Example name: Solar XXI – BIPV/T-PCM Systems

<table>
<tr><td>Template completed by:
Laura Aelenei, Ana Ferreira, LNEG;
laura.aelenei@lneg.pt</td><td rowspan="2"></td></tr>
<tr><td>For installations

BISTS Location: Lisbon
9º10'39.83'' W
38º46'20.27'' N

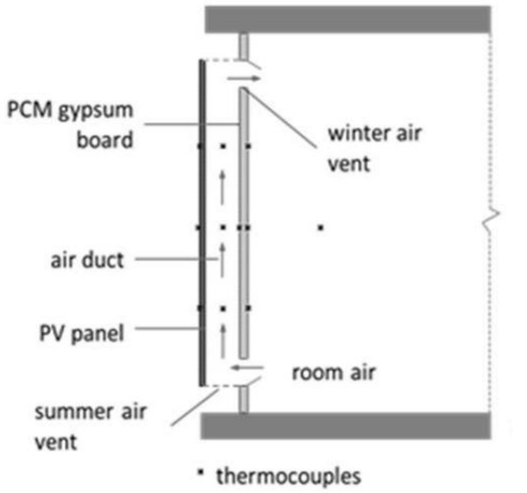
Climate Type: Csa

Building Use: Non-residential: Office

Level of BISTS integration
Rush: Level 2
Reijenga: 5

X New Build
X Refurbishment
O Other: ……………………</td></tr>
<tr><td>Type of BISTS:

Hybrid

Function(s):
X Air heating
O Water heating
O Combi-system
X Cooling/ventilation/shading
X PV/T
O linked to another system (e.g., heat pump)
O Other: ………………………</td><td rowspan="2"></td></tr>
<tr><td>Building element:

X Facade
O Roof
O Other: ……………………..</td></tr>
<tr><td colspan="2">BISTS characteristics:

Technology: PV polycrystalline modules; PCM: Wallboard with 25% of microencapsulated PCM incorporated type Alba®balance.
Collection/latent heat storage area: 1,00m^2
Inclination/Orientation: 90º, fixed in the south façade
Peak power installed: 0,12 kW
Pre-fabrication off-site: Yes
Heating description: space heating provided by solar thermal collector system.
Cooling description: heat storage during the peak heat, preventing the superheat of the office.</td></tr>
</table>

Stage of Development: Complete **Responsible:** LNEG

O	Idea/Patent	…………………………………..
X	Prototype	Solar XXI
O	Demonstration	…………………………………..
O	Integral building element	…………………………………..
O	Commercially available	…………………………………..

BISTS description and context

Project motivation: Study the effect of incorporate phase change materials (PCMs) in the façade of a building.

Building name: Solar XXI, implemented in one office.

Function and form: Office, parallelepiped shape in plant

Size: 18,27m^2

Occupancy: 1 person

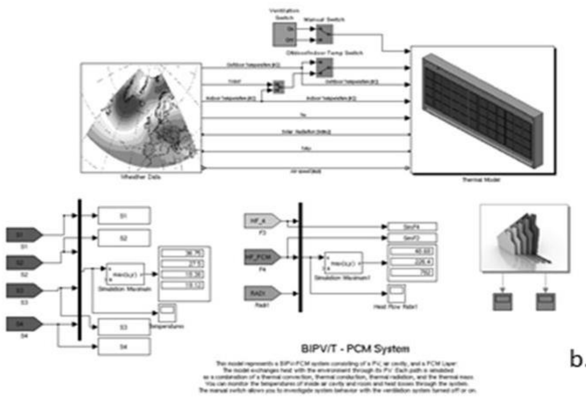
Particular features: Optimization of thermal envelope; Increase the area of solar heat gains – south solar façade, as a direct gain system for heating; Heat recovery by natural ventilation in the photovoltaic façade for indoor environmental heating; Passive cooling during the peak heat through heat storage.

South façade: PV/Wall ratio: 9,5%
Window/Wall ratio: 28,4%

System viability

Under study

Modelling and simulation tools developed/used



b.

A simplified thermal network model for BIPV-PCM has been developed in MATLAB/SIMULINK® which allowed comparing the numerical results with experimental results obtained from testing the BIPV-PCM system after its installation on SolarXXI building façade.

