Building Integrated Solar Thermal Systems: Technology Appraisal

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Introduction

- Buildings account for 40% of the total primary energy requirements in the EU.
- The Renewable Energy Framework Directive sets a 20% target for renewables by 2020.
- This lead to the implementation of the Energy Performance of Buildings Directive (EPBD).
- Recast of EPBD specifies that by the year 2020 the buildings in EU should be of nearly zero energy consumption.
- RES and STS are expected to take a leading role and thus create a new era of renewables in buildings.

What is Building Integration of Solar Thermal Systems

- 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.

- If the building integrated STS is dismounted, dismounting includes or affects the adjacent building component which will have to be replaced partly or totally by a conventional/appropriate building component.

BISTS must provide a combination of the following:

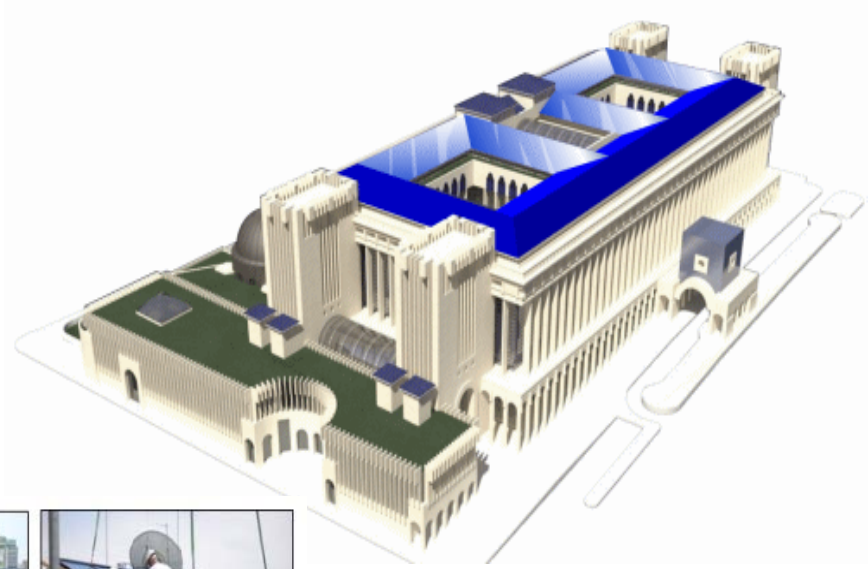
1. Mechanical rigidity and structural integrity.
2. Weather impact protection from rain, snow, wind and hail.
3. Energy economy, such as useful thermal energy, but also shading and thermal insulation.
4. Life expectancy from the various materials involved (at least equal to the life of the building)
5. Fire protection
6. Noise protection.

COST Action TU1205

- This Action examines BISTS
- Transport and Urban Development (TUD) Domain (2013-2017)
- Currently 22 EU countries participating plus two non-COST countries, USA and Canada
- As part of this Action initially a survey was carried out to collect case studies for systems installed worldwide-Some typical cases are presented here.

ÉcoTerra –East Quebec

Integration of STC in a pitched roof (Caixa Geral de Depósitos, bank headquarters), Lisbon



