Example name: Roof integrated solar chimney

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

Fig. 1. (a) Wall and roof facing north direction of the test cell; (b) the roof solar chimney on the south roof of the controlled cell.

For installations

BISTS Location: Pathumthai, Thailand 14.0N, 100.6E
Climate: Aw
Building type: Domestic
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 BIST is a roof integrated solar chimney with water spraying system for passive cooling. The roof of the dwelling is broken into two parts via the roof pitch, the south and north surface. The pitch is at a tilt angle of 45°. The south roof is the solar chimney and the north roof is a water spraying roof. The total area of the solar chimney is 0.945m^2 x 1.900m^2 x 4 (number of channels) = 7.182m^2.

Stage of Development:		Responsible:
O	Idea/Patent	……..
⊖	Prototype	Thammasat University, Pathumthai, Thailand
⊖	Demonstration	Thammasat University, Pathumthai, Thailand
O	Integral building element	……..
O	Commercially available	……..

BISTS description and context

A dwelling with a roof integrated solar chimney and water spraying system was experimentally investigated. The BIST is a roof integrated solar chimney with water spraying system for passive cooling. The roof of the dwelling is broken into two parts via the roof pitch, the south and north surface. The pitch is at a tilt angle of 45°. The south roof is the solar chimney and the north roof is a water spraying roof. The south roof is composed of terracotta roof tiles on the outside with 0.15m air gap formed behind between a gypsum board inner layer. Outdoor air flows into the roof through two fixed louvers. The north roof consists of two layers, the outer surface made of zinc sheet arranged in an adjustable louver style and the inner layer made of a flat zinc sheet with a water pipe mounted on the upper part to create the water spray.

System viability

The experimental results showed that the solar chimney could 1.13 to 2.26 of ACH. At high ambient temperatures and high solar intensities during the day, the solar chimney can reduce the indoor temperature by 1.0 to 3.5°C in ambient air conditions between 32.0 and 40.0°C. Spraying water on the roof along with the solar chimney can reduce indoor temperatures by 2.0 to 6.2°C under the same conditions.

Modelling and simulation tools developed/used

BISTS Performance data

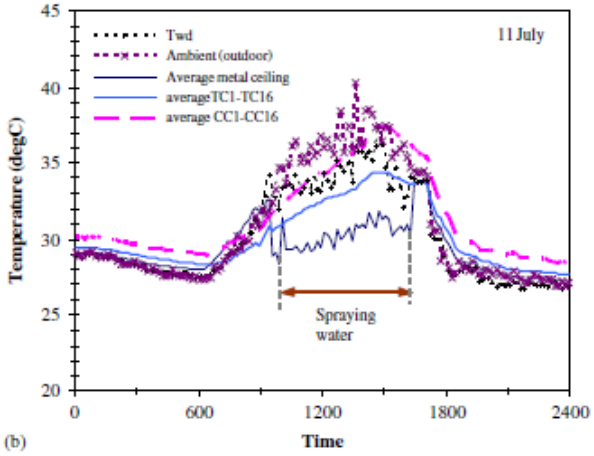
Based on:
O Estimation
O Detailed simulation
⊖ Measurement/testing
O Long-term monitoring

Performance parameters

For integrated systems:
key performance indicators -

For separate collectors:
performance rating coefficients -

Other:



The experimental results during application of the solar chimney and water spraying during July

Additional information:

Sources and references:

S Chungloo, B Limmeechokchai. Application of passive cooling systems in the hot and humid climate: The case study of solar chimney and wetted roof in Thailand. Building and Environment 42 (2007) 3341–3351