

# Introduction on BIPV

Tjerk Reijenga  
BEAR-iD (NL)

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# What is **BIPV** - Definition

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**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 **BAPV** - Definition

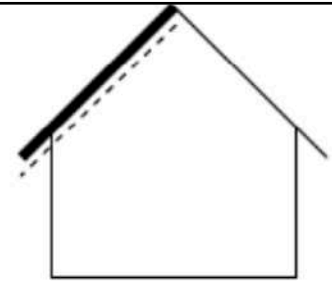

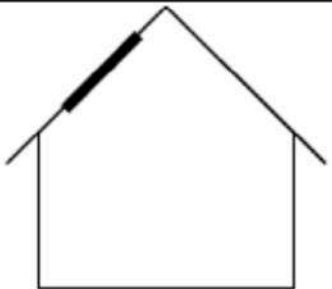

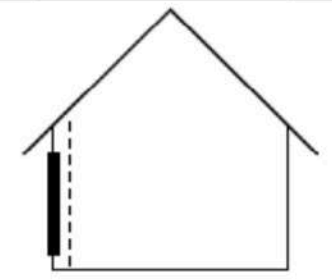

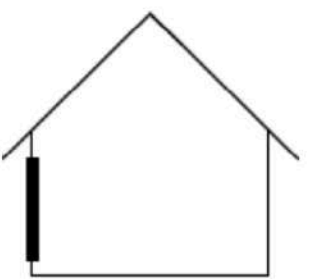

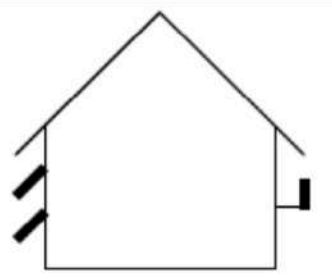

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**Definition** in EN 50583: “Photovoltaics in buildings”

“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

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



# Development of standards

Project/ Standard	2012	2013	2014	2015	2016	2017	2018	2019
<b>ISO 18178</b>	NP			DIS: approved	FDIS: disapproved	NP: Proposed as TS	TS: Issued	
<b>EN 50583 -1 &amp; 2</b>					Issued			
<b>IEC 62980</b>			NP	CD				
<b>Old IEC 63092</b>					NP		Consolidated as IEC 63092	
<b>New IEC 63092 -1 &amp; 2</b>						NP		IS: Planned

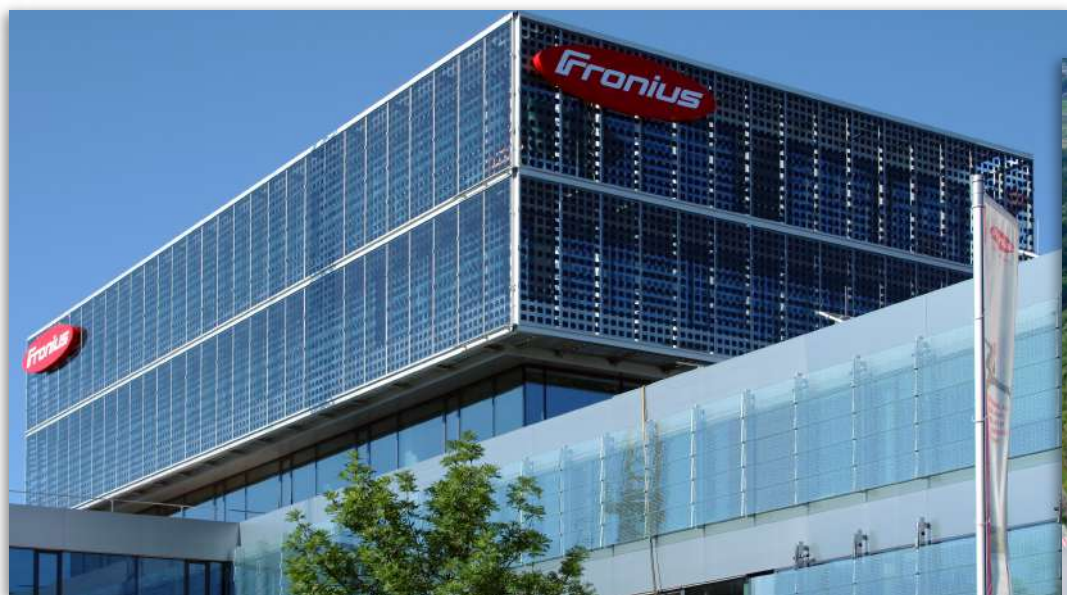
# Why is the **BIPV** so important ?

