Example name: Solar Thermal Glass

<table>
<tr><td>Template completed by:
Jasna Radulovic, jasna@kg.ac.rs
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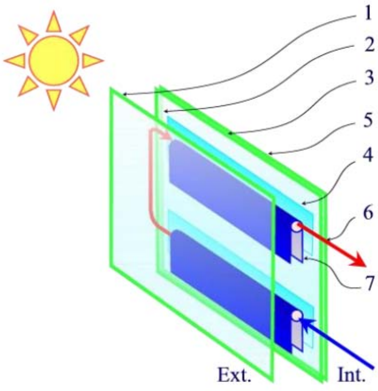
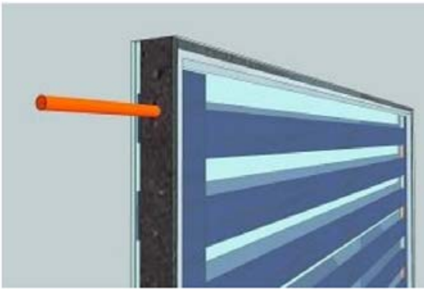
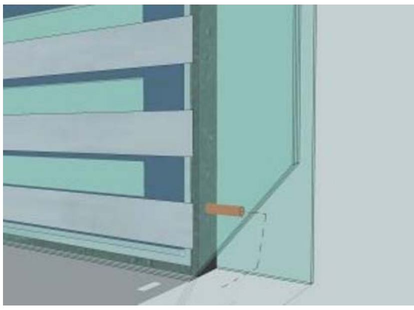
University of Kragujevac</td><td rowspan="2">
Fig. 1 [2], [3]</td></tr>
<tr><td>For installations

BISTS Location:
Paris, 48° 51' N, 2° 21' E
Climate Type: Cfb
Building Use: residential

Level of BISTS integration
Rush classification: 3
Reijenga classification: 2

Ox New Build
O Refurbishment
O Other: ……………………</td></tr>
</table>

Type of BISTS: Active Function(s): O Air heating Ox Water heating O Combi-system O Cooling/ventilation/shading O PV/T O linked to another system (e.g., heat pump) O Other: ………………………	 Fig. 2 [1] 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 5 – Extra white glass, thermally tempered or float 44.2, UV glued over the reflectors (4) with the inner pane (3) 6 – One piece copper serpentine with warm transfer fluid 7 – Aluminium ∩-shape profiles with a solar selective absorber coating
Building element: Ox Facade O Roof O Other: ……………………..	 a  b Fig. 3 [1]

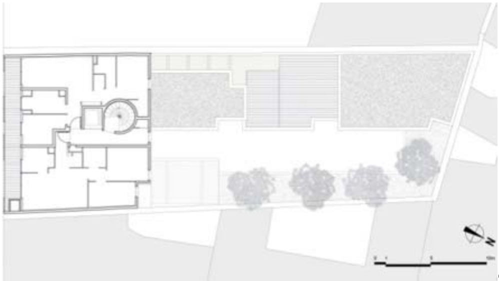
BISTS characteristics:

