

Building Integration of Solar Thermal Systems (BISTS): Case Studies

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A solar thermal system is considered to be building integrated, if for a building component this is a prerequisite for the integrity of the building's functionality.

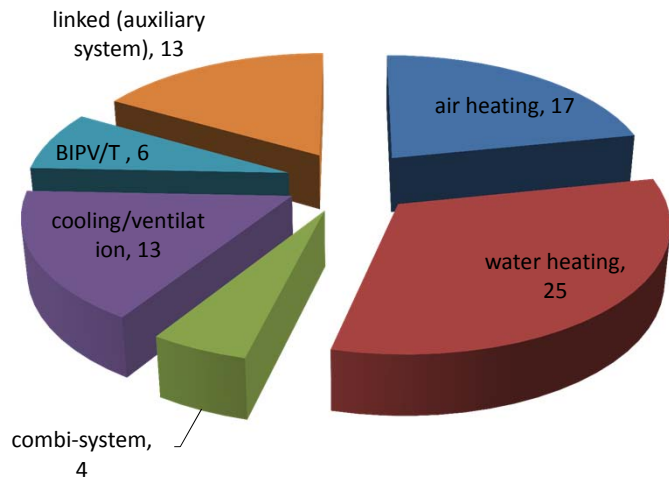


				Installed on					
				Wall		Roof		Other	
				New	Refurbishment	New	Refurbishment	New	Refurbishment
Output	Air	Air heating	Active	4 off	3 off	3 off	4 off	1 off	2 off
			Passive	3 off	1 off	2 off	1 off		
		Combi-systems	Active	1 off		2 off			
				Passive					
	Water	Water heating	Active	8 off	3 off	5 off	2 off	4 off	4 off
			Passive	1 off	1 off	2 off		2 off	1 off
		Cooling	Active	4 off	2 off	3 off	1 off		
			Passive	3 off	1 off	2 off	1 off	1 off	
	Electricity	PV/T	Active						
Passive			2 off	1 off	1 off				

Note: based on 39 cases studies up to BIST ref 47

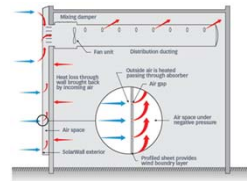
BIST Description

Application



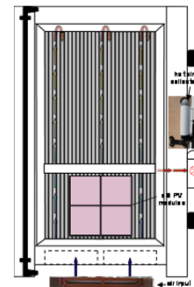
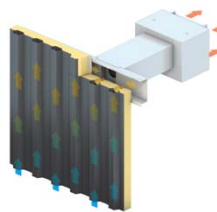
Air heating