- ‘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







Some early examples

**1990 - 2010**



# Education center “De Kleine Aarde” Boxtel (NL)



EU Thermie

design by BEAR-id 1996



# Carbon Neutral housing Heerhugowaard (NL)



design by BEAR-id 2002



# Solar City Freiburg (Germany)

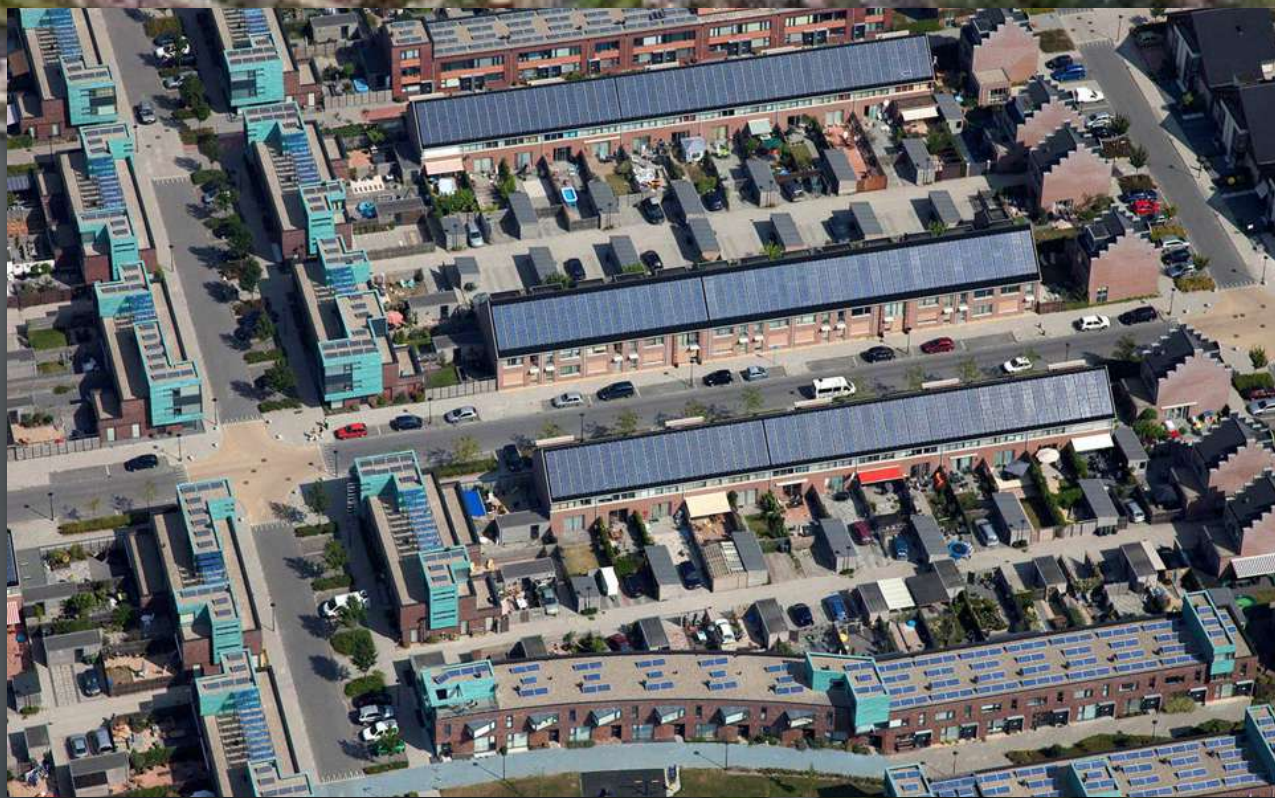


# 1 MW City of the Sun Amersfoort (NL)



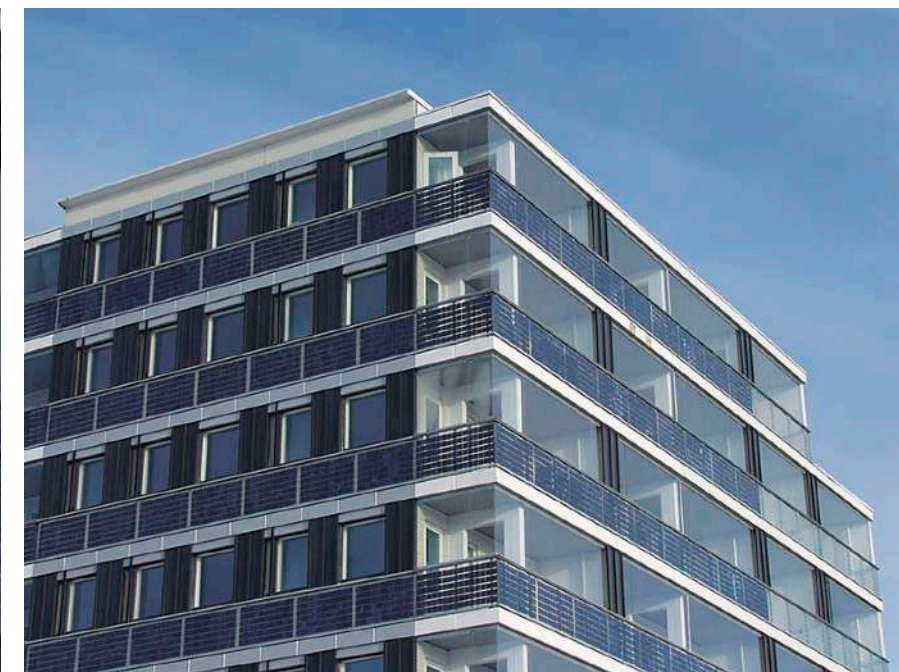


