Example name: OM solar integrated dwelling

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

For installations

BISTS *Location: Japan, 34N 137E*
Climate Type: *Cfa*
Building Use: *residential*

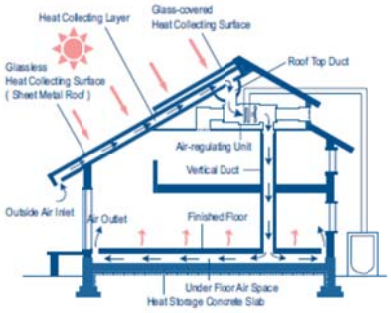
Level of BISTS integration
Rush level 3 / Reijenga level 3

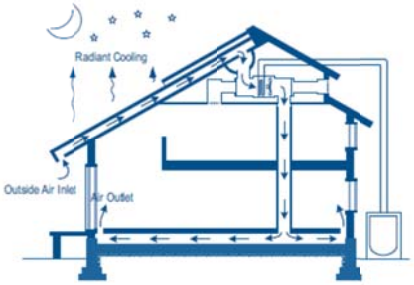
- ~~O~~ New Build
- O Refurbishment
- O Other: ……

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:
During the solar heating mode, fresh outdoor air enters a channel under the roof and flows upward. The air is heated on contact with the metal roof sheet, passing through an upper glazed section (to improve collection) whereupon the heated air enters roof top duct and is mechanically forced through the air-regulating unit. The temperature controlled air is directed down into the space to be heated via underfloor channels between the floor and the concrete slab before finally being diffused into the room through the floor diffusers. In summer cooling mode, outdoor air is drawn through the roof channels at night-time, sub-cooled using radiant cooling, and as with the heating mode, directed into the space to be cooled via the underfloor channels.

Stage of Development:		Responsible:
⊖	Idea/Patent	OM Solar Association
O	Prototype	……..
⊖	Demonstration	OM Solar Association
O	Integral building element	……..
⊖	Commercially available	SAN Atelier Co., Ltd.

BISTS description and context

The OM solar concept building was developed to provide a completely different prefabricated house from those offered by Japan's home manufacturers. The building details are:

Building Envelope: U-values (W/m^{2}K); façade 0.39, roof 0.47, floor 1.11, glazing 1.4
Air tightness: 3.4 l/h
Volume: 473m^3
Surface Area: 168m^2
Specific heat load: 2.1 W/m^{2}K

The solar system specification consists of glass-covered heat-collector: 16m^2; metal heat collector: 11m^2; under-floor storage:64m^2; volume of fresh air supply: 600m^3/h (during heating / cooling) and hot water tank: 300 litres.

System viability

The OM solar system has been very successful and has been replicated in various forms throughout Japan in over 20,000 homes. The modelled heating load of the house for a year is shown below. It shows that 59% of the annual heating energy can be supplied by the solar heat (OM Solar system). Actual measured data of the energy performance for a year is also shown in the next table. Auxiliary heating in the form of a kerosene stove was about 548L (equivalent to 3651Mcal (31.5Mcal/m^2)) for heating the building during the winter-period (Nov 2002 to Mar 2003).

Modelling and simulation tools developed/used

Heating load calculated OM computer simulation software "SunsonsV5"

	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Year	Ratio
OM Heating(Mcal)	419	543	513	474	739	505	3193	59%
Auxilairy Heating(Mcal)	0	387	930	731	153	19	2220	41%

BISTS Performance data

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

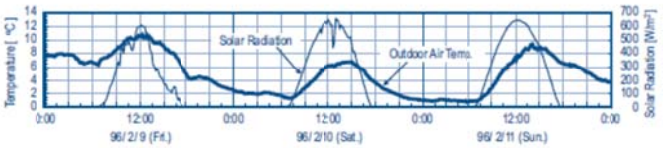
Performance parameters

For integrated systems:
key performance indicators -

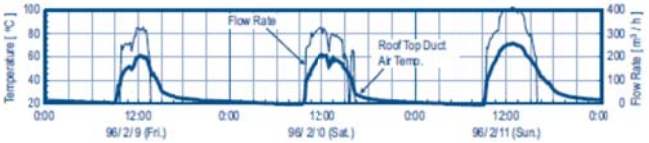
For separate collectors:
performance rating coefficients -

Other:

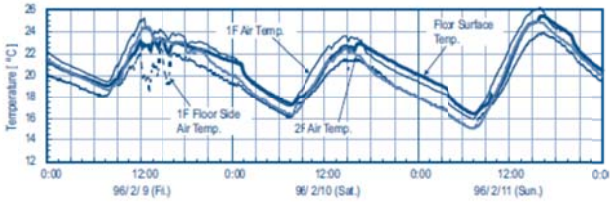
The figures detail the results from three consecutive days of thermal measurements from the building and solar installation during the month of February



Variation of outdoor air temperature and solar radiation



Variation of air temperature in roof top duct and flow rate



Indoor temperature variation

Additional information:

The system operates when solar radiation is greater than about 250 W/m^2. Then the flow rate is about 300-400 m^3/h and the outdoor air temperature can be increased from values of 5 to 10°C to about 40 to 70°C. The recorded energy consumption for the house for a year from Nov 2002 to Oct 2003 is shown below.

	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Year
Kerosene(L)	40	133	140	156	79	0	0	0	0	0	0	0	548
Electricity(kWh)	477	457	612	611	604	577	475	539	552	659	675	526	6764
Water(m^3)	24	23	23	20	22	23	24	25	25	27	29	29	294

Sources and references:

OM Solar Association
4601 Murakushi-cho, Hamamatsu, Shizuoka Prefecture , 431-1207 JAPAN
Phone:(053)-488-1700 FAX:(053)-488-1701 http://www.omsolar.net/