Example name:

Template completed by:
Renee Wansdronk. Wansdronk Architektuur, rw@wansdronk.com

For installations

BISTS Location: Arnhem (NLD)
51° 59' 0" N / 5° 55' 0" E

Climate Type: Cfb

Building Use: residential, commercial, green house

Level of BISTS integration
Reijenga Level 5.
Rush Level 3, 4, 5

✷ New Build
O Refurbishment
O Other: ……………………

Photographs

Type of BISTS:

Active

Function(s):
O Air heating
✷ 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:

✷ Facade
O Roof
✷ Other: indoor heat storage

Drawings/Sketches/Cross-sections

BISTS characteristics:

A south oriented 40 m2 solar collector, with horizontal evacuated tubes and (perforated) compound parabolic concentrator, is connected to a prefabricated 50 tm3 seasonal heat storage water vessel. The solar collector is integrated within the facade of a retrofitted office building.

Stage of Development:	Responsible:
✹ Idea/Patent	Wansdronk
✹ Prototype	Wansdronk
✹ Demonstration	Wansdronk
✹ Integral building element	Wansdronk
✹ Commercially available	Wansdronk

BISTS description and context

The test results will be used to validate the TRNSYS outcomes, and to copy and paste these into a design for student housing projects situated on science parks, which will be used to test the equipment on human behaviour for example.

System viability

The solar collector and heat storage costs are approximately 19,000 euro per dwelling. The different equipment parts are prototypes, which are all based on off-the-shelve product and production technology.

Modelling and simulation tools developed/used The TRNSYS simulation program modules are especially created for the Emporium building concept and energy system characteristics. The Emporium simulations are used to calculate the seasonal storage for a free standing house, and for a semi-detached house. Besides the cooling collector and human behaviour the accuracy is high, because all TRNSYS modules are based on measured data.	
BISTS Performance data Based on: O Estimation ✸ Detailed simulation *TRNSYS* ✸ Measurement/testing ✸ Long-term monitoring **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/m²K* *Noise, fire, etc ratings* *Other:* For separate collectors: performance rating coefficients - (EN12975, a0,a1,a2), ASHRAE, etc Other:	*Graphs for collector efficiency, seasonal energy gains, diurnal/seasonal solar fraction, etc.*

Additional information:

Sources and references:

Emporium building concept

To design, develop and improve a zero energy and zero emission building concept the following test pilots and feasibility studies are produced.

Keyword, tools, and decision-making processes:

Energy system simulation by TNO in 1997
quantitative, confidential, technical, co-operation

Energy system simulation by CORE in 1998
quantitative, published, technical, co-operation

Business model analysis by EUR and TUD in 1999
qualitative, published, social, public participation

Energy circulation test by ECN in 2001
qualitative, confidential, technical, co-operation

Energy system analysis by PARAP and VHK in 2003
qualitative, confidential, technical, co-operation

Energy system analysis by ECN in 2004
quantitative, confidential, technical, co-operation

Energy system analysis by W/E in 2005
quantitative, confidential, technical, co-operation

Construction and system costs by bbn in 2005
quantitative, confidential, financial, co-operation

Cooling system test by ESA and TNO in 2008
qualitative, confidential, technical, co-operation

INSTRUCTIONS

Please fill in as much information as possible.

Tick where appropriate.

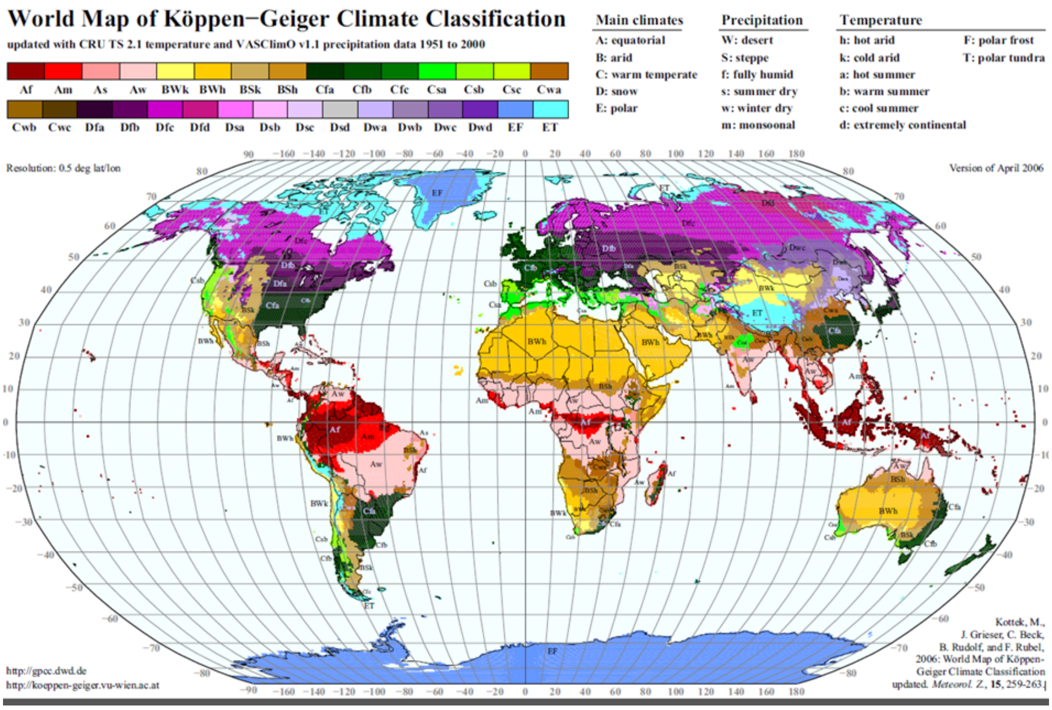
Text in red is suggested guidance. Insert information in provided space, removing red text as appropriate

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'