Example name: Roof integrated solar micro-concentrating collector

Template completed by:
Dr Mervyn Smyth, Uni of Ulster,
m.smyth1@ulster.ac.uk

For installations

BISTS Location: Kensington, NSW, Australia 34.5S, 138.4E
Climate Type: Cfa
Building Use: Domestic, Commercial, Industrial

Level of BISTS integration
Rush level 3 / Reijenga level 3

~~O~~ New Build
O Refurbishment
O Other: ……………………

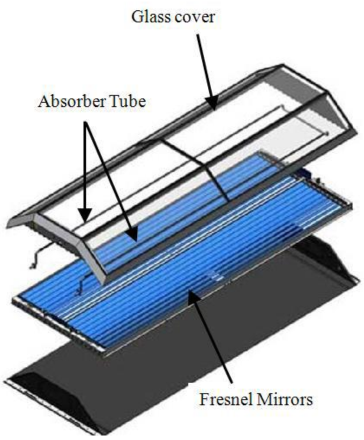
Type of BISTS:

Active/~~Passive/Hybrid~~

Function(s):
O Air heating
~~O~~ Water heating
O Combi-system
O Cooling/ventilation/shading
O PV/T
O linked to another system (e.g., heat pump)
O Other: ………………………

Building element:

O Facade
~~O~~ Roof
O Other



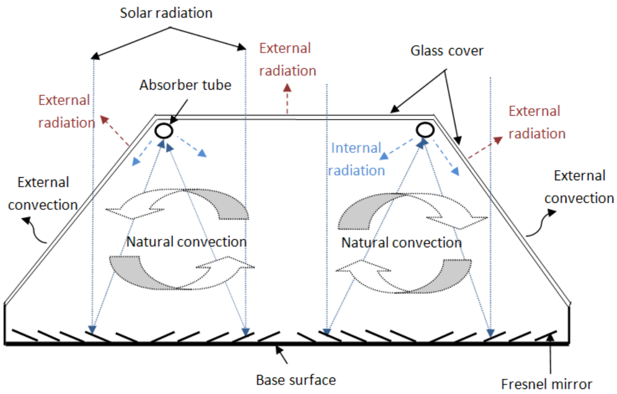
BISTS characteristics:

The solar thermal micro-concentrating collector (MCT) uses linear Fresnel reflector technology and is designed to operate at temperatures up to 220°C. The concept is a modular rooftop integrated concentrating solar thermal system primarily for commercial high temperature applications.

Stage of Development:		**Responsible:**
~~O~~	Idea/Patent	University of New South Wales, Kensington, NSW, Australia
~~O~~	Prototype	University of New South Wales, Kensington, NSW, Australia
O	Demonstration	…………………………………..
O	Integral building element	…………………………………..
O	Commercially available	…………………………………..

BISTS description and context

The MCT system module is approximately 3.2m long by 1.2m wide and 0.3m deep. The MCT collector utilizes linear Fresnel reflector optics. The receiver consists of two 16 mm diameter stainless steel absorber tubes. Each receiver has a secondary reflector that directs beam radiation to the absorber tube. The entire optic system is enclosed in a sealed glazed canopy.



Rooftop solar cooling technologies need to be very space efficient. As low temperatures can only be used to drive single effect chillers, traditional flat panel collectors need more than twice the roof area to produce sufficient cooling for a low rise building. High temperature systems, such as parabolic trough collectors, require more space on the rooftop to avoid shading as they track the sun. In this regard the MCT is considered more efficient compared to both low temperature collectors and more complex high temperature systems.

System viability

The concept is a modular rooftop integrated concentrating solar thermal system primarily for commercial high temperature applications (up to 220°C) to replace parabolic trough and linear Fresnel systems which have not integrated well on rooftops as they have been complex, cumbersome, have high wind loading and are difficult to maintain. The micro-concentrator collector (MCT) can be seamlessly integrated into the architecture of buildings. The applications of this system include domestic hot water, industrial process heat and solar air conditioning for commercial, industrial and institutional buildings.

Modelling and simulation tools developed/used

A computational model for the prototype collector was developed using ANSYS-CFX, a commercial computational fluid dynamics software package. Radiation and convection heat loss was investigated as a function of absorber temperature. Preliminary ray trace simulation was performed using SolTRACE and the optical efficiency evaluated.

BISTS Performance data

Based on:
O Estimation
~~O~~ Detailed simulation
O Measurement/testing
O Long-term monitoring

Performance parameters

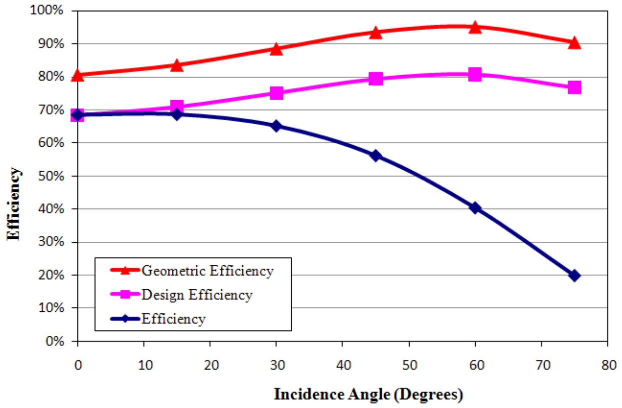
For integrated systems:
key performance indicators -

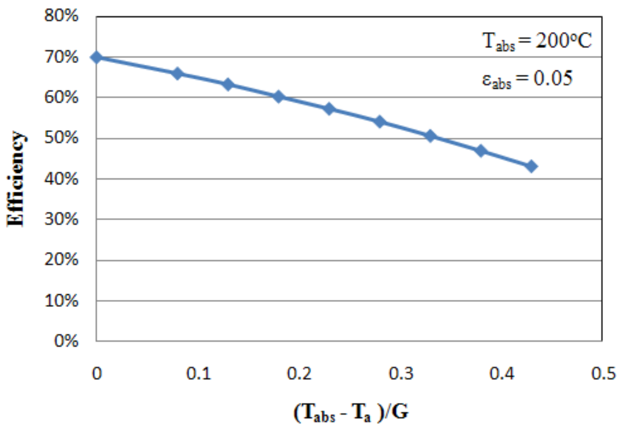
For separate collectors:
performance rating coefficients -

Heat loss coefficient of the absorber tube was evaluated at 5.8 W/m^2K using CFD simulation

Overall efficiency of about 60% at its design operating temperature of 200°C.

Other:





Additional information:
Sources and references: *T Sultana, GL Morrison, S Bhardwaj, G Rosengarten. Heat loss characteristics of a roof integrated solar micro-concentrating collector. Proceedings of the ASME 2011 5th International Conference on Energy Sustainability ES2011 August 7-10, 2011, Washington, DC, USA*