- The solar thermal glass is supplied on racks made from waste wood or specially designed metal A-frames (against consignment). Glass and rack must be stored in a dry place and protected from sunrays.
- The surface on which the rack with modules rests must be smooth and able of taking the entire weight of the rack.
- Each solar thermal glass is separated from the next one by foam sheeting or protective cork separators. These low adhesive separators must be removed from the glass by the joiner/façade specialist during installation.
- Each tube exiting from the glass comprises a 50mm-long split silicon sleeve. That sleeve allows the dilation of the tubes after the reconstitution of the sealant with silicone and aluminium adhesive strips after the possible drilling of holes in the connector.
- Each solar thermal glass sheet comprises on one side 2 copper tubes, each with a diameter of 8*7mm. These tubes must be perfectly circular and exit perpendicularly from the glass on 100mm.
- The tubes that exit in dependence of the module dimension on the side or top of the glass.
- Upper and lower copper tubes are closed with removable yellow stoppers.
- The modules are wrapped to the racks with a polyethylene film.
- Beyond the polyethylene film, at the bottom of the module situated at the exterior a thin wood plate (OSB) protect them.
- The modules are maintained to the rack with a one way or reusable girth.
- A label stuck on the right side at the bottom of the interior glass mentioned main characteristics about the solar thermal glass, as well as, each, its serial number.
- If referent, printed information on corner of the glass indicates in reference to the applicable norm that it is tempered.
- A Solar Keymark/ solar thermal collector label (70*42mm) is glued over the polyurethane, where the upper pipe goes out, on the rand of the IGU. A QR placed at the bottom, on the right side of the two UV glued glazing give a cloud access to the documentations.
- A label placed on the inner pane help to identify orientation (Top/Down) and position (Place this face inside the building). It also warns that the unit must never be turned round. This label and eventual glue rest must be removed with ethanol by the joiner/façade specialist after installation of the solar thermal glass in the frame.
- The standard width is 1016 mm (glass rand). The upper and lower pipe who goes out of the glass on the side adds between 25 mm (which is the minimum cupper dimension to connect or disconnect) and 100 mm (standard delivery length) to that width. The height of the lower copper pipe axis is located 51 mm from the bottom of the glass.

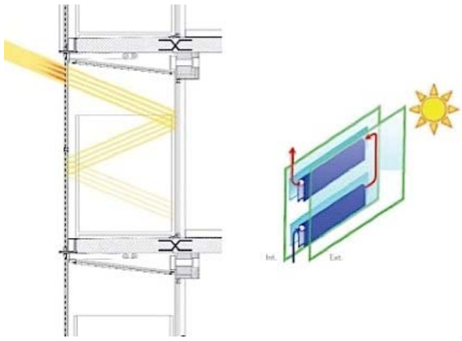
Stage of Development:Responsible:.

O	Idea/Patent	…………………………………..
O	Prototype	…………………………………..
O	Demonstration	…………………………………..
Ox	Integral building element	Robin Sun Solar Thermal Glass
Ox	Commercially available	Robin Sun Solar Thermal Glass

BISTS description and context



a



b

Fig 4 [3]

Eco-friendly architecture is becoming a priority to almost many of the architects and designers worldwide. One of the architects that join with the whole world in designing structures with saving the earth in mind is the Philippon-Kalt Architects, whom had designed the first building for social housing in Paris that has solar panels.
The agency Philippon-Kalt just delivered, opposite the station Barbès, the first building of social housing in Paris with a facade solar panels. Seventeen social housing units for lower income have been created in a very constrained environment with a willingness to implement innovative environmental techniques. The facade shows its solar panels on the Boulevard de la Chapelle, and capturing solar gain free to provide 40% of domestic hot water needs. A control system to verify the system performance of solar water heating. Robin Sun sensors, in the absence of technical advice, were the subject of a notice of the specific area of operation. Double skin, double use, solar panels reflect the image a powerful instrument panel, atypical in the scope of protection of historic monuments. It preserves the privacy of passengers' views of dwellings from the Skytrain and offers private balconies protected from the noise of the Boulevard de la Chapelle by forming trellis acoustic masks [3].

System viability

Modelling and simulation tools developed/used

Simulation with Polysun designer, and TRNSYS model of solar thermal collector for complex simulations.

BISTS Performance data

Based on:
O Estimation
Ox Detailed simulation
O Measurement/testing
O Long-term monitoring
tick all that apply

Performance parameters

For integrated systems:
key performance indicators -

Solar savings fraction: %
Light transmittance: %
Solar transmittance:%
Total solar energy transmittance: %:
Solar heat gain factor: %
Building fabric U-values: W/m^{2}K
Noise, fire, etc ratings
Other:

For separate collectors:
performance rating coefficients -
(EN12975, a0,a1,a2), ASHRAE, etc

Collector and IAM measurement (EN 12975-1, 2:2006) for module H-1432:

Optical efficiency based on aperture area ETA 0: 52,5 %
a1 : 4,746 [W m^{-2} K^{-1}]
a2 : 0.0351 [W m^{-2} K^{-2}]
Heat mass: 7.66 kJ/K

