Introduction on BIPV

Tjerk Reijenga
BEAR-iD (NL)

San Sebastian 06-11-2019

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement Nº 691768

What is **BIPV** - Definition

Definition in EN 50583: “Photovoltaics in buildings - Part 1: BIPV modules”

“Building integrated photovoltaics - **BIPV**” form a building component providing a function as defined in the European Construction Product Directive (CPD 89/106/EEC). (The dismounting of PV modules leads to their replacement by an appropriate building component).”

Functions provided : mechanical rigidity or structural integrity - primary weather impact protection (rain, snow, wind, hail) - energy economy - shading, daylighting, thermal insulation – fire or noise protection - enclosure - security, shelter or safety.

What is **BIPV** - Definition

Definition in EN 50583: “Photovoltaics in buildings - Part 2: BIPV systems”

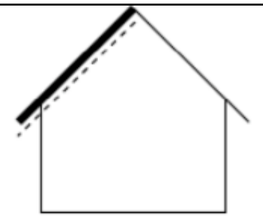
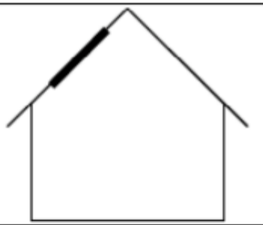
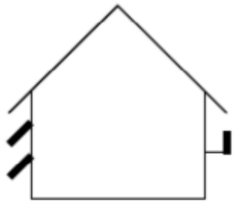
“**BIPV** system, photovoltaic systems are considered to be building-integrated, if the PV modules they utilize fulfil the criteria for BIPV modules as defined in EN 50583-1 and thus form a construction product providing a function as defined in the European Construction Product Regulation CPR 305/2011.”

What is **BAPV** - Definition

Definition in EN 50583: “Photovoltaics in buildings”

“Building Attached Photovoltaic system - **BAPV** system. Photovoltaic systems are considered to be building attached, if the PV modules they utilize do not fulfil the criteria for BIPV modules as defined in EN 50583-1.”

EN 50583
Mounting categories

Category A:	**Sloping, roof-integrated, not accessible from within the building** The BIPV modules are installed at a tilt angle between 0° and 75° including horizontal (see Fig.1), with another building product installed underneath.	
Category B:	**Sloping, roof-integrated, accessible from within the building** The BIPV modules are installed at a tilt angle between 0°and 75° including horizontal (see Fig.1).	
Category C:	**Non-sloping (vertically) envelope-integrated, not accessible from within the building** The BIPV modules are installed at a tilt angle between and including both 75° and 90° (see Fig. 1) with another building product installed behind.	
Category D:	**Non-sloping (vertically), envelope-integrated, accessible from within the building** The BIPV modules are installed at a tilt angle between and including both 75° and 90° (see Fig. 1).	
Category E:	**Externally-integrated, accessible or not accessible from within the building** The BIPV modules are installed to form an additional functional layer (as defined in 3.1) exterior to its envelope (e.g. balcon y balustrades, shutters, awnings, louvers, brise soleil etc.).	

Development of standards

Project/ Standard	2012	2013	2014	2015	2016	2017	2018	2019
ISO 18178	NP			DIS: approved	FDIS: disapproved	NP: Proposed as TS	TS: Issued	
EN 50583 -1 & 2					Issued			
IEC 62980			NP	CD				
Old IEC 63092					NP		Consolidated as IEC 63092	
New IEC 63092 -1 & 2						NP	CD: On ballot (Formulated joint project team with ISO)	IS: Planned

Why is the BIPV so important ?

- ‘Sustainable - Green - Smart’ Building becomes more and more important
- There is a fast developing trend of Net Zero Buildings (USA) or Nearly Zero Energy Buildings (EU)
- Locally produced energy is in almost every case Photo-Voltaic energy
- We want to invest in buildings that have a future
- In difficult economic times “well designed” buildings keep the value