# 5 MW City of the Sun Heerhugowaard (NL)





# Switzerland, Spain, Germany, France







# Roof systems

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





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



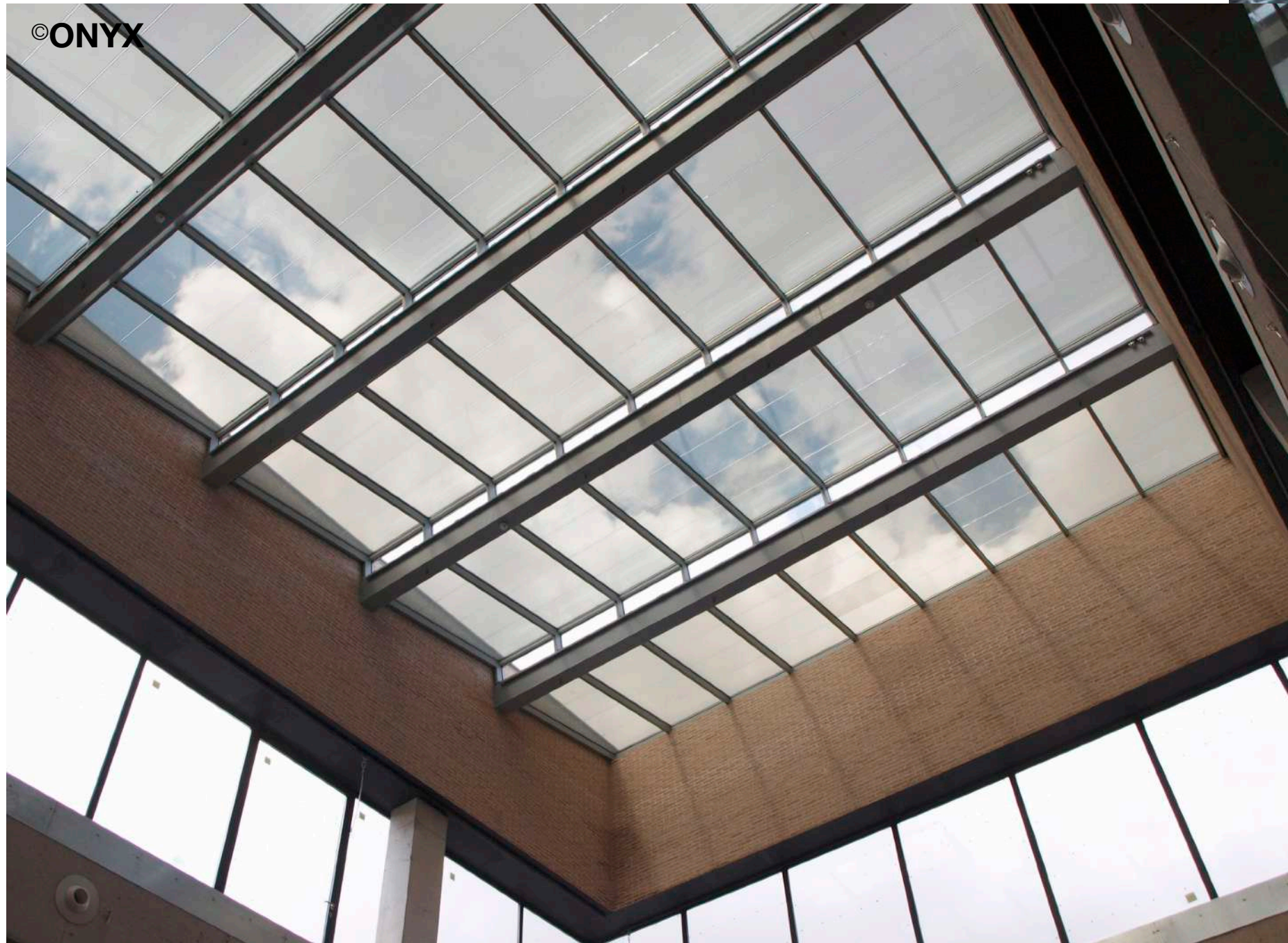


# Pitched roof Mons Belgium

Watertight system - invisible profiles



# Pitched roof – transparent





# Transparent solar modules

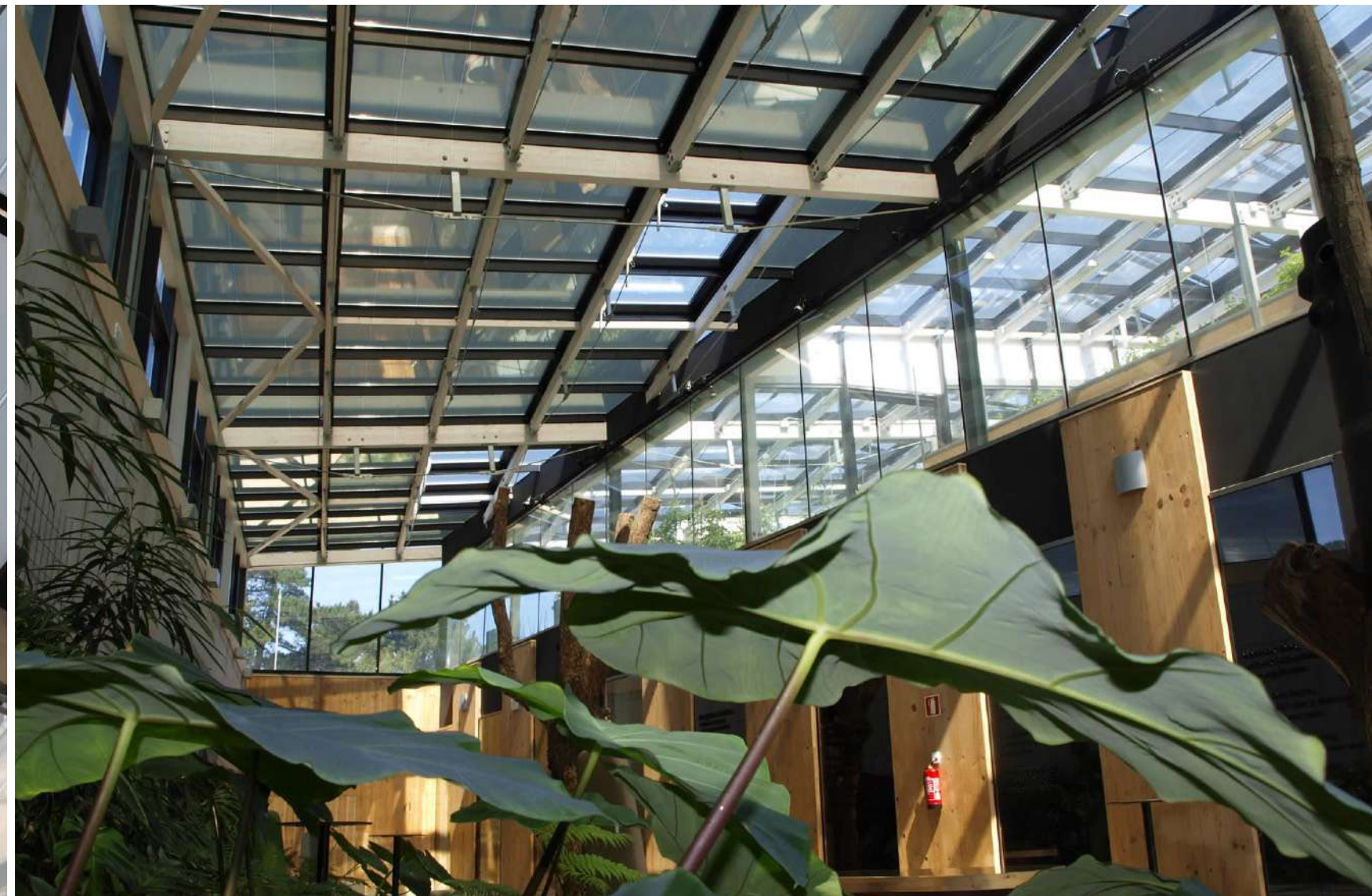
## Restaurant Azurmendi Bilbao (ES)