Operating Control Centre of BRISA, (Carcavelos) Lisbon

Concordia UNIVERSITÉ UNIVERSITY

CZEBS

iiSBE

APEC

CYPRUS UNIVERSITY OF TECHNOLOGY 2004

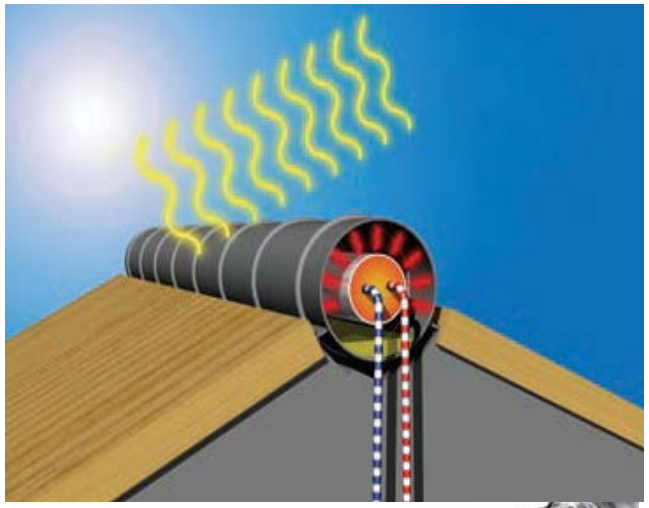
BISTS balustrade/railing feature

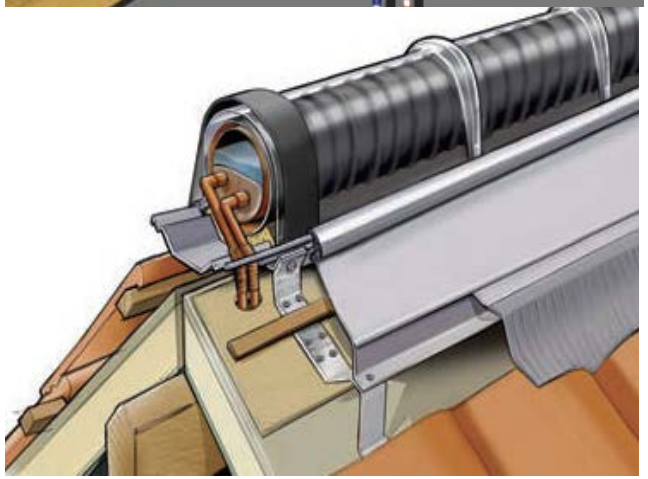





Solar collectors act as balcony railings of the building, Beijing, China

ICS-Solar Water Heaters

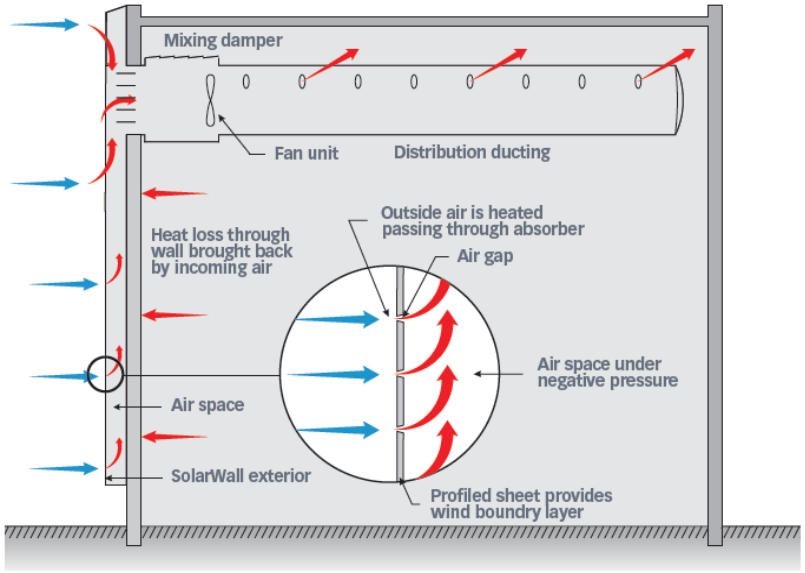


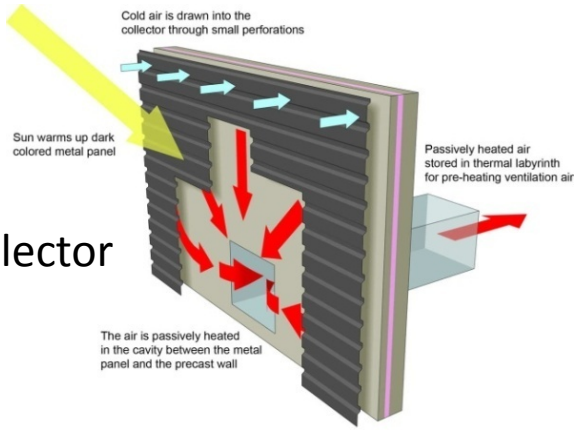


Eco-Nok roof integrated solar water heater, The Netherlands

Bombardier (Canadair Facility), Montreal

One of the mostly used system





Transpired collector

In 1996 it was the largest solar air heating system in the world. The solar installation was integrated on the extensive renovations that were needed to improve the indoor air quality and the appearance of the aged buildings of the complex.

Same principle

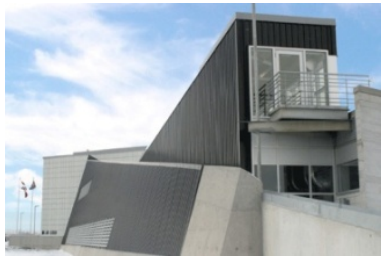
Dr. David Suzuki Public School
Windsor, Ontario, Canada

Avon Theatre, Stratford, Ontario, Canada

Erlangen City Hall, Germany

Other applications in Canada

Health Canada, Ontario, Canada



Greater Toronto Airport Authority, Ontario, Canada

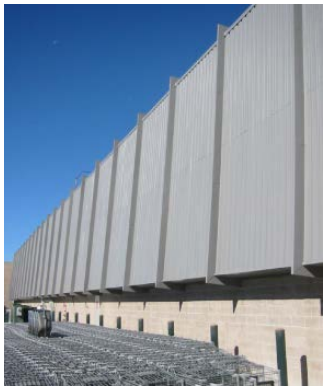
Fred Douglas Place, Winnipeg, Manitoba, Canada

Applications in USA

Northern Arizona University Distance Learning Center, AZ, USA

Rapid City Community Centers, SD, USA

FedEx, Colorado, USA



Wal-Mart, Denver, CO, USA

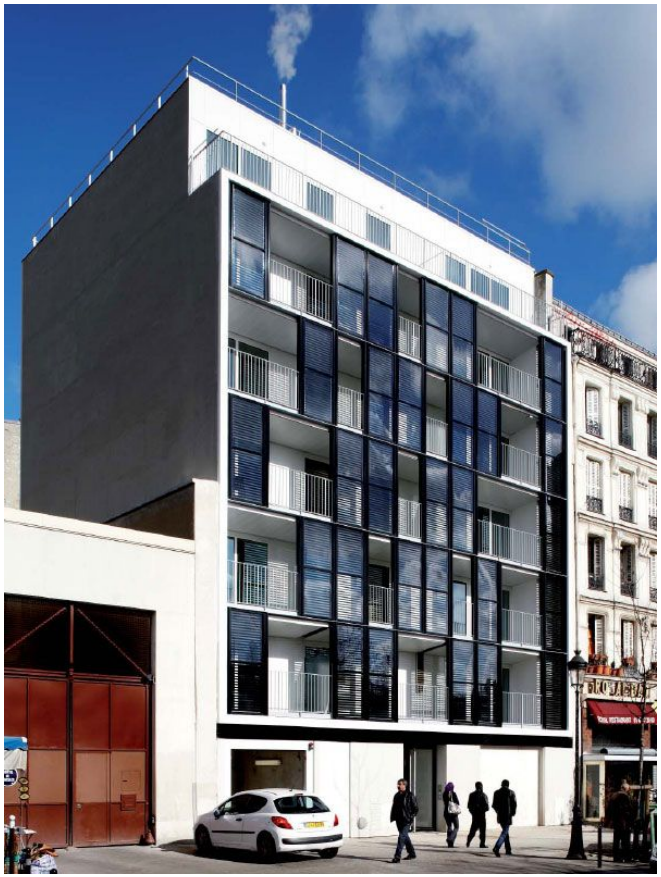
St Louis County's Hibbing Courthouse Annex, MN, USA

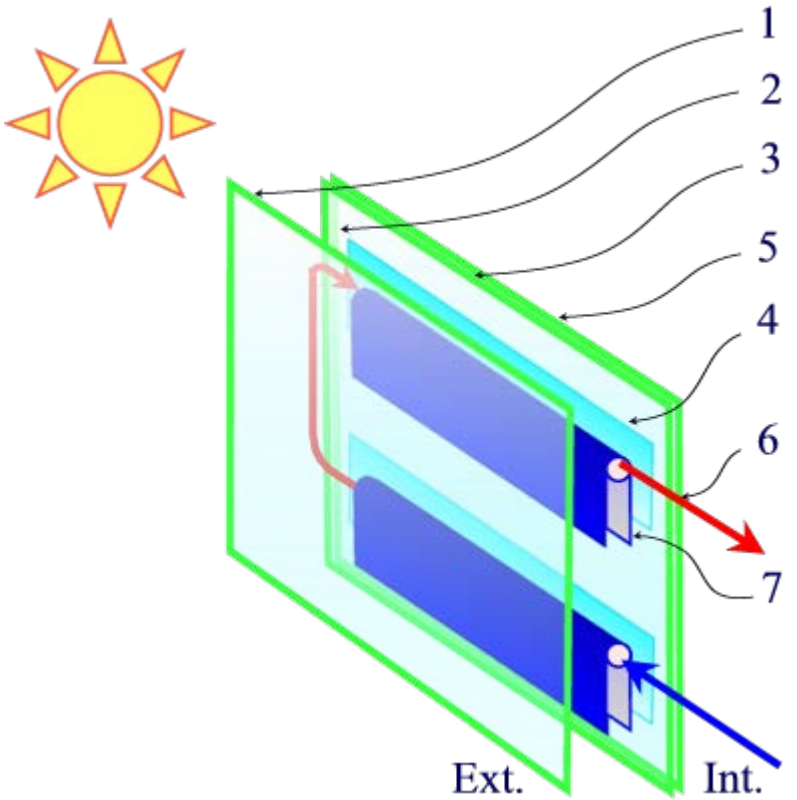
Applications in Europe

Toyota Motor Manufacturing, Onnaing, France

Marks & Spencer, Leicestershire, UK

BIST in social housing (Paris)