BISTS Performance data

Based on:
X Estimation
X Detailed simulation MATLAB/SIMULINK
X Measurement/testing
X Long-term monitoring

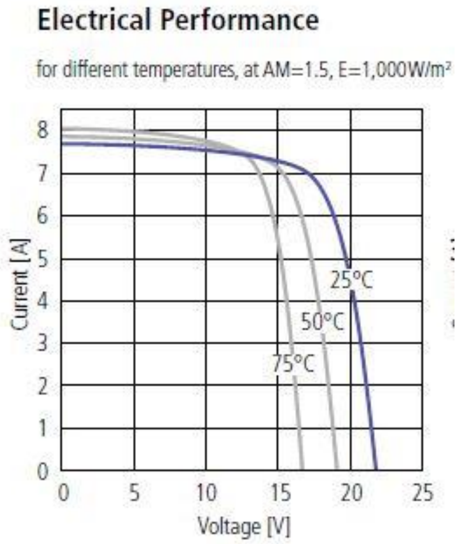
Performance parameters

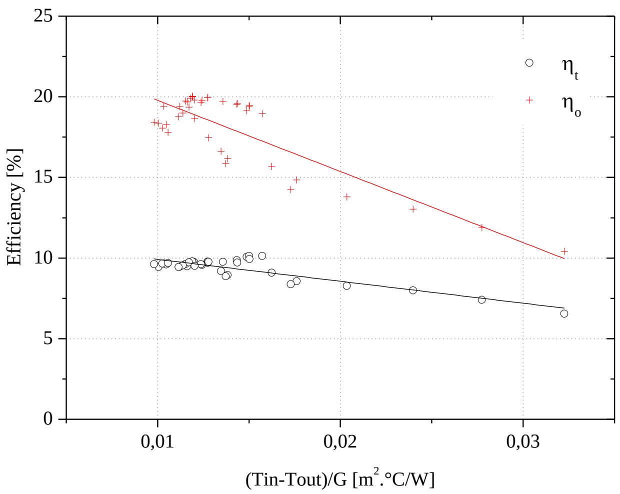
For integrated systems: BIPV/T-PCM key performance indicators -

Solar savings fraction: %
Light transmittance: %
Solar transmittance: %
Total solar energy transmittance: %:
Solar heat gain factor: 75 %
Building fabric U-values: …W/m^{2}K
Noise, fire, etc ratings
Other:

For separate collectors:
performance rating coefficients -

Other:





Additional information:

Prototype constructed within FRAME project.

Sources and references:

[1] L. Aelenei, R. Pereira, H. Gonçalves, A. Athientis, Thermal performance of a hybrid BIPV-PCM: modeling, design and experimental investigation, Energy Procedia 2014, Elsevier;
[2] L. Aelenei, R.Pereira, H. Gonçalves, A.Rocha e Silva, Energy saving potential of a hybrid BIPV-T system integrated with heat storage material, 2nd International Conference on Sustainable Energy Storage, June 19-21, Trinity College Dublin, Ireland.

INSTRUCTIONS

Please fill in as much information as possible.

Tick where appropriate.

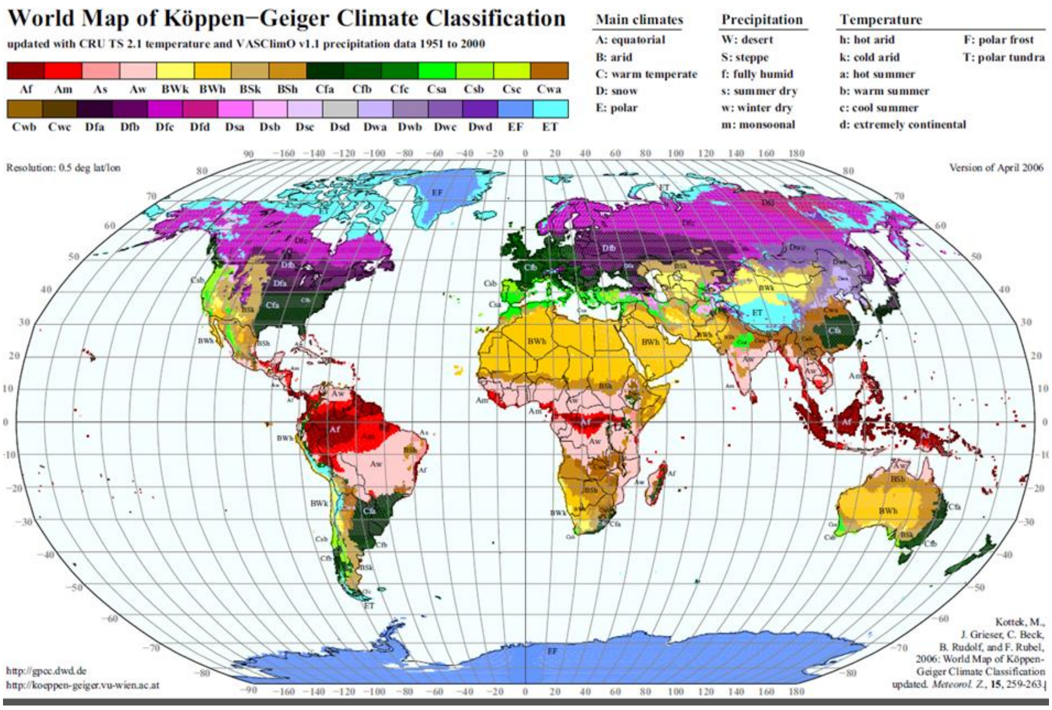
Text in red is suggested guidance. Insert information in provided space, removing red text as appropriate

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 Classification updated. 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’