Examples of BIPV

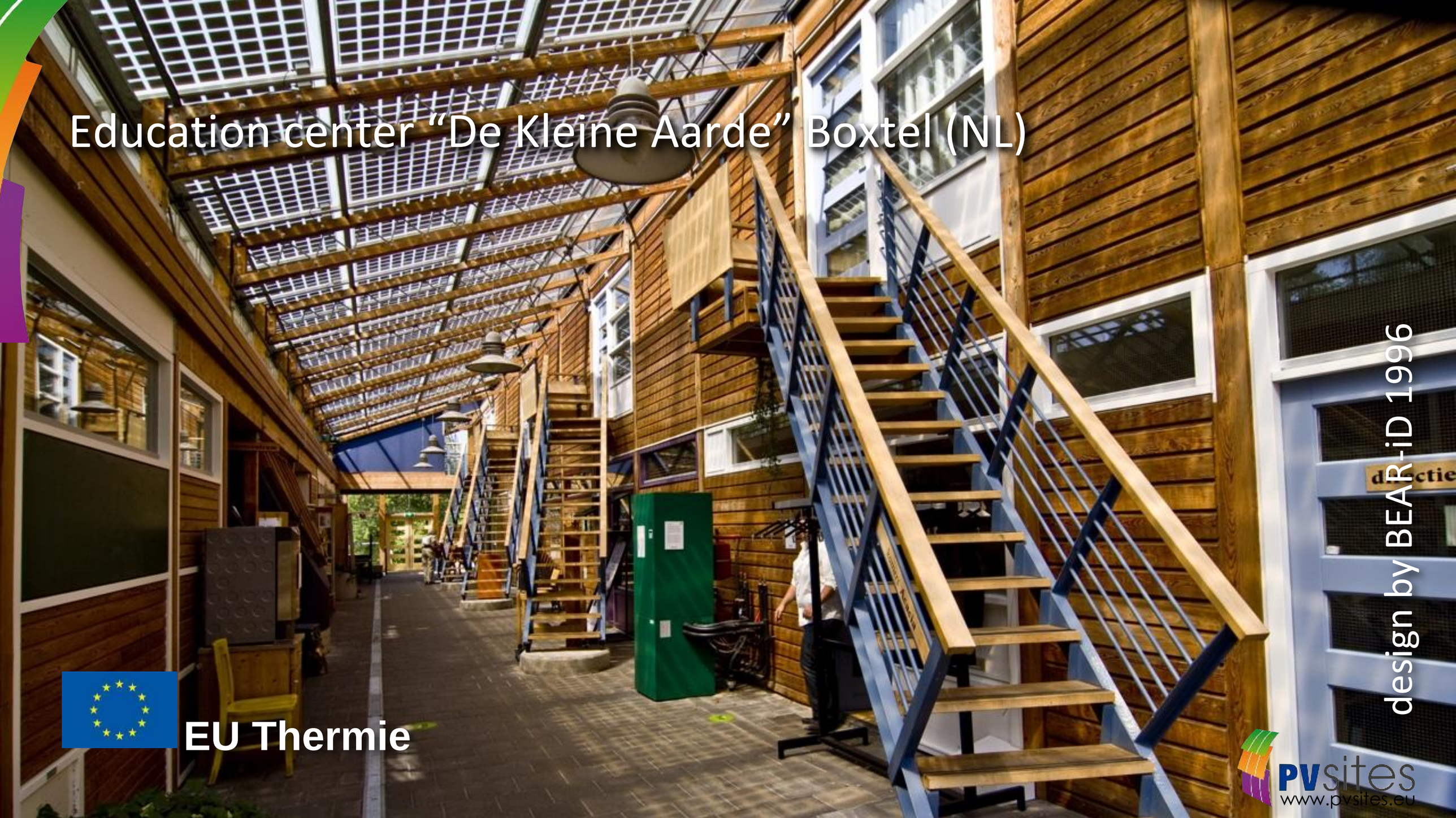
www.**BEAR**-iD.com

PVsites
www.pvsites.eu

Some early examples

1990 - 2010

Education center “De Kleine Aarde” Boxtel (NL)



EU Thermie

design by BEAR-iD 1996

PVsites
www.pvsites.eu

Carbon Neutral housing Heerhugowaard (NL)

design by BEAR-iD 2002

PVsites
www.pvsites.eu

Solar City Freiburg (Germany)

Arch Rudolf Disch

PVsites
www.pvsites.eu

1 MW City of the Sun Amersfoort (NL)

www.BEAR-iD.com

PVsites

5 MW City of the Sun Heerhugowaard (NL)

www.**BEAR**-iD.com

PVsites
www.pvsites.eu

Switzerland, Spain, Germany, France

Roof systems

Carbon **Neutral** housing Eindhoven (NL) (2015)

PVsites
www.pvsites.eu

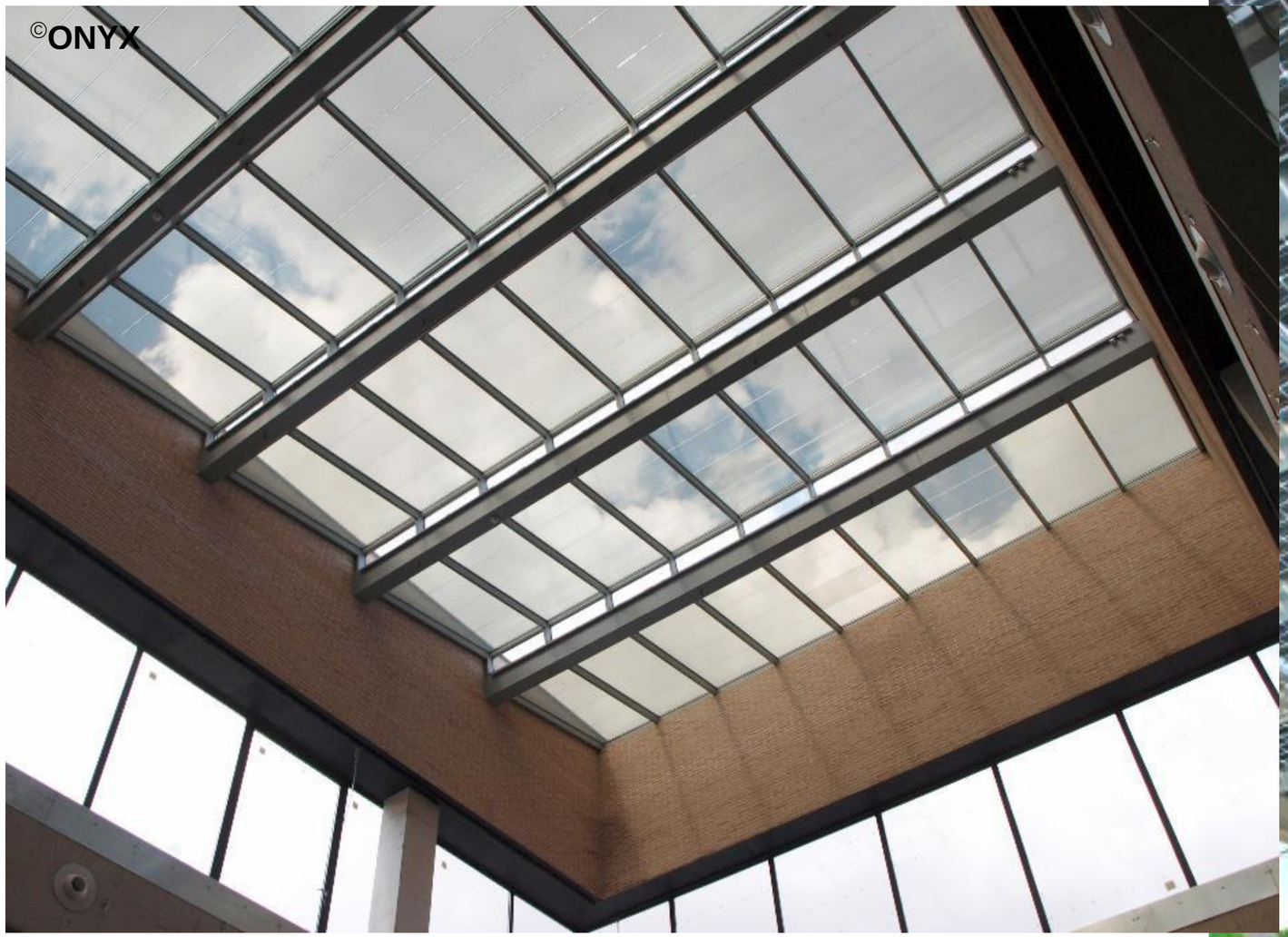
Carbon **Neutral** offices Vale Gard (SE) (2016)

