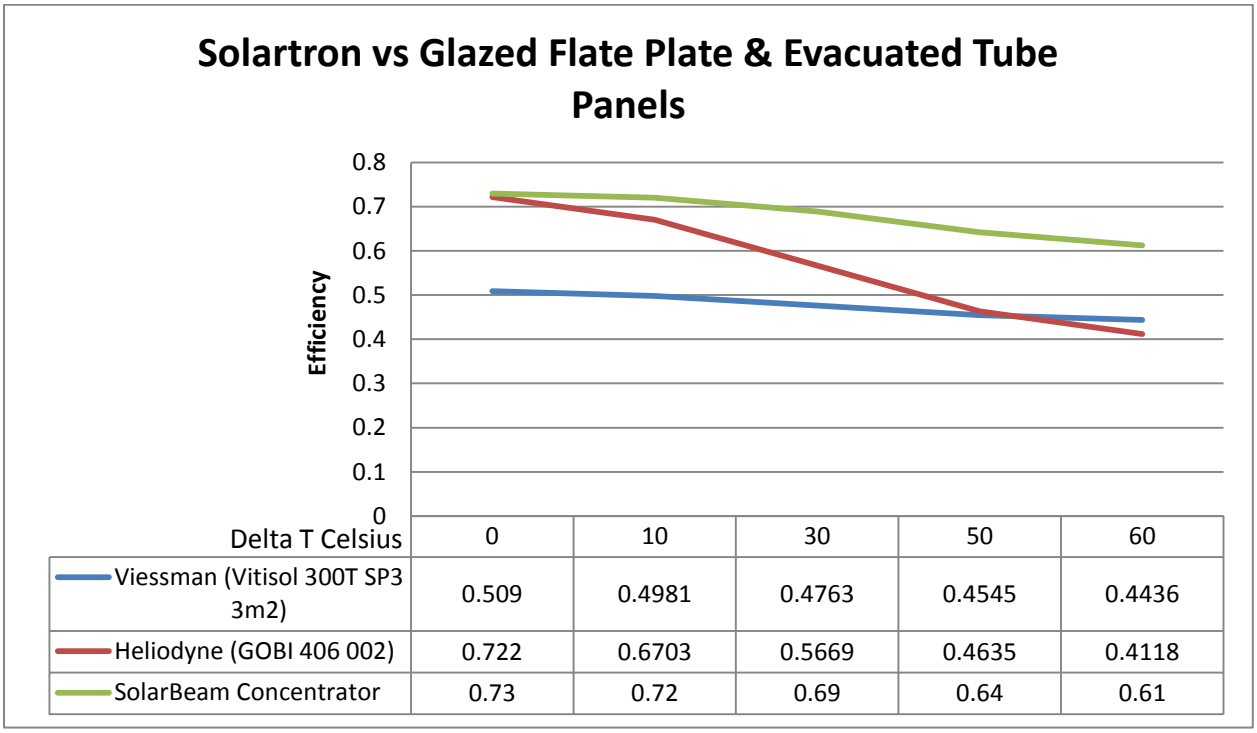
SolarBeam™ Concentrator Performance Curve

The performance curve for the SolarBeam Concentrator shows overall high efficiency within the temperature ranges. Many flat plate panels & evacuated tube panels experience lower efficiency when higher temperatures are required.



Delta T Celsius	0	10	30	50	60
Viessman (Vitisol 300T SP3 3m2)	0.509	0.4981	0.4763	0.4545	0.4436
Heliodyne (GOBI 406 002)	0.722	0.6703	0.5669	0.4635	0.4118
SolarBeam Concentrator	0.73	0.72	0.69	0.64	0.61

It is important to note that the chart above does not take into account heat loss from cold or high winds. As well, the data above is instantaneous efficiency and does not reflect efficiency of tracking the sun. The data as well included comparison of one of the best glazed flat panel and evacuated tube technology.

In addition to the high efficiency, the SolarBeam™ generates an additional 30% more energy than solar collector panels due to the dual axis sun tracking.

In geographic regions that experience cold temperatures, the efficiency on the flat panel and evacuated tube panels lose more heat due to the large absorber area. The SolarBeam™ only has an absorber area of 0.0625 m2 compared to a flat panel that needs an equivalent area of 15.8 m2.

Note that due to its special two-axis tracking system, the SolarBeam™ Concentrator will always operate at peak efficiency. The effective area of the SolarBeam collector is always the actual surface area. Flat plate collectors, such as Heliodyne Gobi 406 002, will lose potential power based on the equation below if not properly aligned:

$$P_L = 1 - \cos i$$

(P_L refers to power lost in %, i refers to misalignment from normal in degrees)