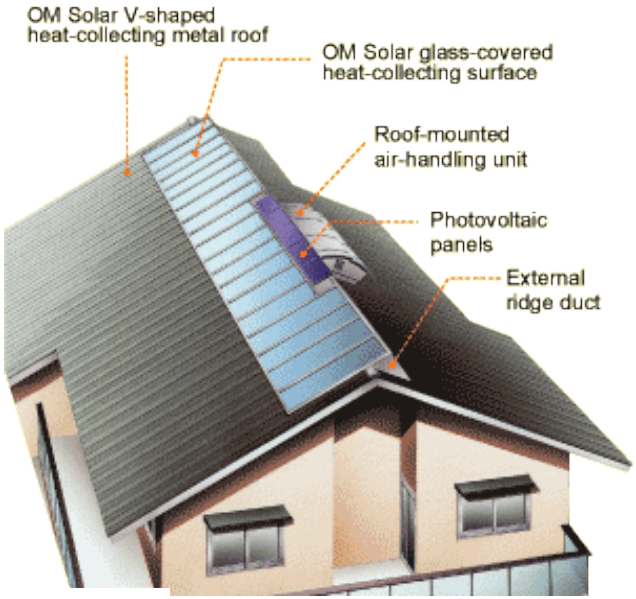




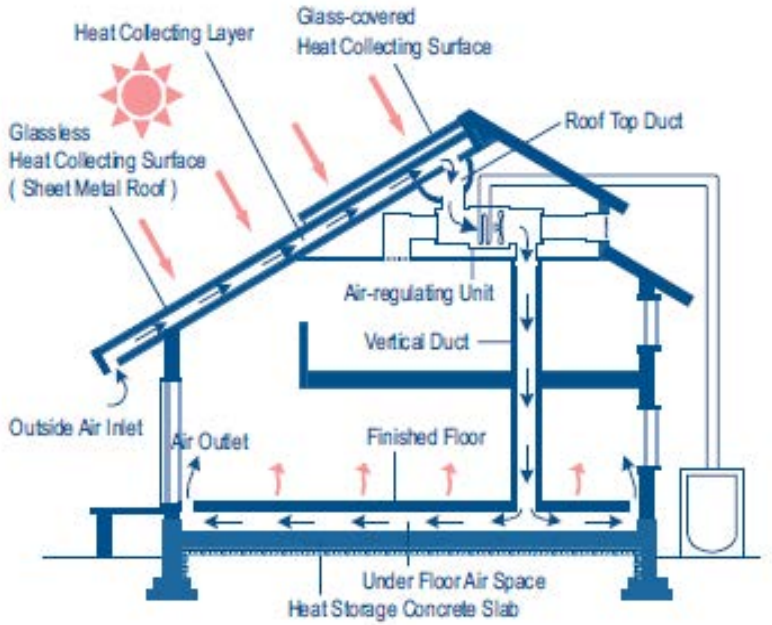
1 – Outer pane: Extra white glass, thermally tempered
2 - Argon filling
3 – Inner pane: Float glass tempered with a low-e soft coating (pos.3)
4 – Aluminium strips with PVD silver coating (one side) reflectors: 98% visible light – 95% total reflection
6- One piece copper serpentine with warm transfer fluid
7 – Aluminium ∩-shape profiles with a solar selective absorber coating

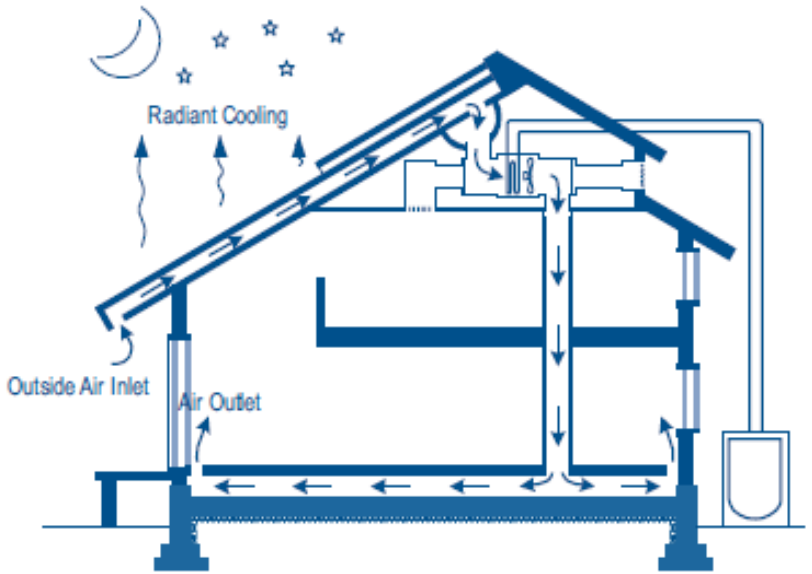
OM solar integrated dwelling

http://www.omsolar.net/



The system offers both solar heating and cooling (using radiant cooling)