Pitched roof Mons Belgium

Watertight system - invisible profiles

PVsites
www.pvsites.eu

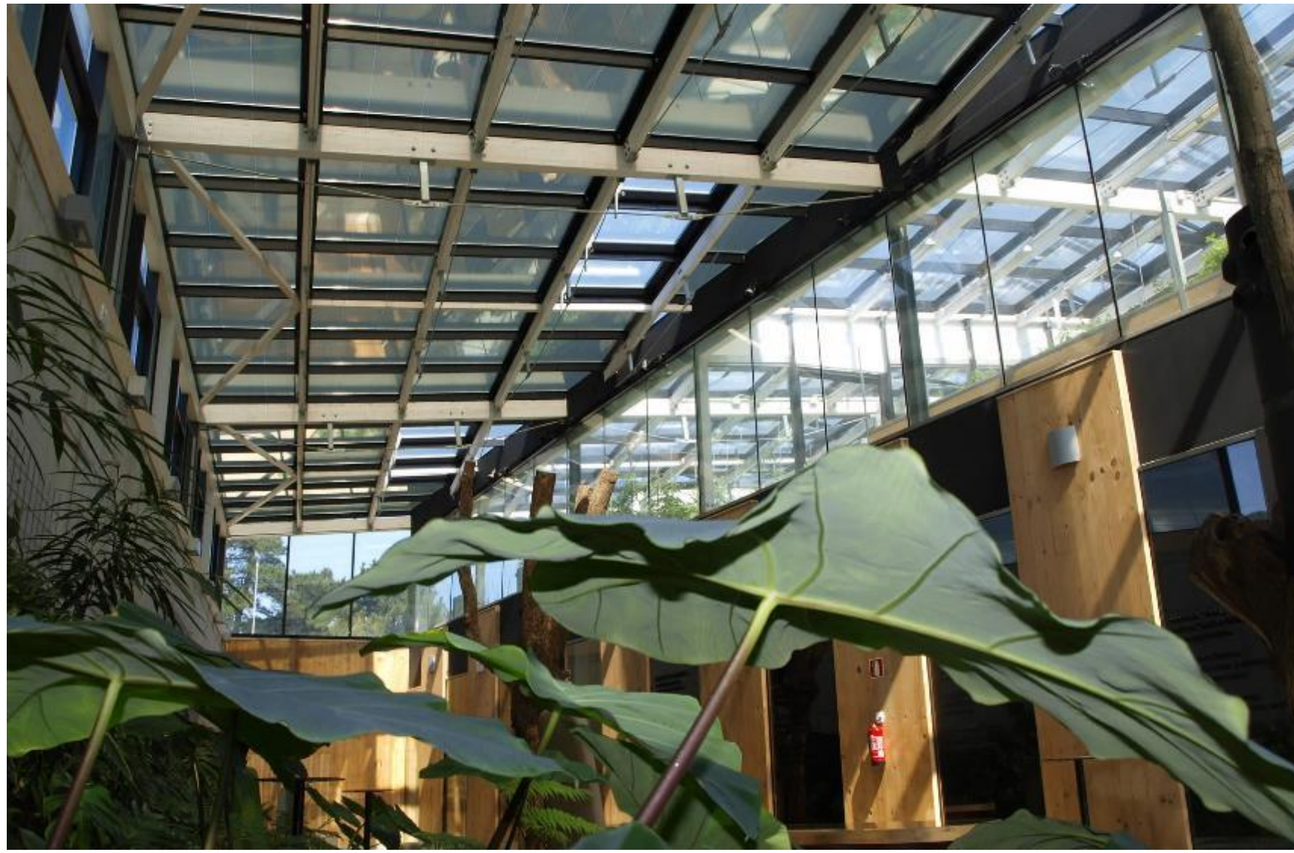
Pitched roof – transparent



www.**BEAR**-iD.com

Transparent solar modules
Restaurant Azurmendi Bilbao (ES)

Transparent solar modules
Restaurant Azurmendi Bilbao (ES)



www.**BEAR**-iD.com

PVsites
www.pvsites.eu

Facade systems

Cost effective cladding - Camrose (CA)

Cost effective cladding

www.**BEAR**-iD.com

Glass cladding wall - Bolzano (IT)

www.BEAR-iD.com

PVsites
www.pvsites.eu

Cladding system - Skagelse (DK)