# Transparent solar modules

## Restaurant Azurmendi Bilbao (ES)







# Facade systems



# Cost effective cladding - Camrose (CA)





# Cost effective cladding





# Glass cladding wall - Bolzano (IT)





# Cladding system - Skagelse (DK)







# Building components



# Building component





# Building component

Pergola or Super Roof

Function : Shading



Foto: Unique / Ralph Bensberg / 18.09.2002





# Building component

Pergola or Super Roof





# Building component

## Balcony







# Recent developments



# Copenhagen International School

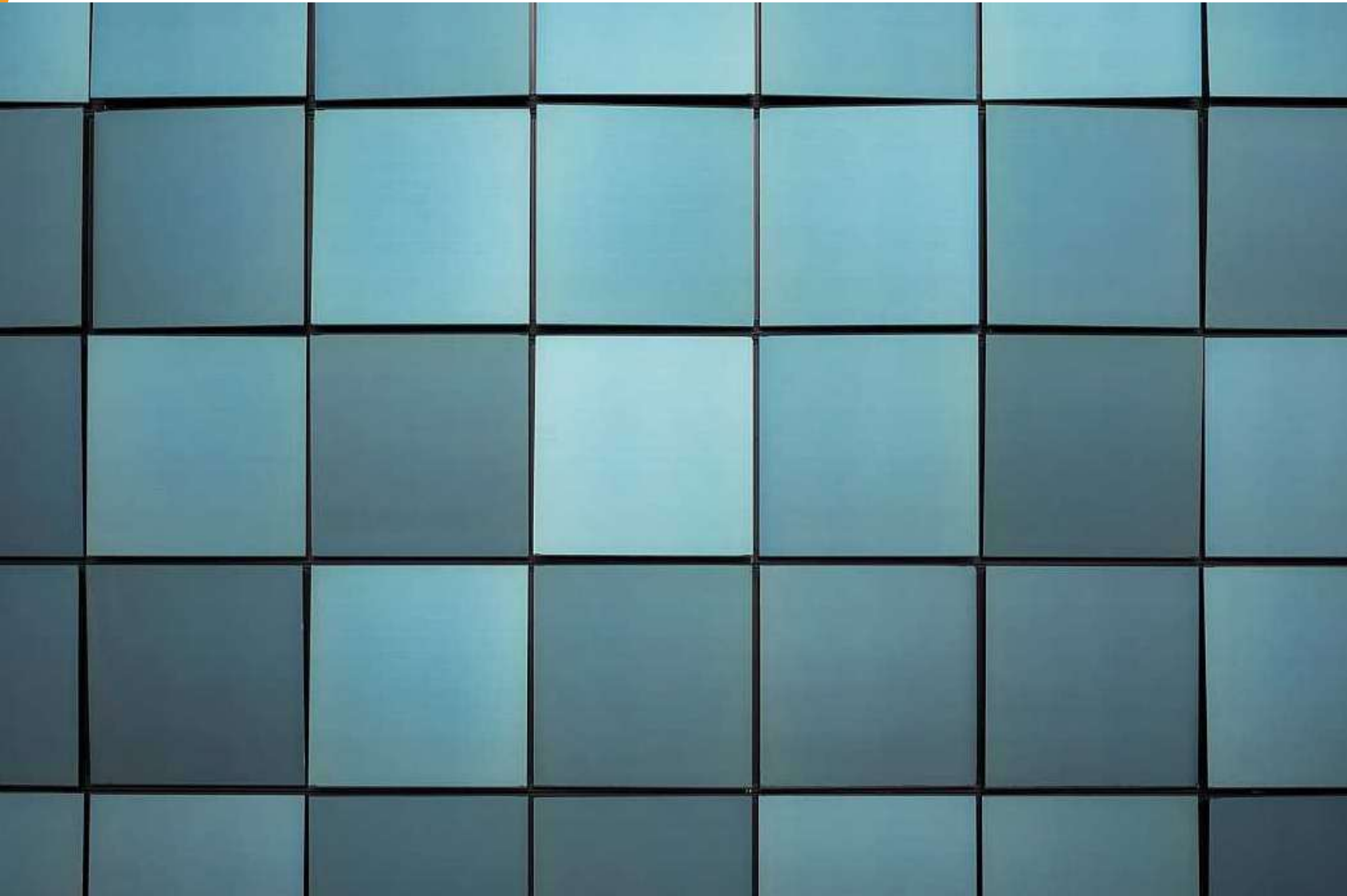


Kromatix

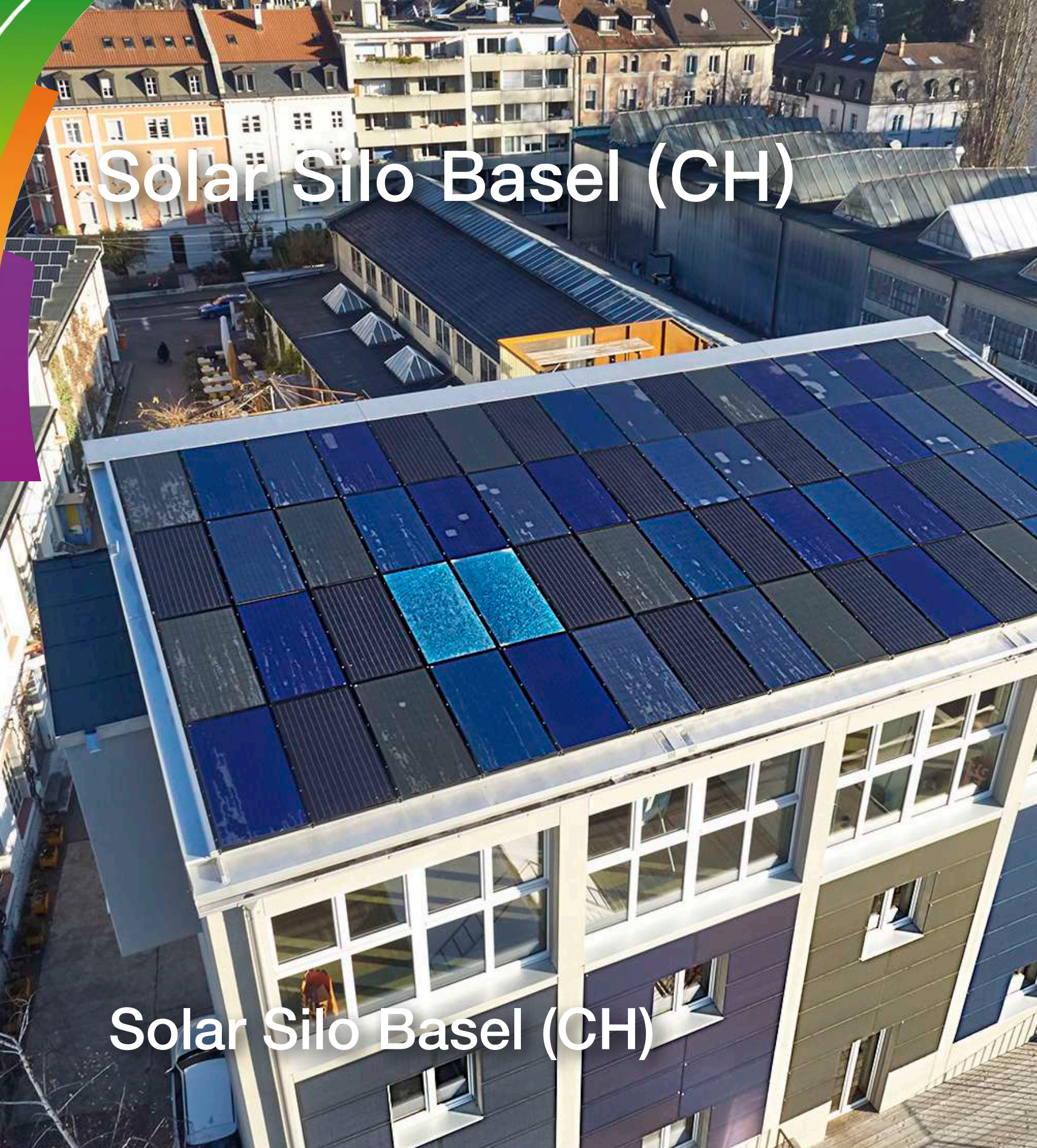
Arch C.F. Möller



# Coloured solar modules







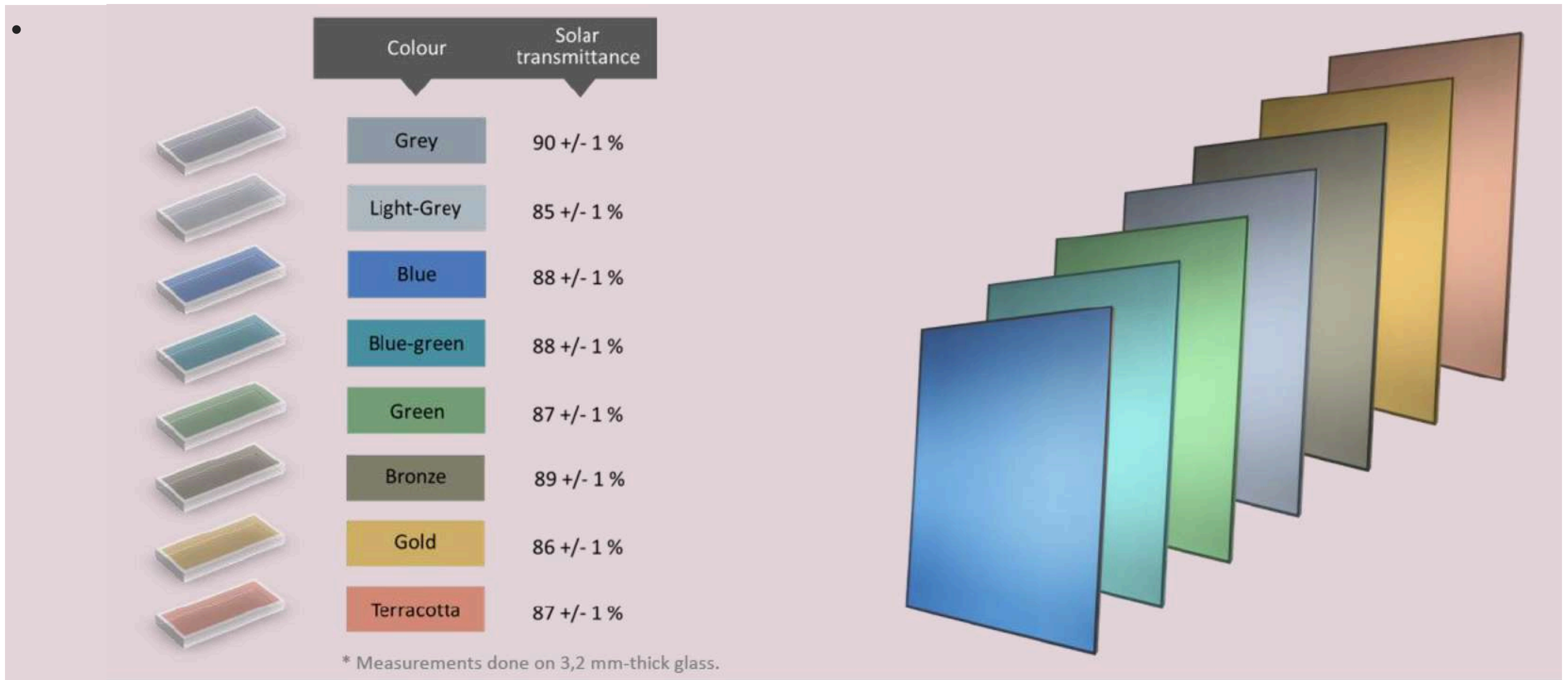
Solar Silo Basel (CH)

Solar Silo Basel (CH)



Kromatix

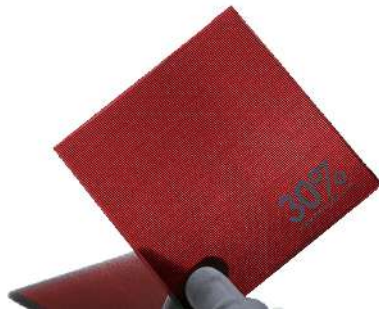
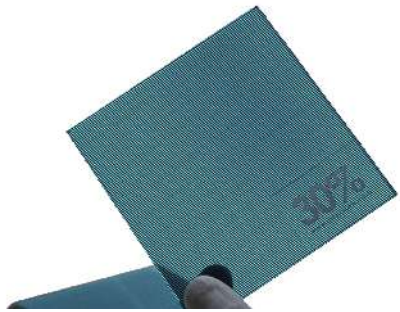