Transpired façade collector, Canada



Façade crown collector, UK

Window shutter, France



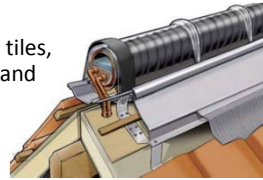
PVT roof collector, Canada

Water heating

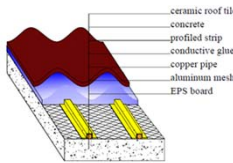


Shading device,
France

Ridge tiles,
Holland



Integrated roof tiles, China



Solar
balustrade,
USA

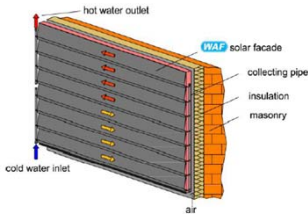


Unglazed façade
collector,
Switzerland

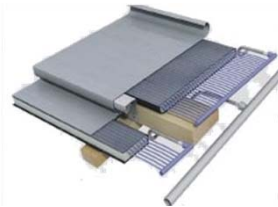


Flat plate collector, Ireland

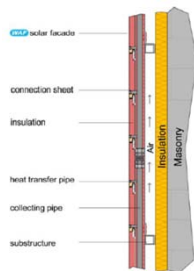
Combi-system



Roof combined
air/water
collector

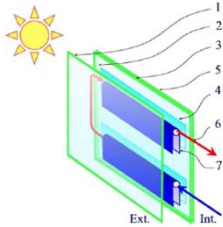


Wall combined
air/water
collector

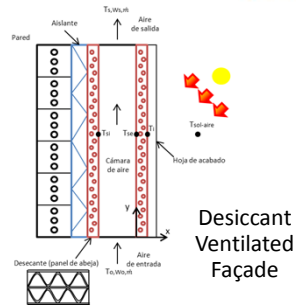


Cooling/ventilation/shading

Solar thermal glass, France



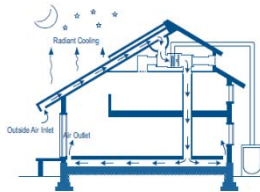
Solar awning, USA



Desiccant Ventilated Façade

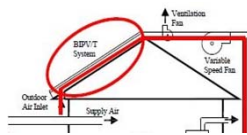


Radiant cooling, Japan

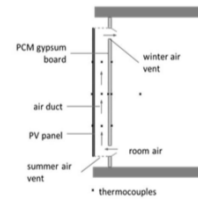


Solar facade blinds, USA

Building Integrated PV/Thermal



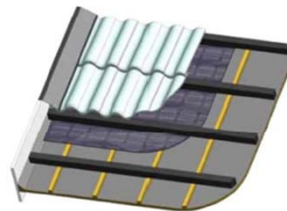
PV roof air heating, Canada



PV air heating, Portugal



PV water heating, Sweden

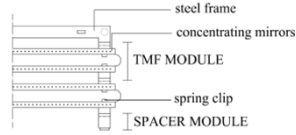


Linked systems



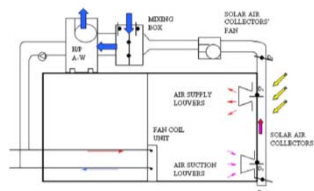
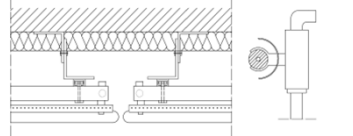
District heating, Sweden

FRONT VIEW



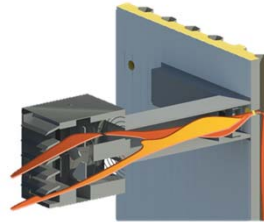
Façade integrated solar thermal concentrated system linked to absorption chiller, Italy

HORIZONTAL SECTION

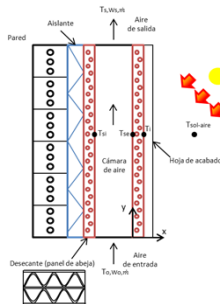


Air heat pump on the roof, Greece

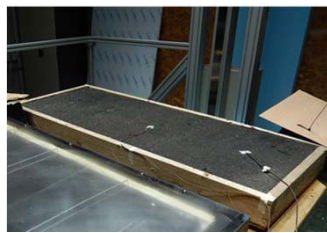
Kingspan facade linked to auxiliary air heater, UK