www.**BEAR**-iD.com

PVsites
www.pvsites.eu

Building components

Building component

www.**BEAR**-iD.com

PVsites
www.pvsites.eu

Building component

Pergola or Super Roof

Function : Shading

www.**BEAR**-iD.com

Building component

Pergola or Super Roof

www.**BEAR**-iD.com

Building component

Balcony

www.**BEAR**-iD.com

Recent developments

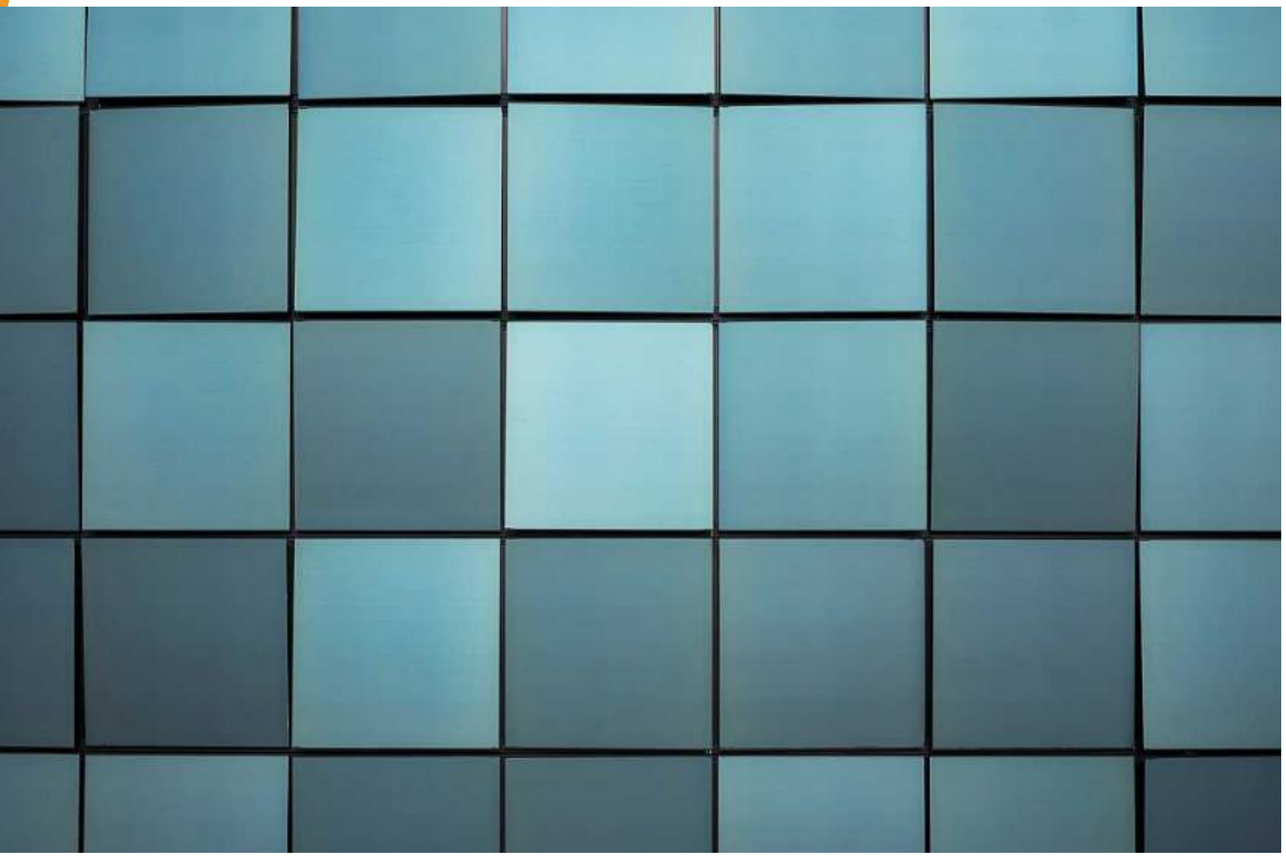
Copenhagen International School

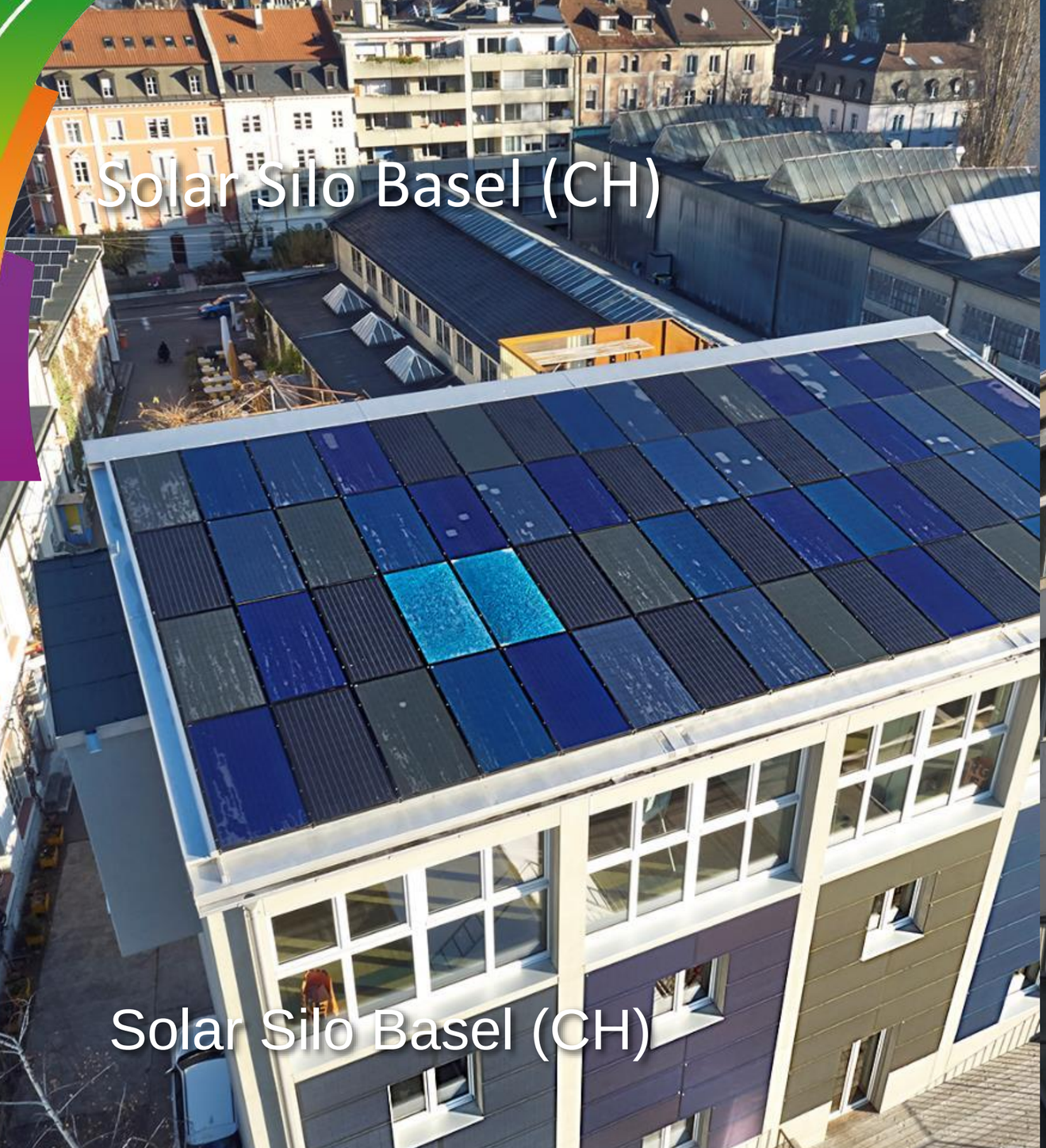
Kromatix

Arch C.F. Möller

PVsites
www.pvsites.eu

Coloured solar modules




Solar Silo Basel (CH)
Solar Silo Basel (CH)