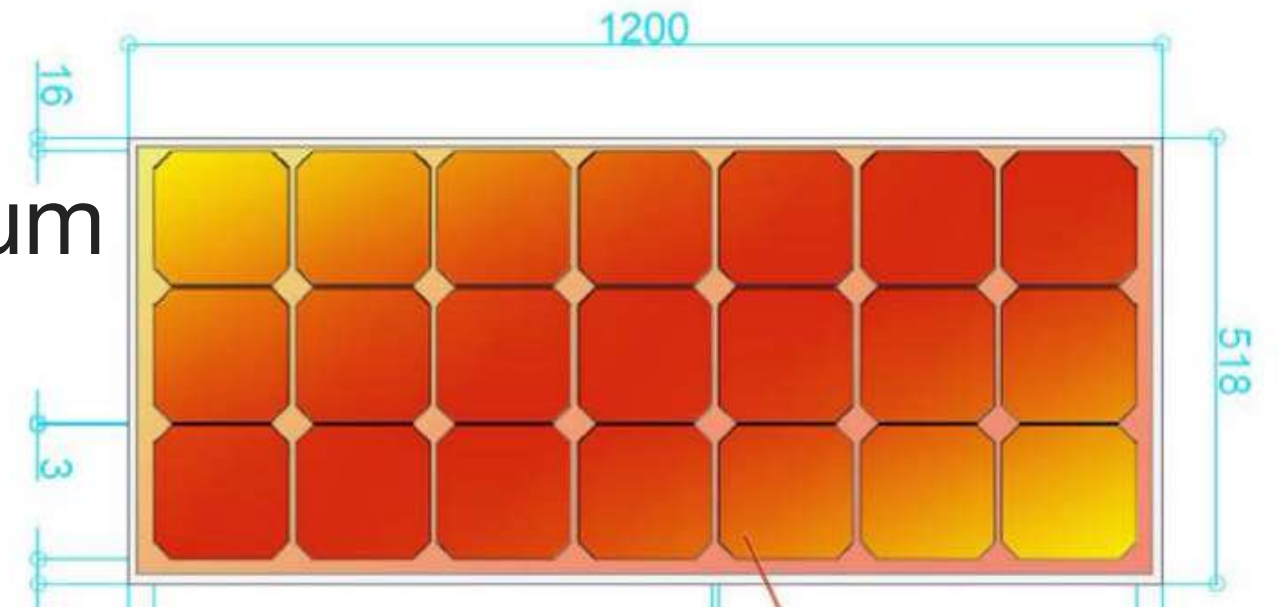


...many **others**

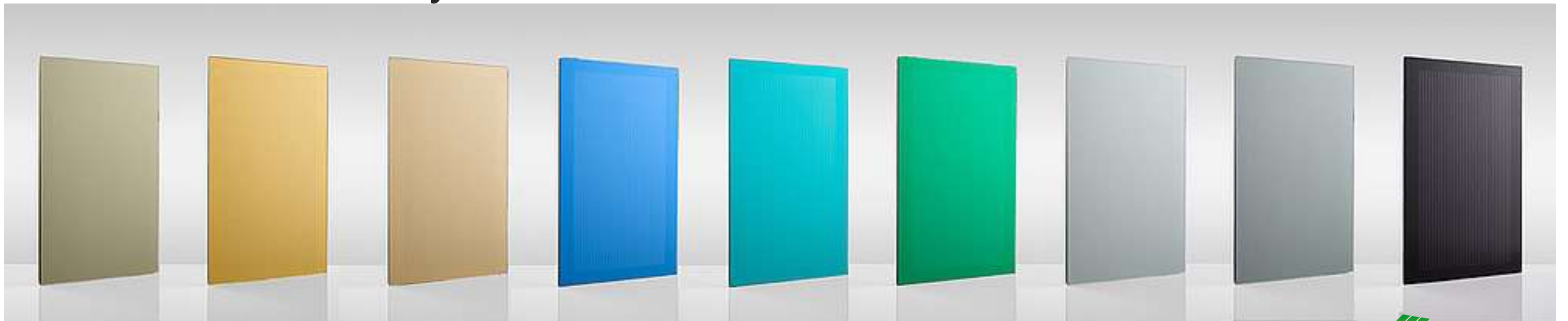
ONYX - Spain



ISSOL - Belgium