The IAM (Incident Angle Measurement) values are corrective coefficients of the optical efficiency to take into account the solar flux reflected by the mirrors in dependence of the solar positions. Transversal values over 1 are the specific characteristic of the solar thermal collector working with concentrators or, in our case, reflectors:

θ en °	0	10	20	30	40	50	60	70
Kθb(θt)=	1,00	1,03	1,11	1,18	1,25	1,28	1,26	0,19
Kθb(θl)=	1,00	1,00	1,00	0,99	0,98	0,95	0,89	0,76

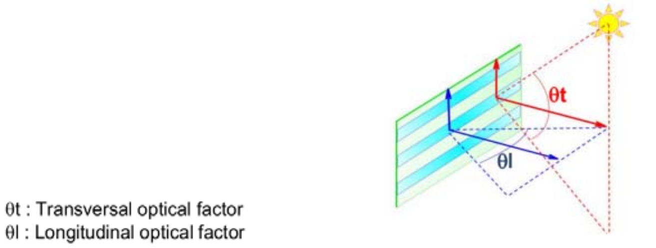


Fig. 5 [1]

The total solar energy transmittance, named as well solar factor, g-value or SHGC for Solar Heat Gain Coefficient, is for an IGU the total amount of energy transmitted inside the building. It has been measured by the Fraunhofer ISE for 3 characteristic solar heights (0°, 30° and 60°)

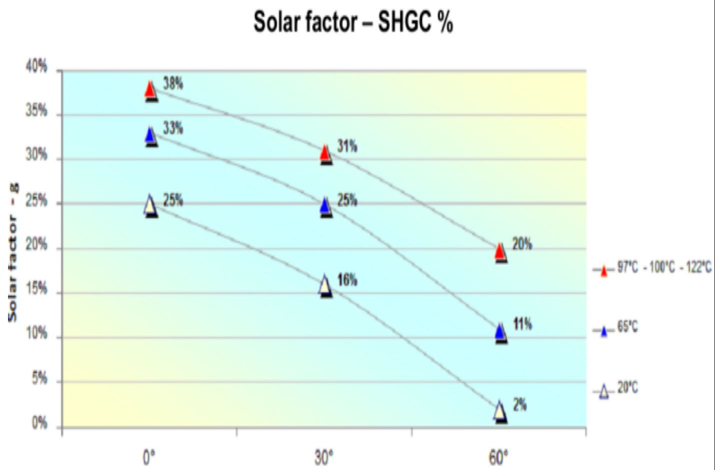


Fig. 6 [1]

Light transmission: Value of the light transmission factor (LT) in %:

Incidence Angle °	0°	30°	60°
LT %	35%	29%	7%

Additional information:

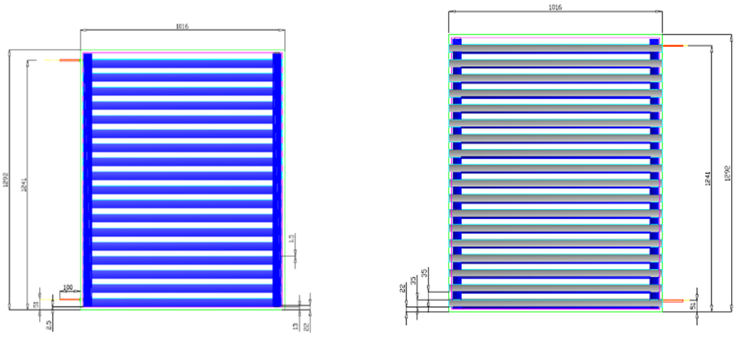


Fig. 7 Robin Sun solar thermal glass seen from the a) outside of the building, b) inside of the building [1]

Sources and references:

[1] Technical documentation, Robin Sun Solar Thermal Glass, http://www.robinsun.com/media/technical_documentation

[2] Photo album of Robin Sun Solar Thermal Glass projects, http://www.robinsun.com/en/projects/

[3] http://architizer.com/firms/philippon-kalt-architectes/

INSTRUCTIONS

Please fill in as much information as possible.