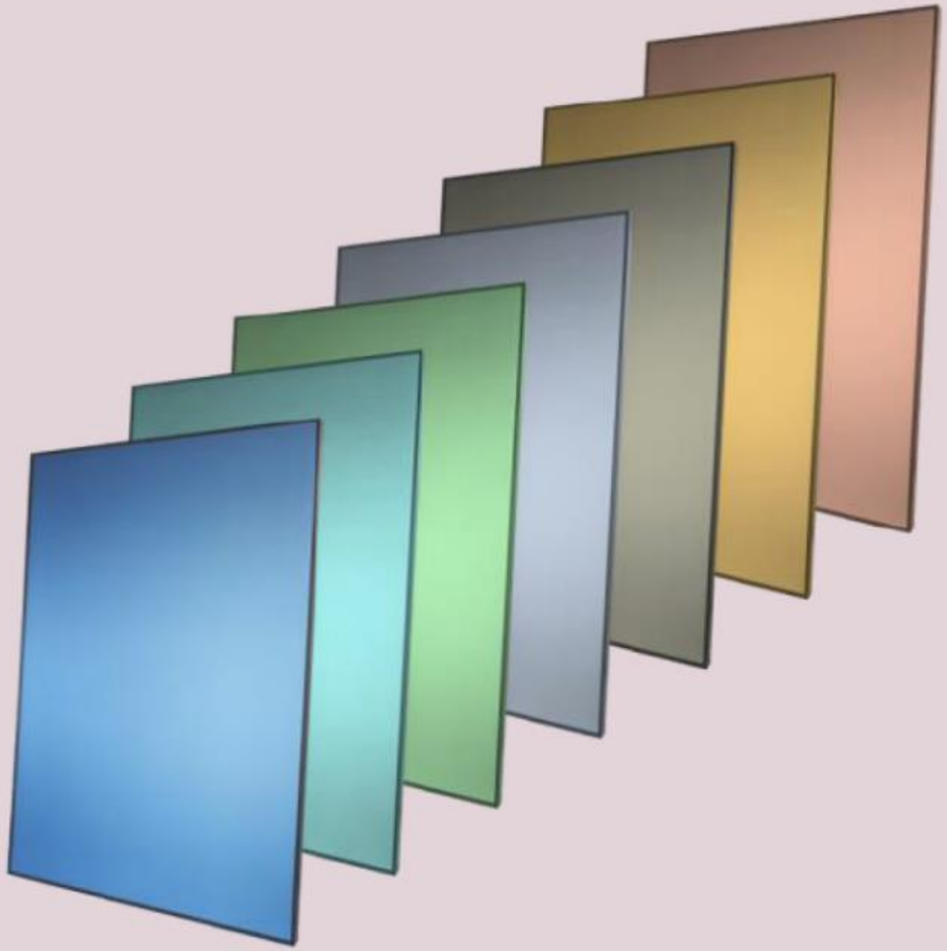

Kromatix
PVsites
www.pvsites.eu

Kromatix

Kromatix™
PATENTED TECHNOLOGY

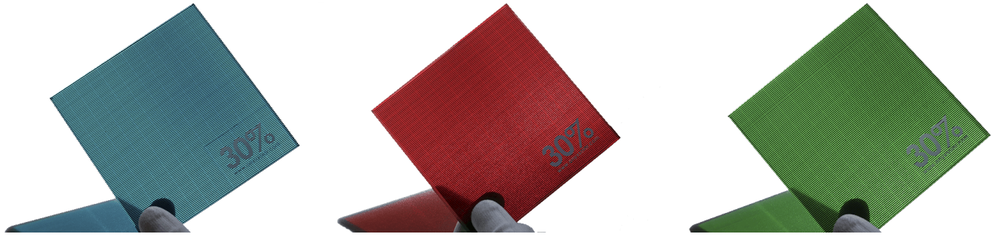
Colour	Solar transmittance
Grey	90 +/- 1 %
Light-Grey	85 +/- 1 %
Blue	88 +/- 1 %
Blue-green	88 +/- 1 %
Green	87 +/- 1 %
Bronze	89 +/- 1 %
Gold	86 +/- 1 %
Terracotta	87 +/- 1 %

* Measurements done on 3,2 mm-thick glass.