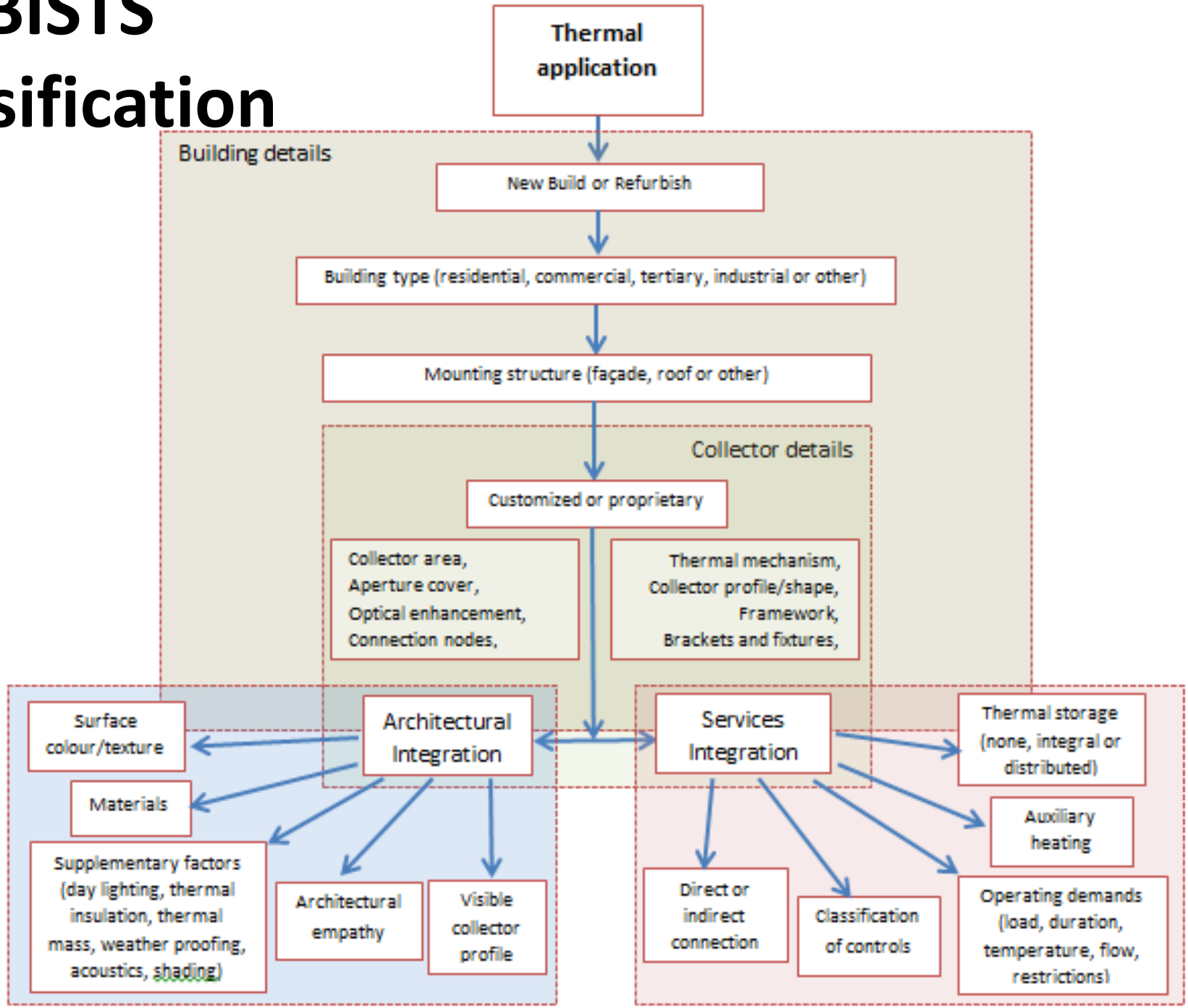




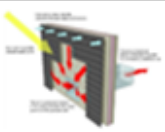
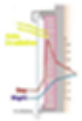
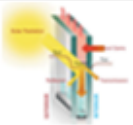
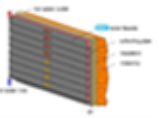
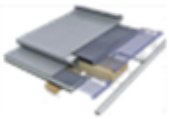
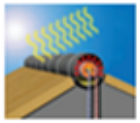
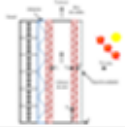
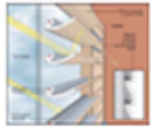
Sunlighthouse, Pressbaum, Austria

- BISTS give architects new tools to express their creativity abilities

BISTS Classification



BISTS Taxonomy

				Installed element					
				Façade		Roof		Other	
				New	Retrofit	New	Retrofit	New	Retrofit
OUTPUT	AIR	Air heating & ventilation	Active						
			Passive						
		Space heating	Active						
			Passive						
		Combined air and water heating	Active						
			Passive						
	WATER	Water heating	Active						
			Passive						
		Cooling & ventilation	Active						
			Passive						
	ELECTRICITY	PVT	Active						
			Passive						

BOOK: OVERVIEW OF BISTS STATE OF THE ART, MODELS AND APPLICATIONS

OVERVIEW OF BISTS STATE OF THE ART, MODELS AND APPLICATIONS

COST Action TU1205 (BISTS)

Building Integration of Solar Thermal Systems

COST Action TU1205:
Building Integration of Solar Thermal Systems (BISTS)

Overview of BISTS State of the Art, Models and Applications

Energy use in buildings represents 40% of the total primary energy used in the EU and therefore developing effective energy alternatives is imperative. Solar thermal systems (STS) will have a main role to play as they contribute directly to the heating and cooling of buildings and the provision of domestic hot water. STS are typically mounted