Tick where appropriate.

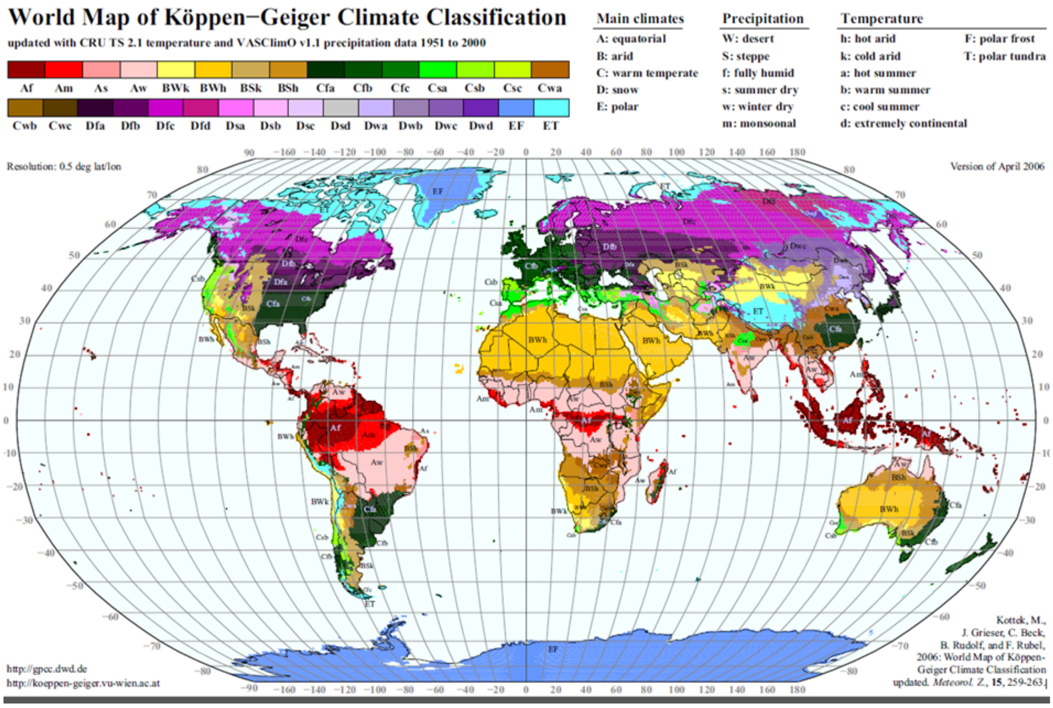
Text in red is suggested guidance. Insertinformation in provided space, removing red text as appropriate

If possible, use metric values.

If necessary, supply additional information on separate sheets

<u>Reference listing</u>

Köppen climate classification



(Kottek, M.,J. Grieser, C. Beck,B. Rudolf, and F. Rubel,2006: World Map of Köppen-Geiger Climate Classificationupdated. Meteorol. Z., 15, 259-263.)

Reijenga classification

The integration of PV systems in architecture can be divided into five categories:

1. Applied invisibly
2. Added to the design
3. Adding to the architectural image
4. Determining architectural image
5. Leading to new architectural concepts.

(Reijenga, TH and Kaan, HF. (2011) PV in Architecture, in Handbook of Photovoltaic Science and Engineering, Second Edition (eds A. Luque and S. Hegedus), John Wiley & Sons Ltd, Chichester, UK)

Rush classification

The architectural/visual expression of building services systems are identified as:

Level 1. Not visible, no change
Level 2. Visible, no change
Level 3. Visible, surface change
Level 4. Visible, with size or shape change
Level 5. Visible, with location or orientation change

(Rush, RD. (1986) The Building systems integration handbook Wiley, New York, USA)

Collector test standards

BS EN 12975-2 2006 'Thermal solar systems and components solar collectors - Part 2 test methods'

ASHRAE Standard 93-2010 'Methods of Testing to Determine the Thermal Performance of Solar Collectors'
ASHRAE Standard 95-1987 'Methods of Testing to Determine the Thermal Performance of Solar Domestic Water Heating Systems'