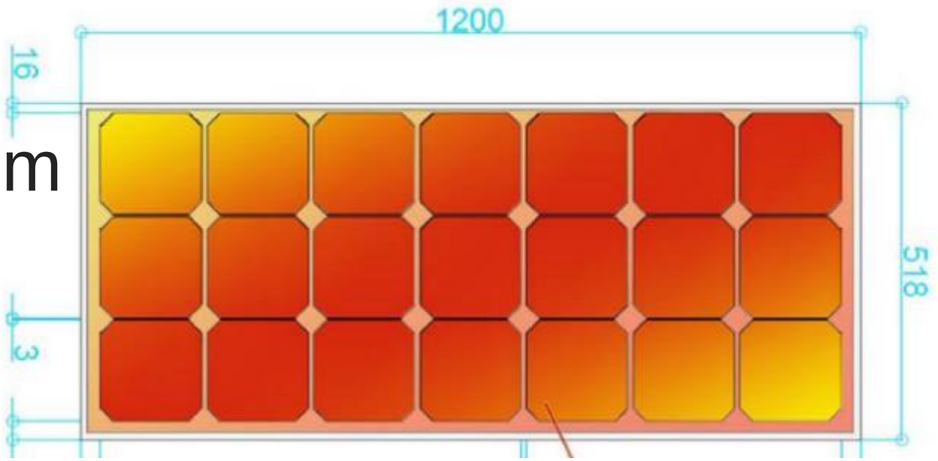


…many **others**

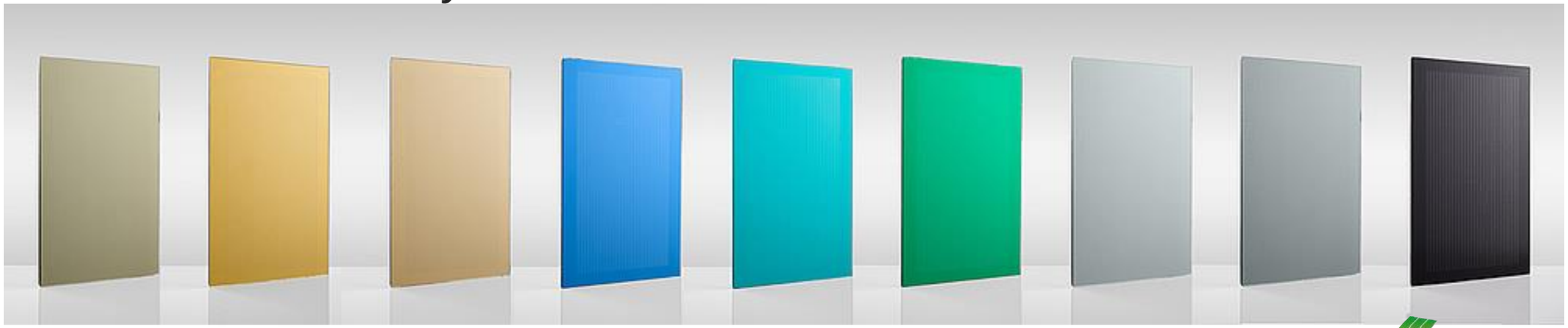
ONYX - Spain



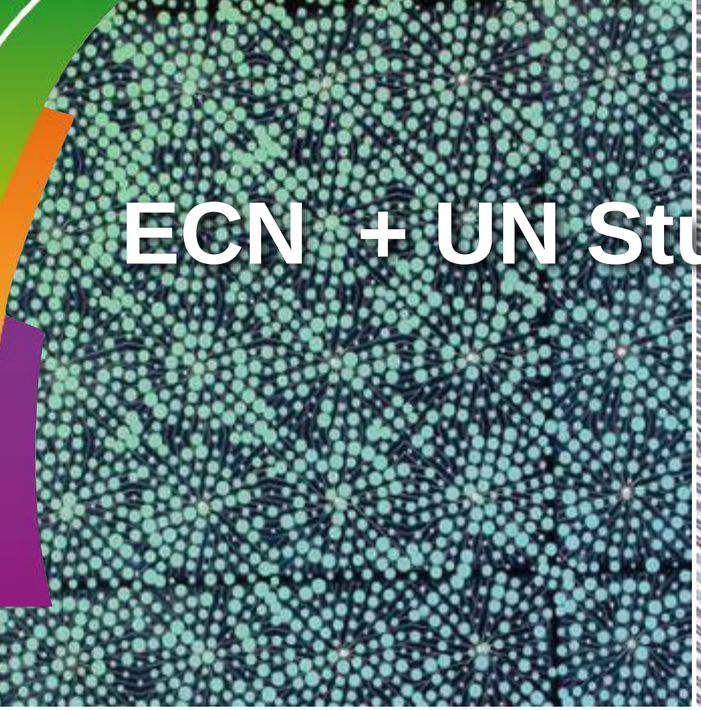