on building roofs with no attempt to incorporate them into the building envelope, creating aesthetic challenges and space availability problems. The Action will foster and accelerate long-term development in STS through critical review, experimentation, simulation and demonstration of viable systems for full incorporation and integration into the traditional building envelope. Viable solutions will also consider economic constraints, resulting in cost effective Building Integrated STS. Additionally, factors like structural integrity, weather impact protection, fire and noise protection will be considered. The most important benefit of this Action is the increased adoption of RES in buildings. Three generic European regions are considered; Southern Mediterranean, Central Continental and Northern Maritime Europe, to fully explore the Pan-European nature of STS integration. The Action consortium presents a critical mass of European knowledge, expertise, resources, skills and R&D in the area of STS, supporting innovation and conceptual thinking.

Action web page: http://www.tu1205-bists.eu/

Domain: Transport and Urban Development (TUD).

http://www.cost.eu/COST_Actions/tud/Actions/TU1205

Countries participating: Austria, Belgium, Bulgaria, Cyprus, Denmark, France, Germany, Greece, Ireland, Israel, Italy, Lithuania, Malta, Netherlands, Poland, Portugal, Serbia, Spain, Turkey, United Kingdom.

COST is supported by the EU Framework Program Horizon 2020

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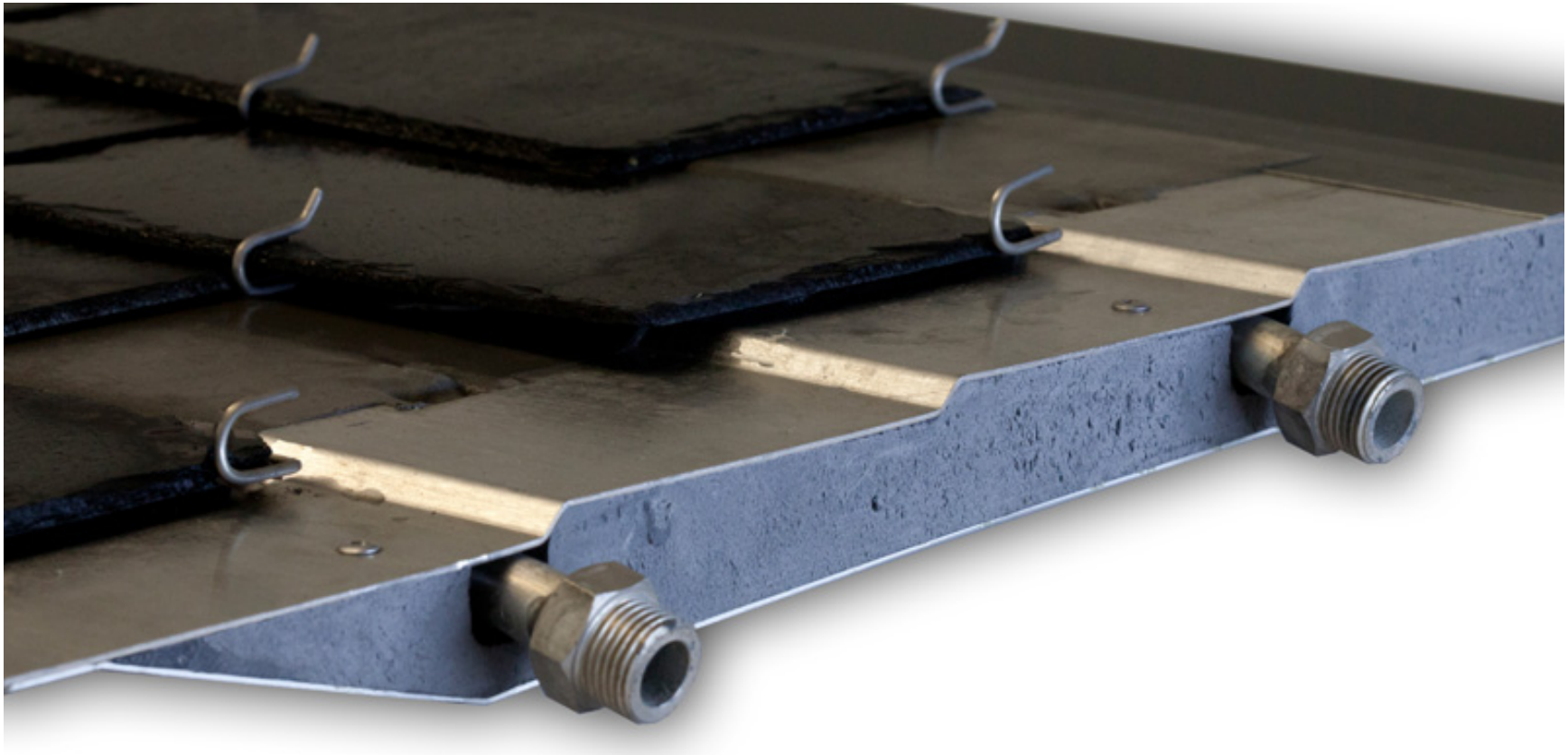
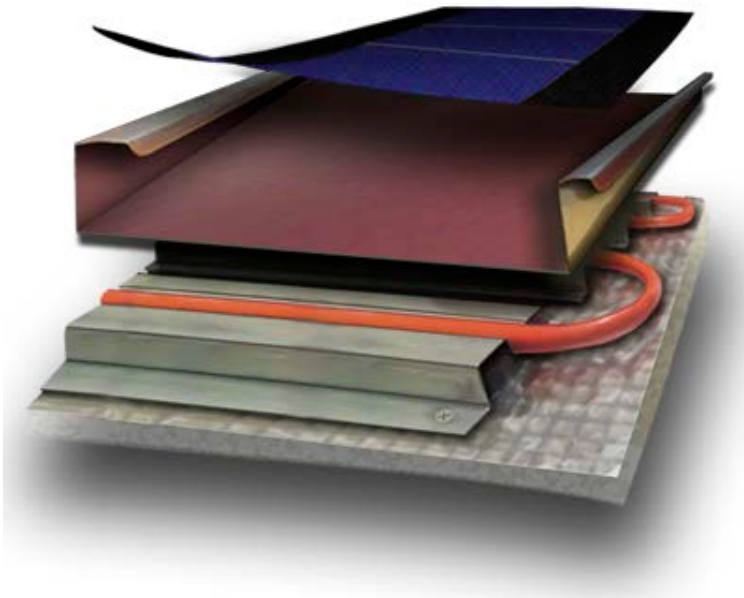
Commercial Products