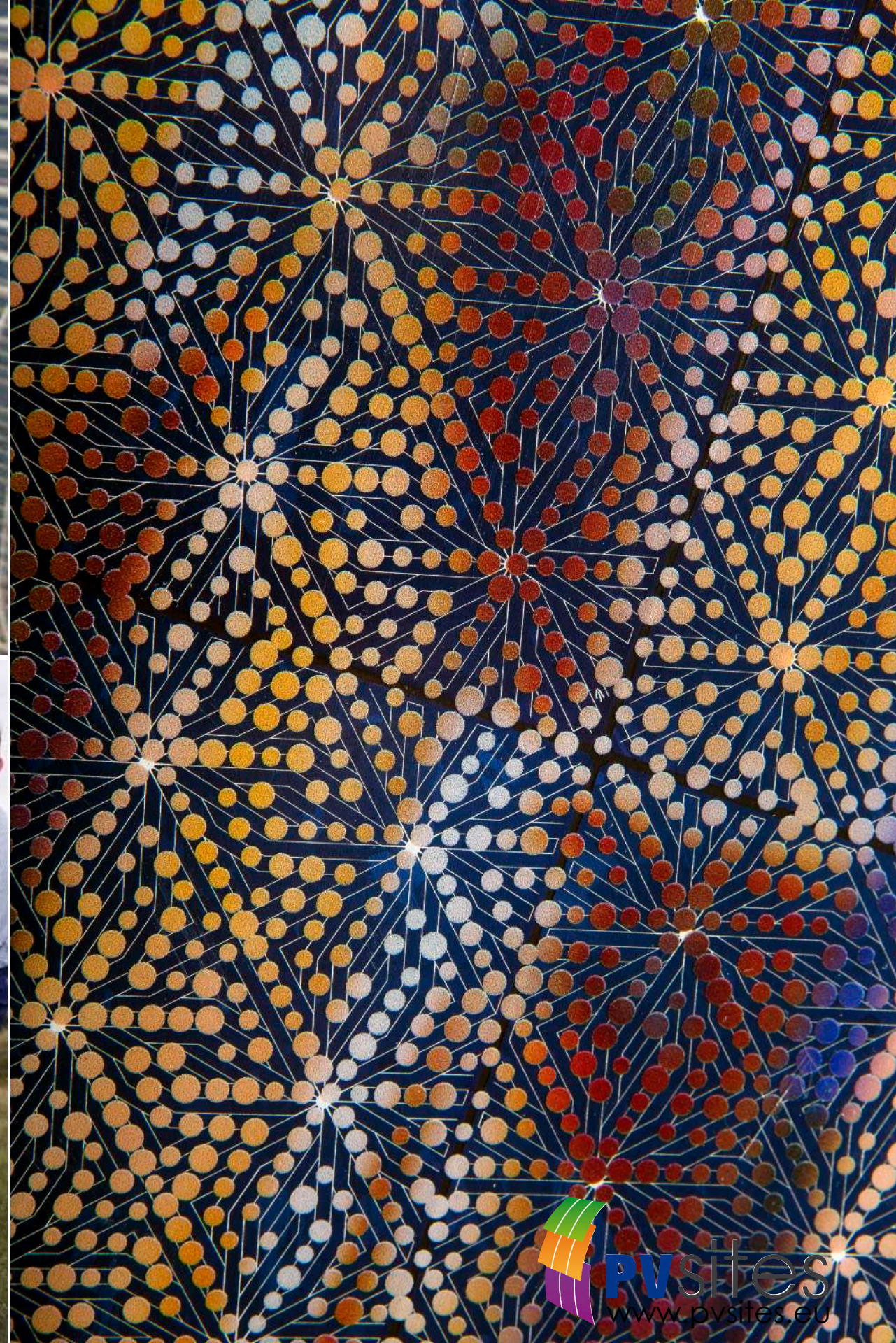
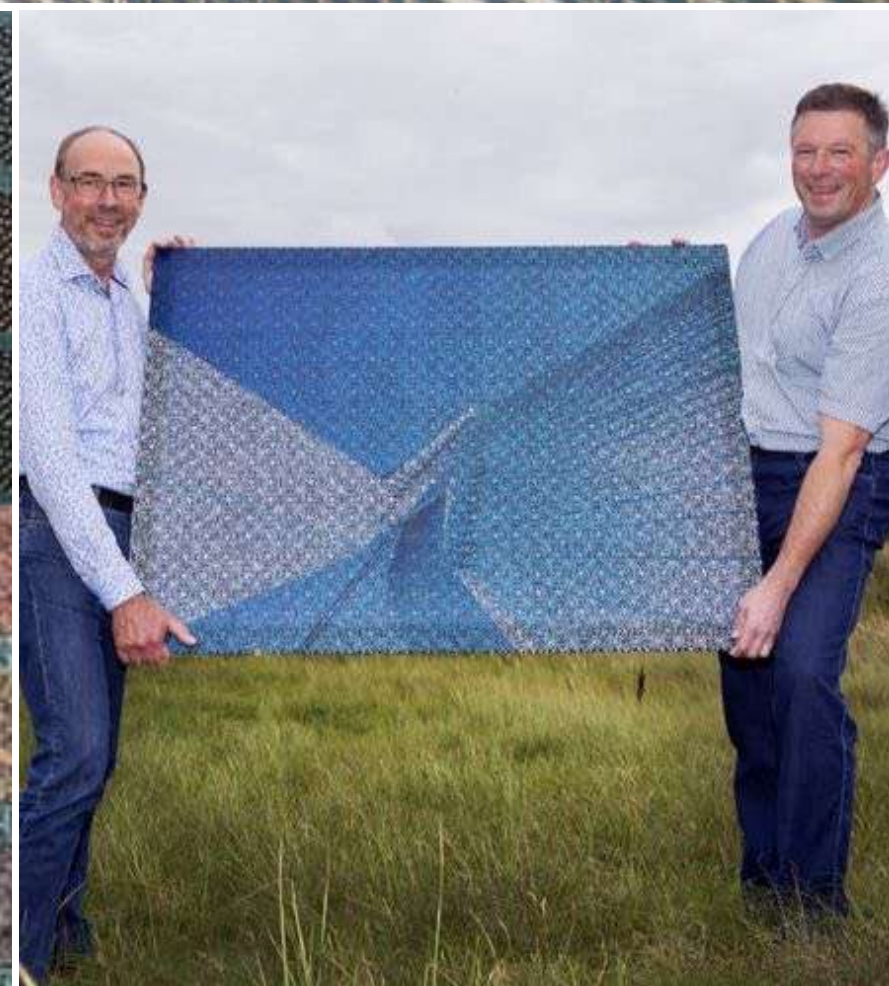
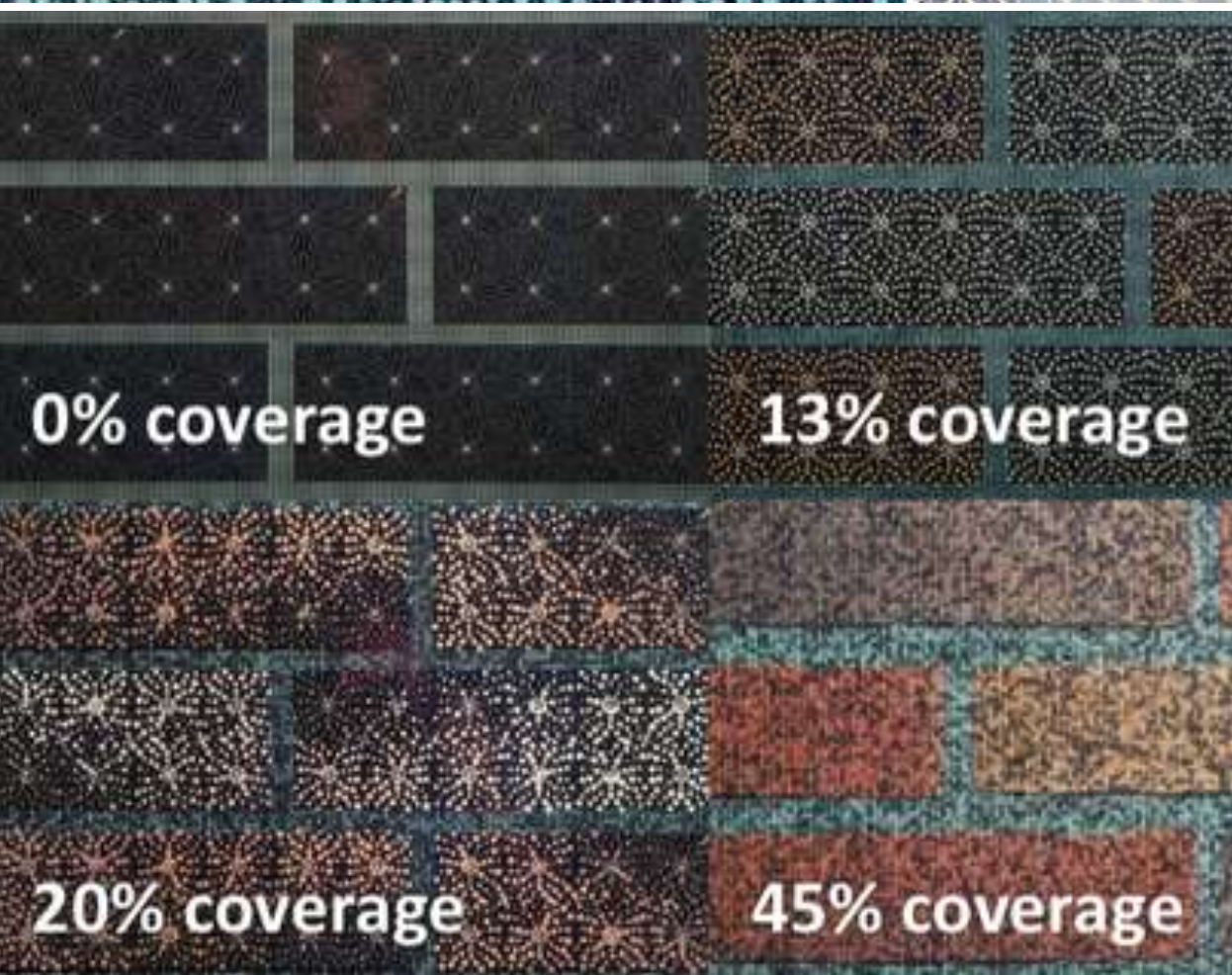