ISSOL - Belgium

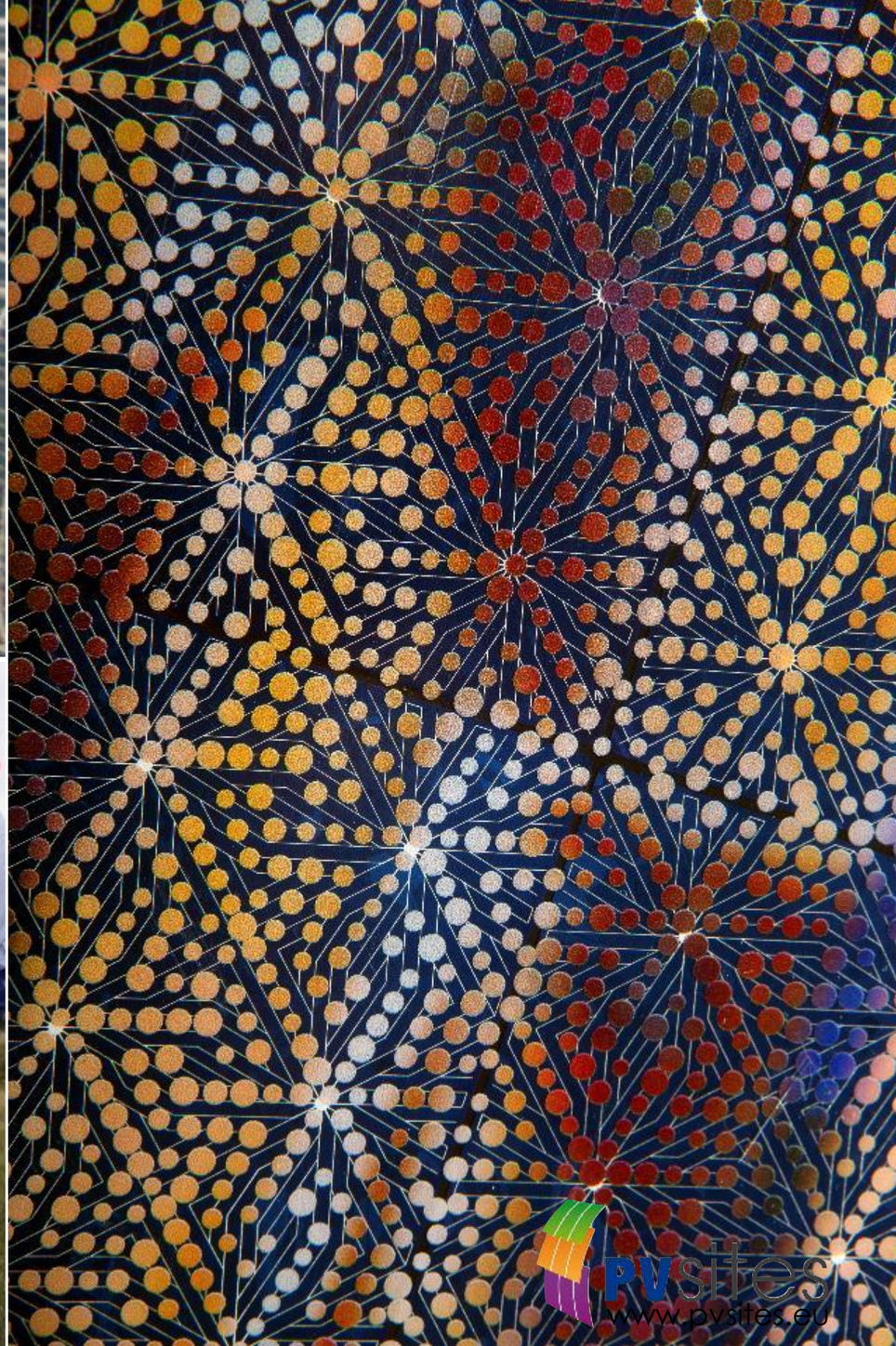


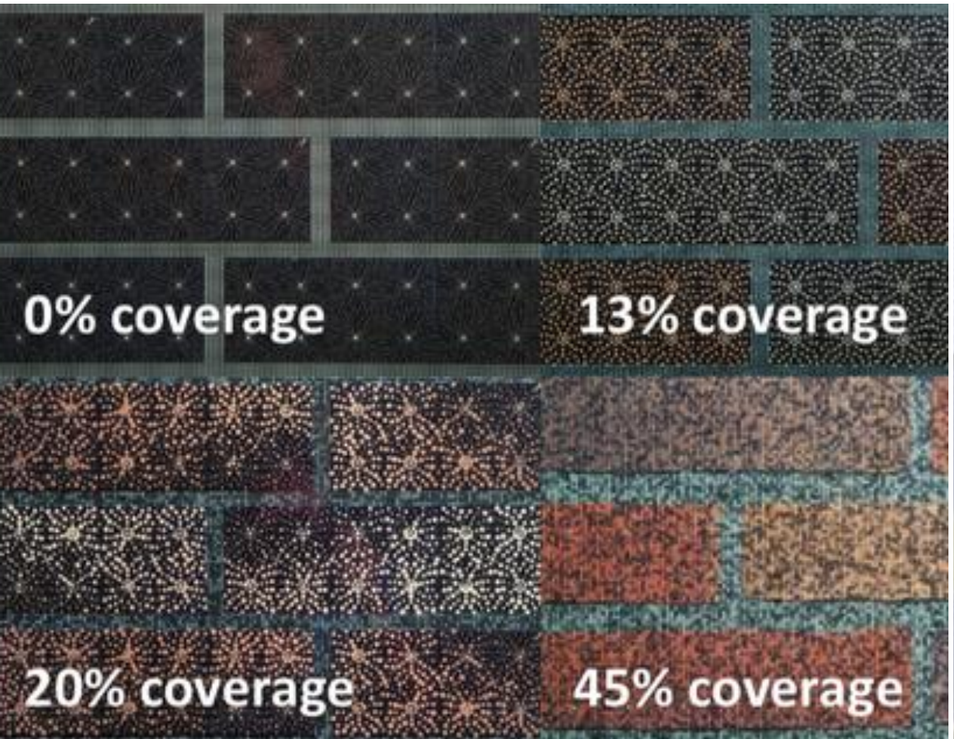
AVANCIS - Germany



ECN + UN Studio (NL)