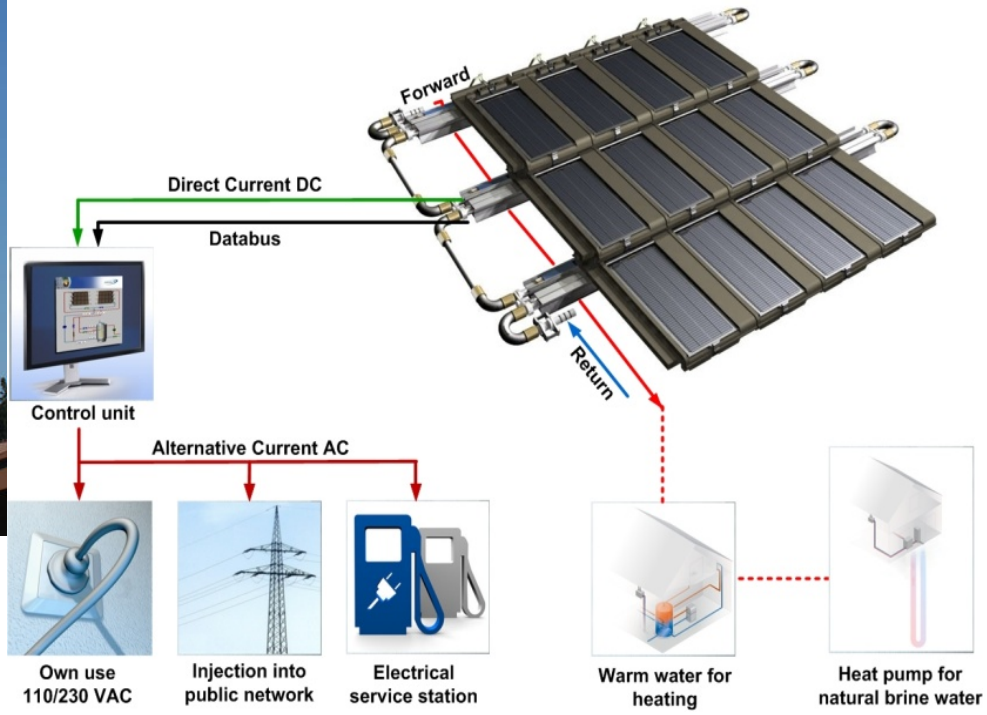
Thermoslate



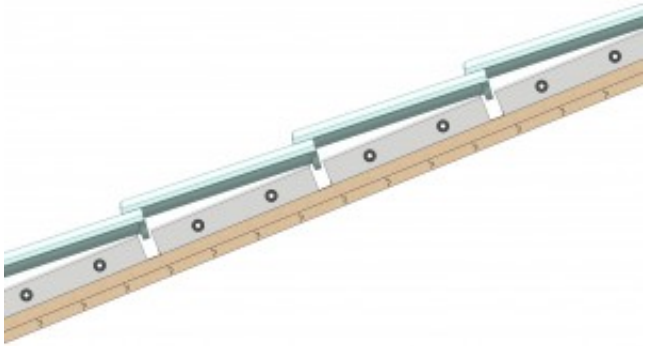
Englert Solar Sandwich

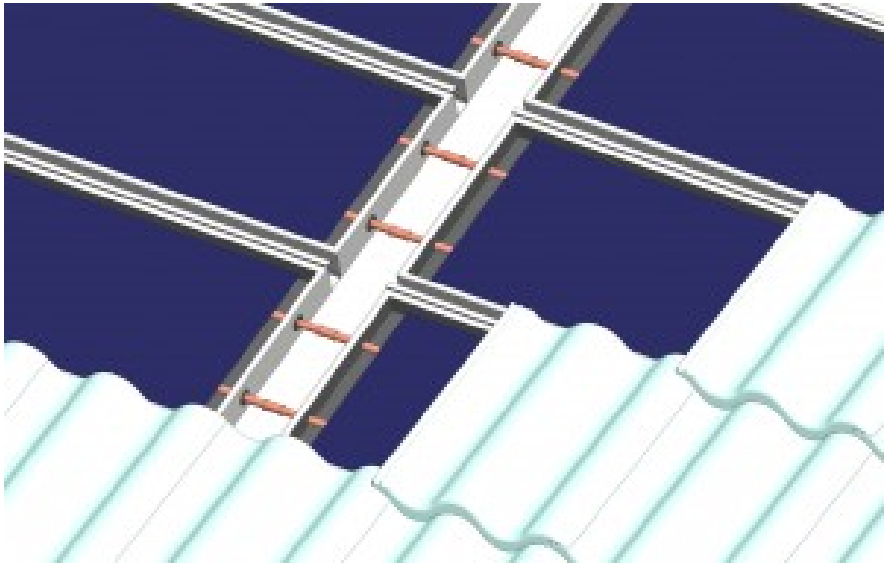


Panotron

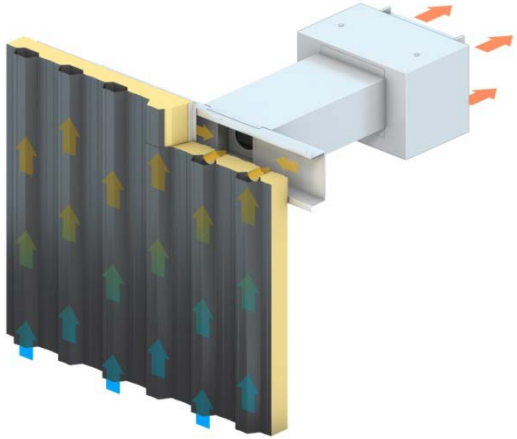

Forward
Direct Current DC
Databus
Return
Control unit
Alternative Current AC
Own use
110/230 VAC
Injection into
public network
Electrical
service station
Warm water for
heating
Heat pump for
natural brine water

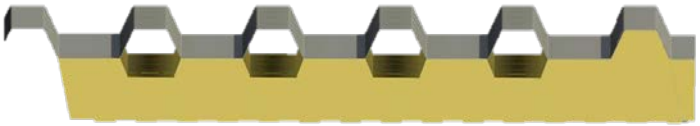
Soltech



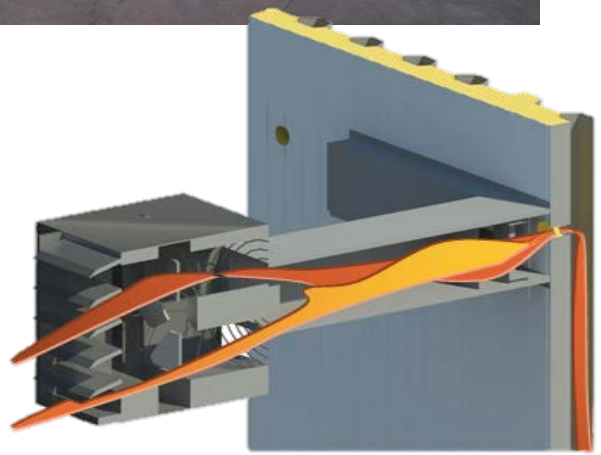


Kingspan facade solar air heater



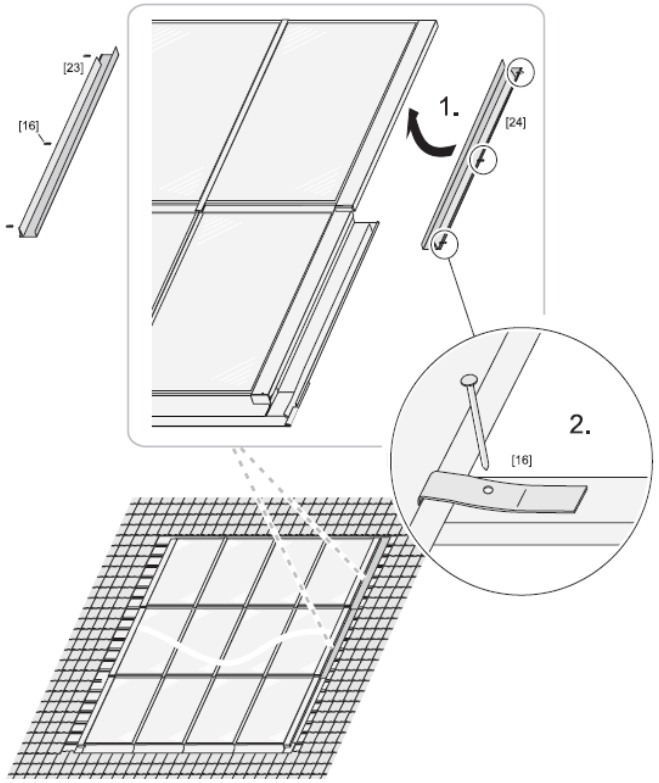


Location: Doncaster, UK



Citrin Solar

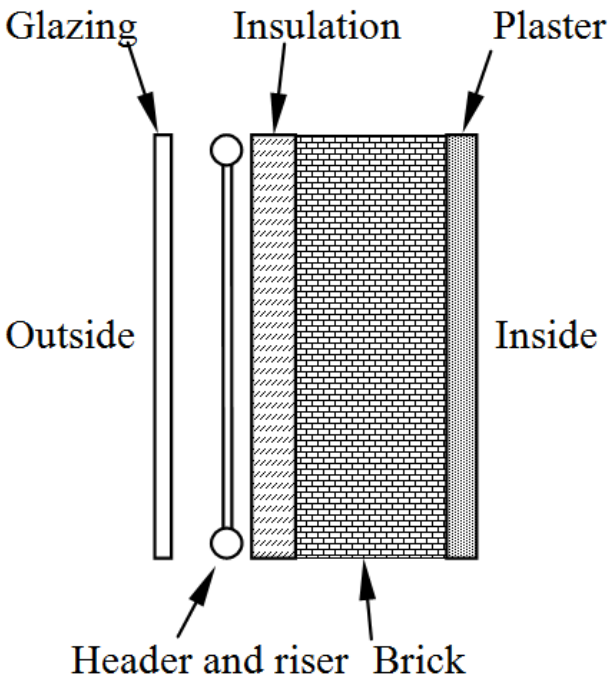
Location: *Moosburg, Germany*

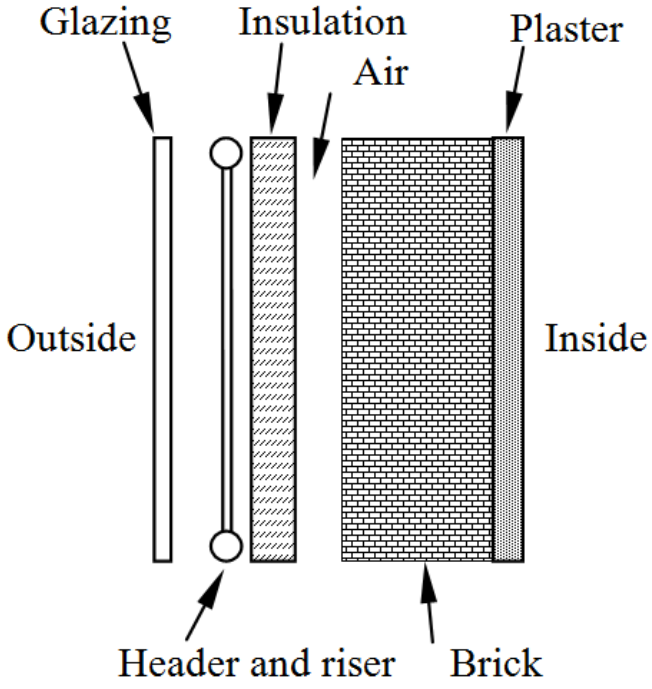


The collector system is a commercial product for roof application. In this example it was used as a demonstration in a facade application.