Other



Desiccant Ventilated Façade

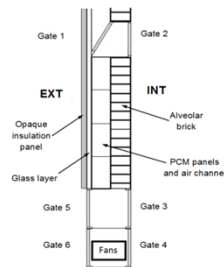


NCT asphalt collector, UK



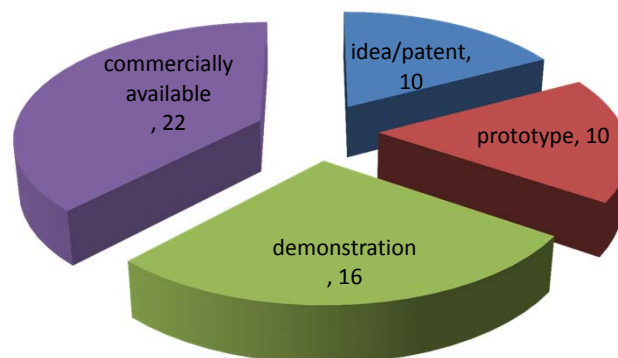
Integrated photo-bioreactor, Germany

PCM envelopes, Spain



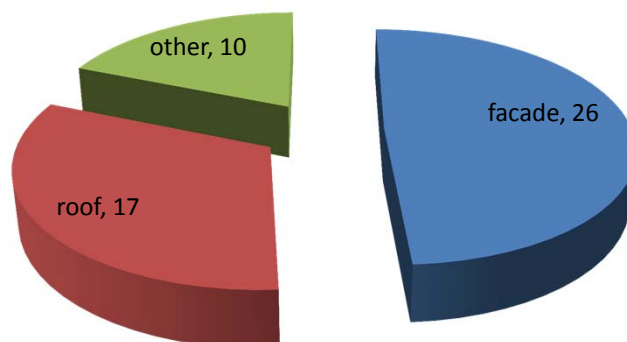
BIST Description

Stage of development



BIST Description

Collector building element



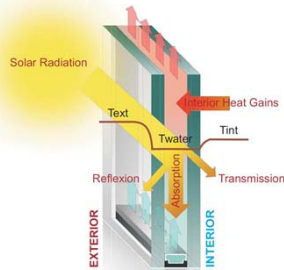
Architectural wave, China



Other



All-ceramic solar collector, China



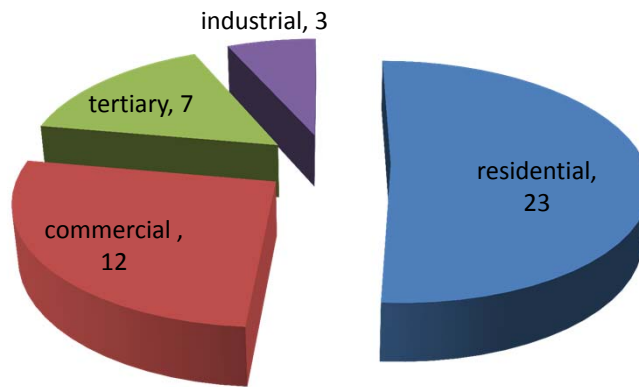
Intelliglass, Spain



Garden fence, USA

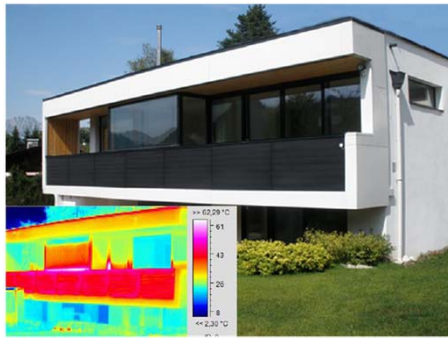
Architectural integration

Building type

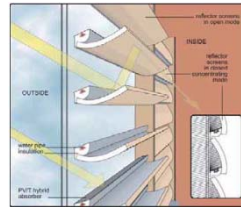


Architectural integration

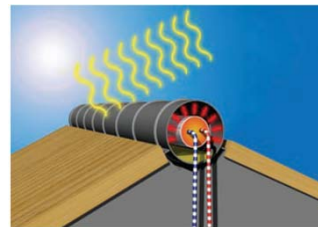
Building physics



Structure: Combined air/water balcony

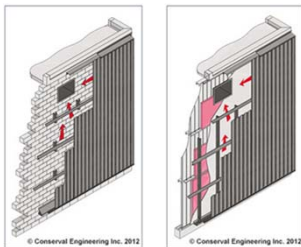


Shading: PVT window blinds, Sweden

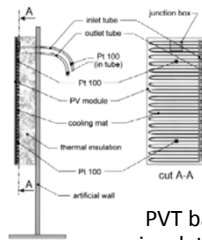


Integral storage: ICS ridge collector, Holland

Insulation



Transpired air collector with and without back insulation

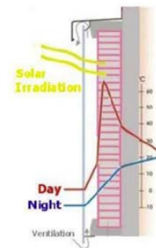


PVT back panel insulation, Brazil

Significant back panel insulation, Portugal



Solar-comb insulation, Austria



Architectural integration

Building Architectural Integration

Architectural empathy?

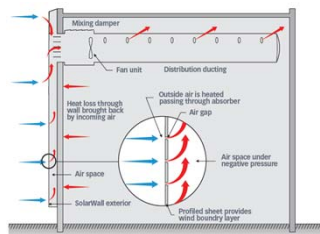


Obvious, but the north side is covered with the same stainless steel elements but not thermally active

Blended, mounted in the apex ridge of pitched roof



Invisible transpired wall collector



Out of sight

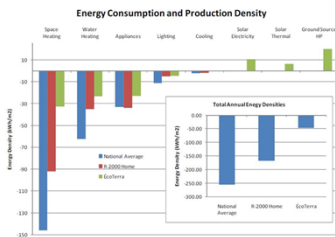
Wider considerations

Areas of obvious technological development and deployment

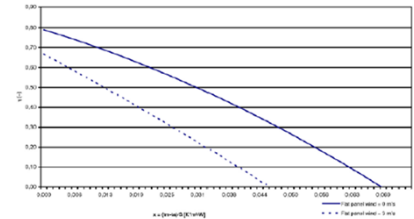
Minimal work published in

- Economics....some on capital costs and running costs, nothing on payback and maintenance
- Some on embodied energy, nothing on sustainable materials, environmental impact, fire safety
- Some on project motivation, nothing on social impact or legislation

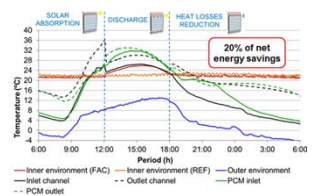
Performance



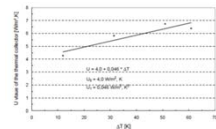
System contribution



Collector efficiency

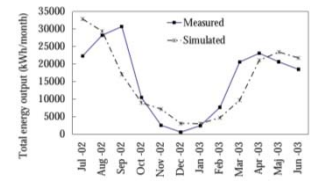


Temperature vs time



Heat loss coefficient

Comparison

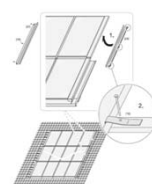


τ (h)	0	10	20	30	40	50	60	70
$K_{ib}(t) =$	1,00	1,03	1,11	1,18	1,25	1,28	1,26	0,19
$K_{ib}(l) =$	1,00	1,00	1,00	0,99	0,98	0,95	0,89	0,76

IAM

Case Studies – observations...so far

- **Wide range of interesting concepts/systems** (although some repetition of the same system on different buildings)
- **Limited information**
- **BIST description** (generally good, less regarding the building detailing)
- **Sizing procedure** (minimal)
- **Building physics** (secondary consideration)
- **Physical connection** (some detailing, but minimal)
- **Costs - economic, environmental, social** (limited)
- **Performance** (wide variation)
- **Aesthetics** (missing)
- **Distribution** (exclusively developed world)



European Cooperation in the field of Scientific and Technical Research
Building Integration of Solar Thermal Systems – TU1205 – BISTS



Thank you