AVANCIS - Germany





# ECN + UN Studio (NL)



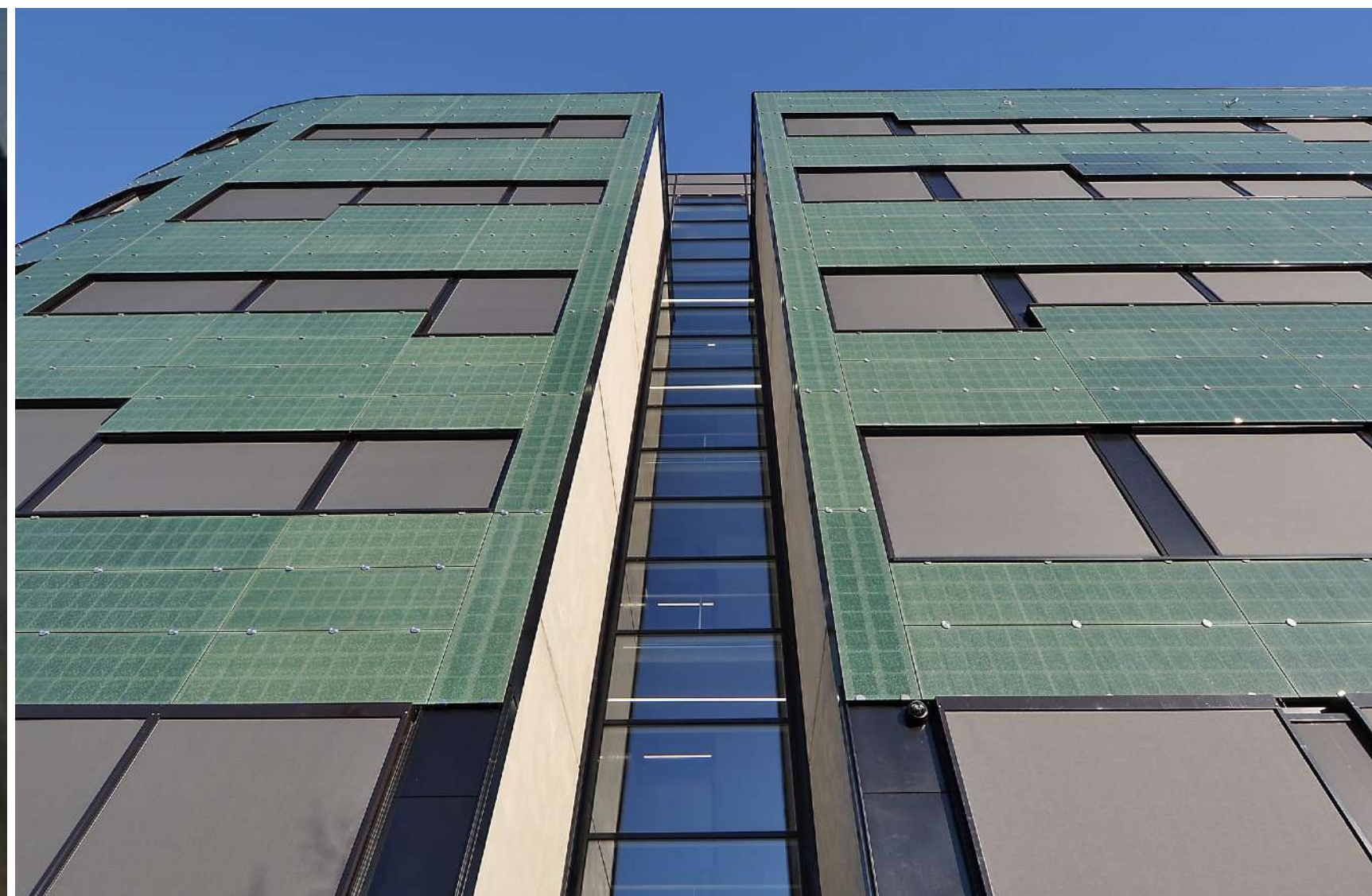


# Coloured solar modules





# Coloured solar modules







Zürich Switzerland

[www.BEAR-ID.com](http://www.BEAR-ID.com)





But ...

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we have already BAPV and BIPV but now we get

BHPV ...

**Building Hidden Photo-Voltaics**



# BHPV - some examples

Bilbao Spain





# BHPV - some examples

Madrid Spain



Hidden solar modules

Zürich Switzerland

[www.BEAR-ID.com](http://www.BEAR-ID.com)

design by Karl Vriden



# Hidden solar modules





# BHPV - some examples

**WHITE Solar (Solaxess) Switzerland**



# Photovoltaics in Buildings – finance



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



# Some remarks

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- 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**

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