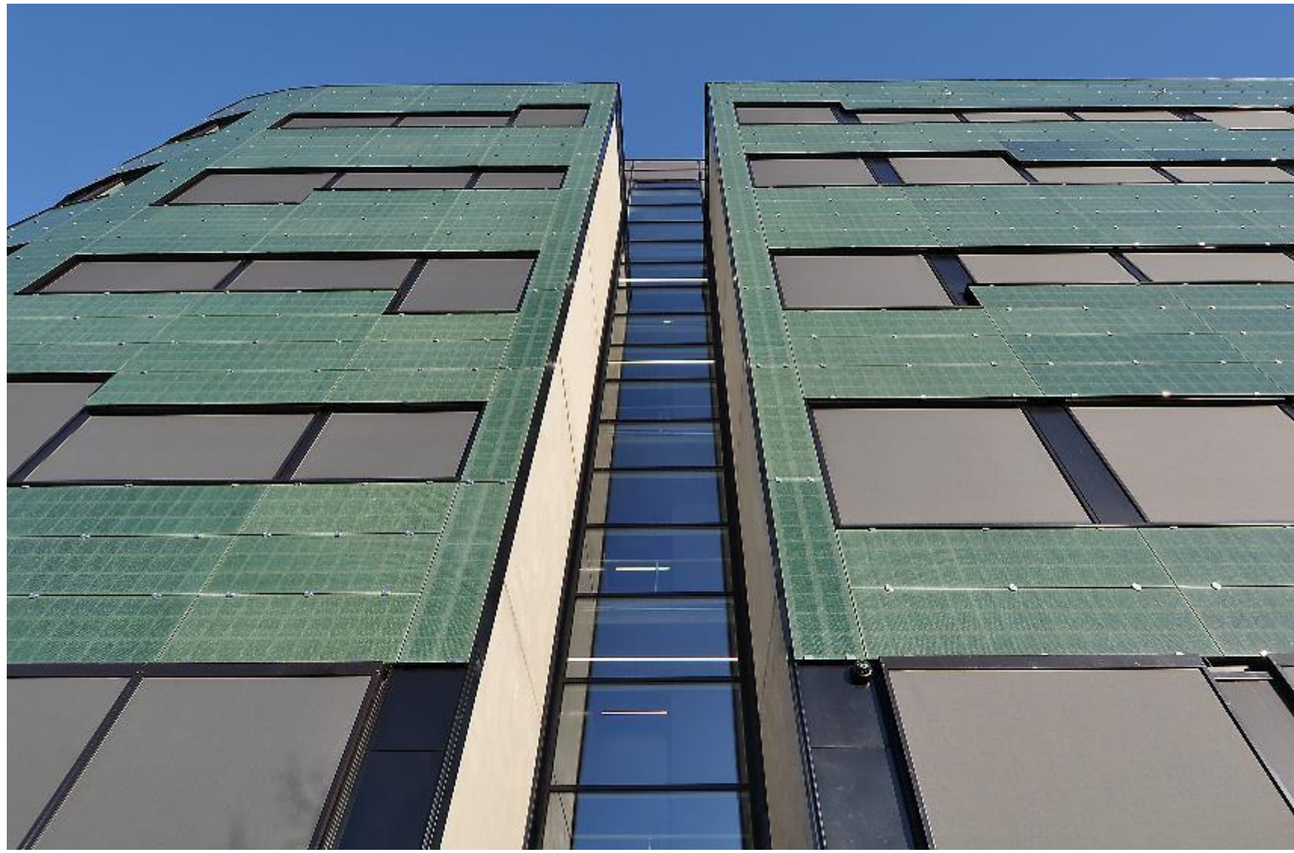




PVsites
www.pvsites.eu

Coloured solar modules

Coloured solar modules




Zürich Switzerland
www.BEAR-iD.com
PVsites
www.pvsites.eu

But ...

we have already BAPV and BIPV but now we get BHPV ...

Building **Hidden P**hoto-**V**oltaics

BHPV - some examples

Bilbao Spain

BHPV - some examples

Madrid Spain

PVsites
www.pvsites.eu

Hidden solar modules

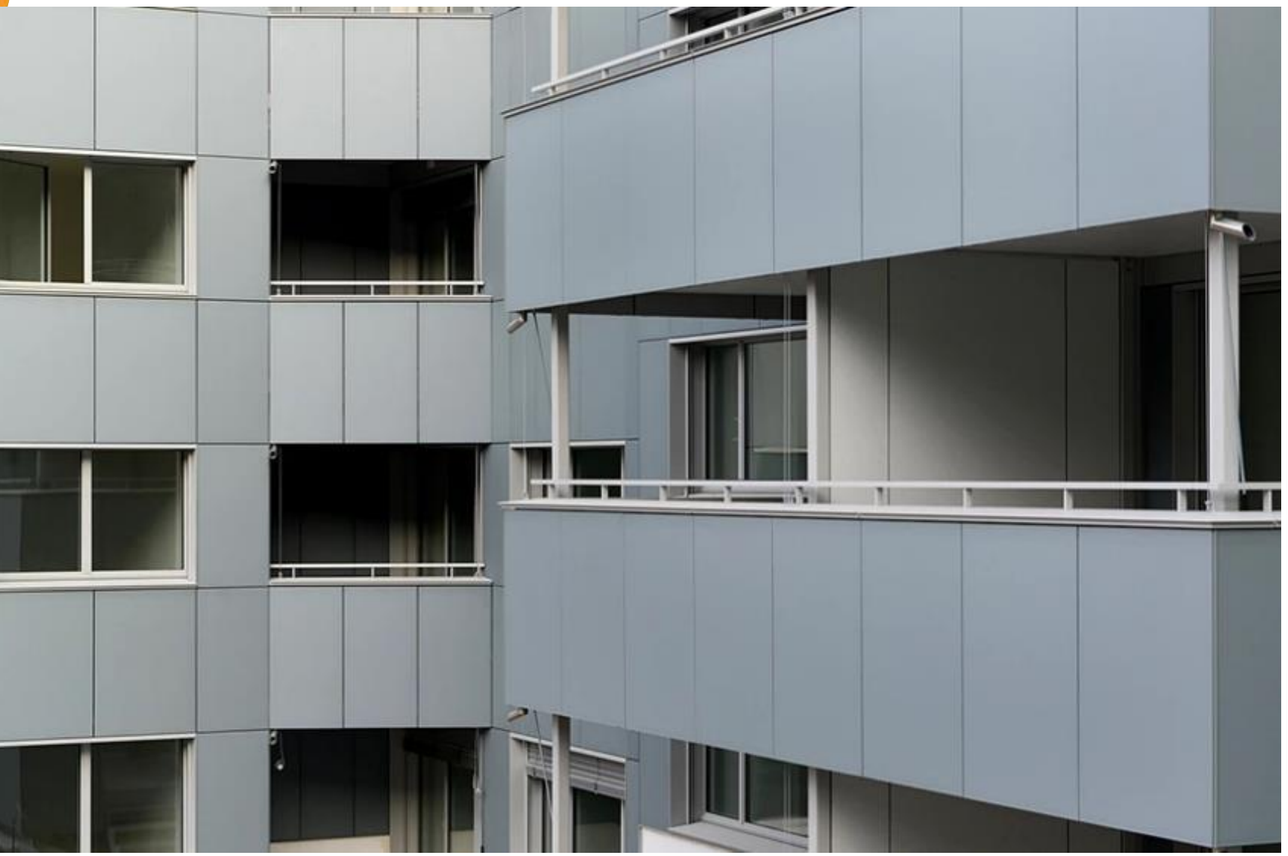
design by Karl Vriden

Zürich Switzerland

www.BEAR-iD.com

PVsites
www.pvsites.eu

Hidden solar modules



BHPV - some examples

WHITE Solar (Solaxess) Switzerland

PVsites
www.pvsites.eu

Photovoltaics in Buildings - finance

	Regular cladding	Solar cladding
Investment	€ 300/m^2	€ 550/m^2
Lifecycle	20 years	20 years
Cost a year	€ 15/m^2	€ 27,5/m^2
Energy production	0 kWh	100 kWh
Energy profit	€ 0/year	> € 35/year
Energy profit 20 years	€ 0	> € 700
Total cost 20 years	- € 300/m^2	> € 150/m^2

Some remarks

- The **development** of PV systems in building goes on
- The cost are **decreasing. Competitive** with other cladding
- We have to think about the **holistic design**
- We have to think about (aesthetically) well integrated Photo-Voltaics in order **to add value** to the building and to keep that value

Gracias por su atención Thank you for your attention

PVsites
www.pvsites.eu