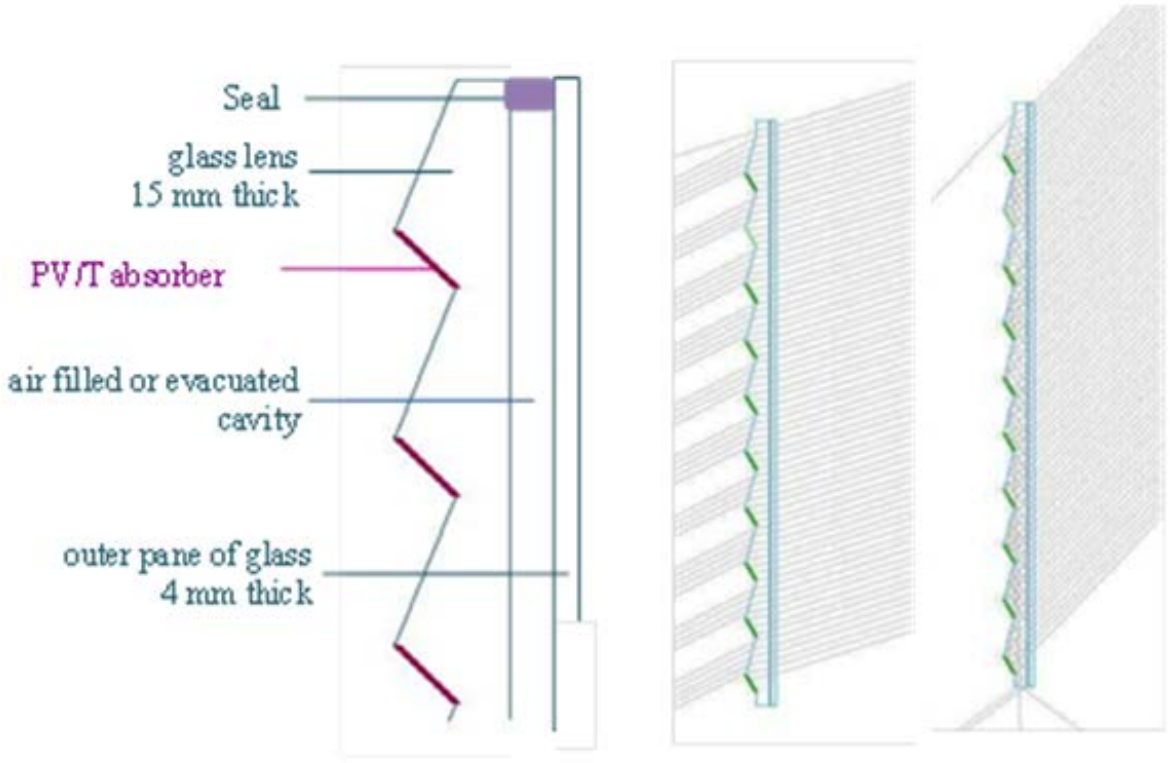
New Systems
Developed within the Action

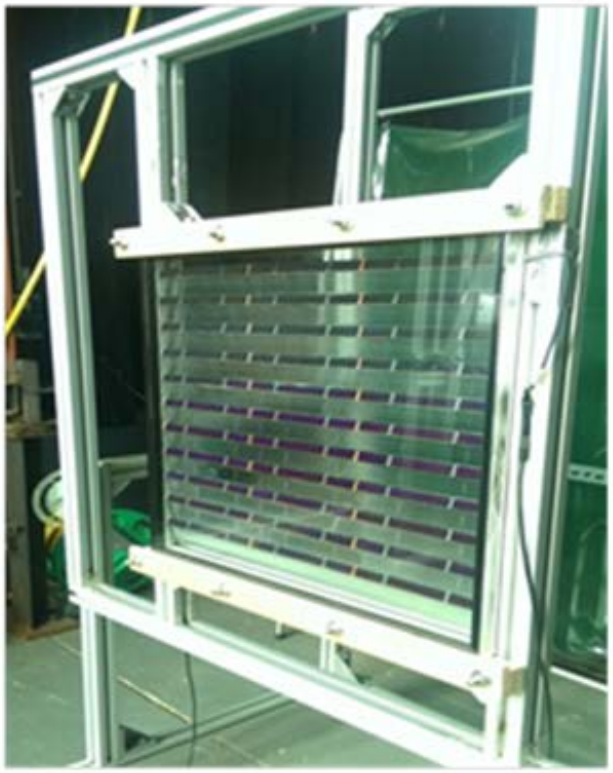
Flat-plate collector – Façade & Roof



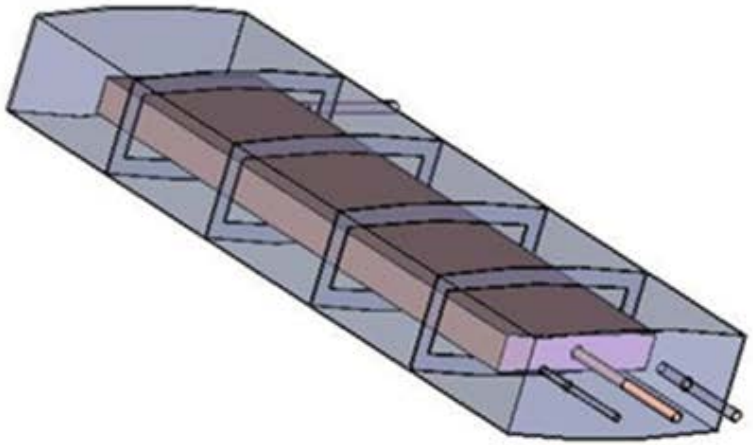


Concentrating PV/T Double Glazing

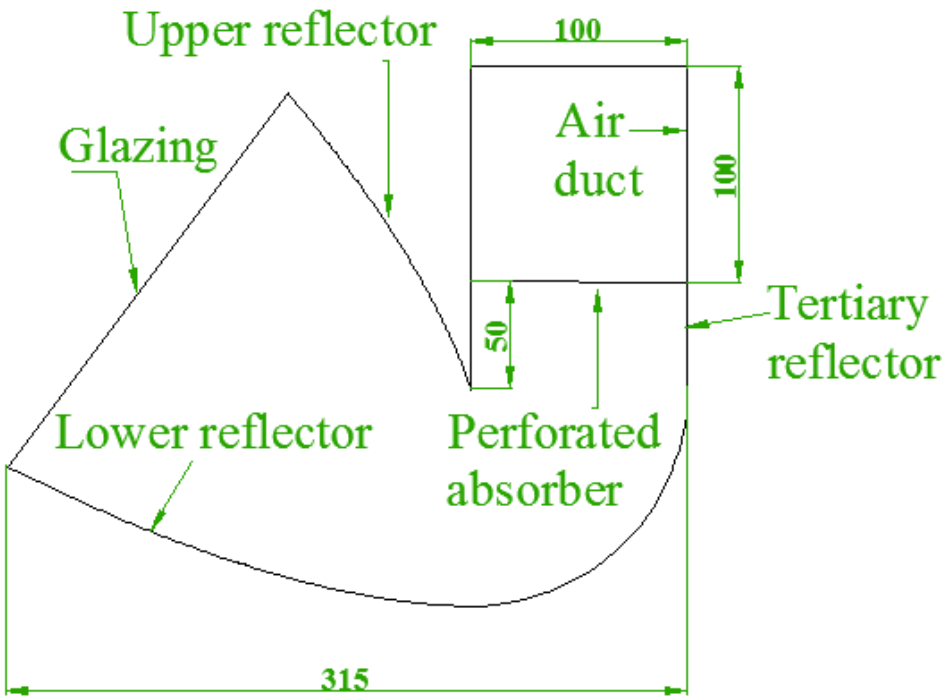


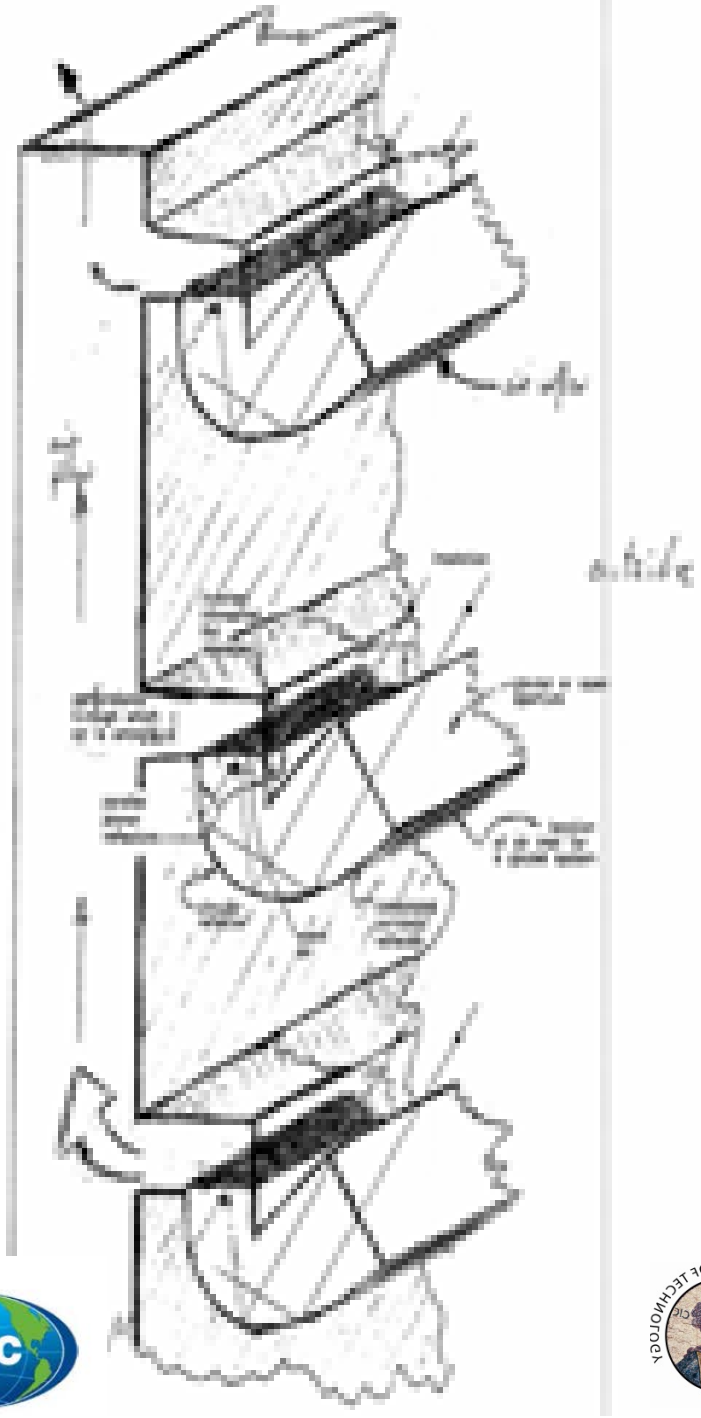


Hybrid Photovoltaic/Solar Thermal (HyPV/T) Façade Module



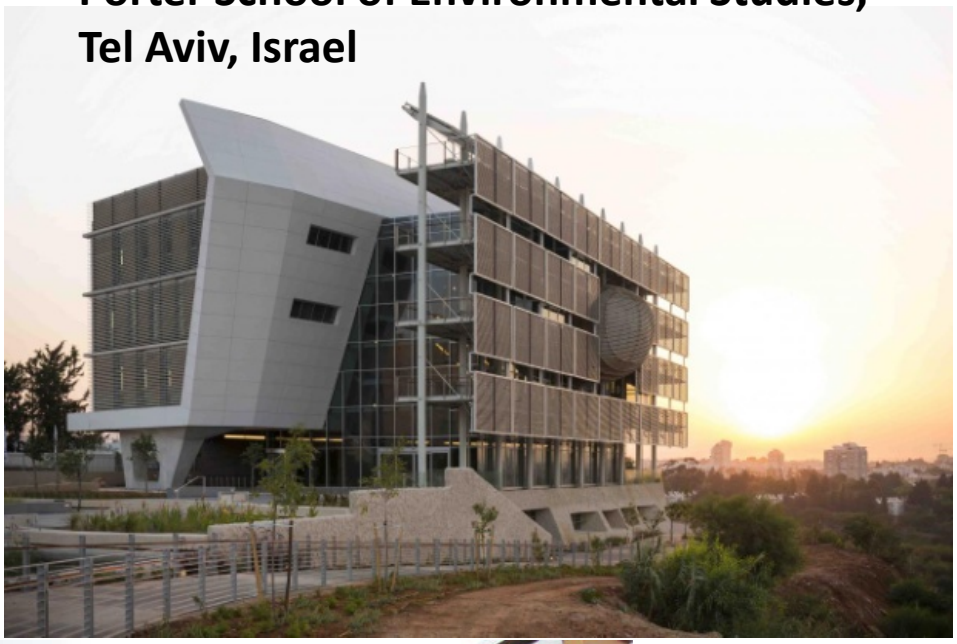
Solar Plenum

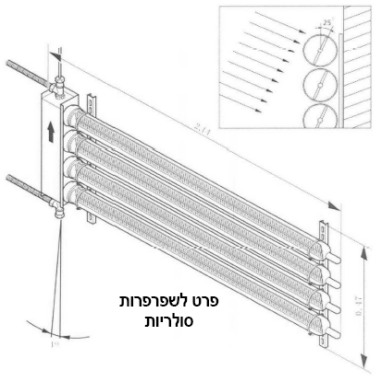




Evacuated tube collectors

Porter School of Environmental Studies, Tel Aviv, Israel





You cannot harness a wild BEAST

But you can use BISTS to harness the immense power of the sun

More details:

- COST web page: www.cost.eu/domains_actions/tud/Actions/TU1205
- Action web page:
- http://www.tu1205-bists.eu/ (includes case studies)

- Thank you for your attention.
- Any questions please????
- Soteris Kalogirou: Email: soteris.kalogirou@cut.ac.cy