



# BUILDING INTEGRATED PHOTOVOLTAIC (BIPV): TRAINING WORKSHOP AND GUIDED TOUR

## Overview of PVSITES products

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Empa Dübendorf 13. Nov 2019



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# Products – whole value chain

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Modules

BOS

Other  
products

## Products trying to answer market challenges

Enhanced flexibility of design, outstanding aesthetical value, multi-functionality and cost-effectiveness

Assistance to design phase through the joint simulation of BIPV products and building energy performance

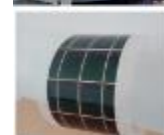
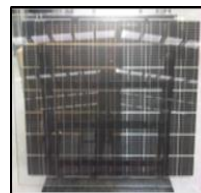
More predictable, manageable, grid-friendly profitable BIPV generation

Demonstration of performance and reliability of BIPV solutions through effective incorporation onto real buildings

# Key technologies - modules

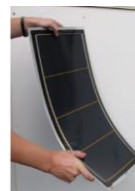
- **Glass – glass c-Si solutions (Onyx) and curved CIGS (collab.with Flisom)**

- Hidden bus-bar and L-interconnections
- Back-contact solar cells as see-thru glass-glass
- Large formats
- Glazing treatments



- **Flexible CIGS on metal substrates (Flisom)**

- Roofing shingles, CIGS on steel
- Solar roof tiles on different metal sheets
- Large area flexible membranes, roof and façade



- **Semitransparent low concentration – passive solar control BIPV solutions (Tecnalia – Onyx)**

- Skylight
- Ventilated façade
- Shading elements



# Key technologies - modules

## Glass-glass crystalline silicon based solutions (ONYX Solar)





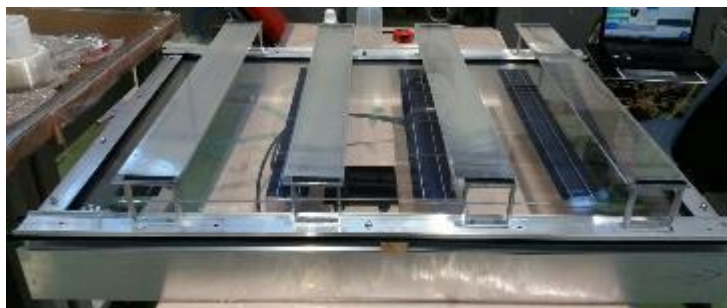
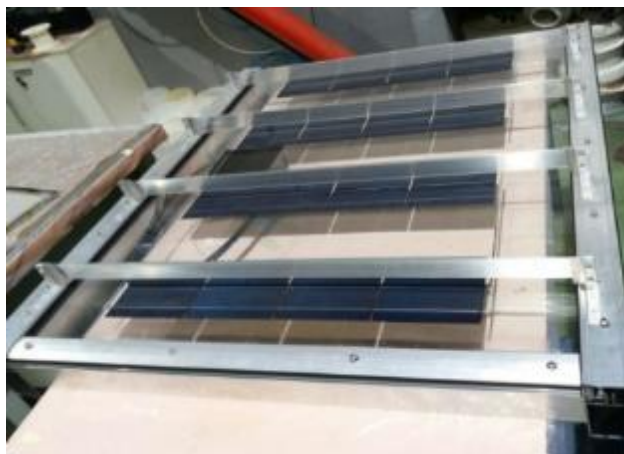
# Key technologies - modules

## Glass-glass based solutions (ONYX Solar)



# Key technologies - modules

**Semitransparent low concentration – passive solar control BIPV solutions (Tecnalia – Onyx)**



# Key technologies - modules

## CIGS on metal BIPV modules (FLISOM)

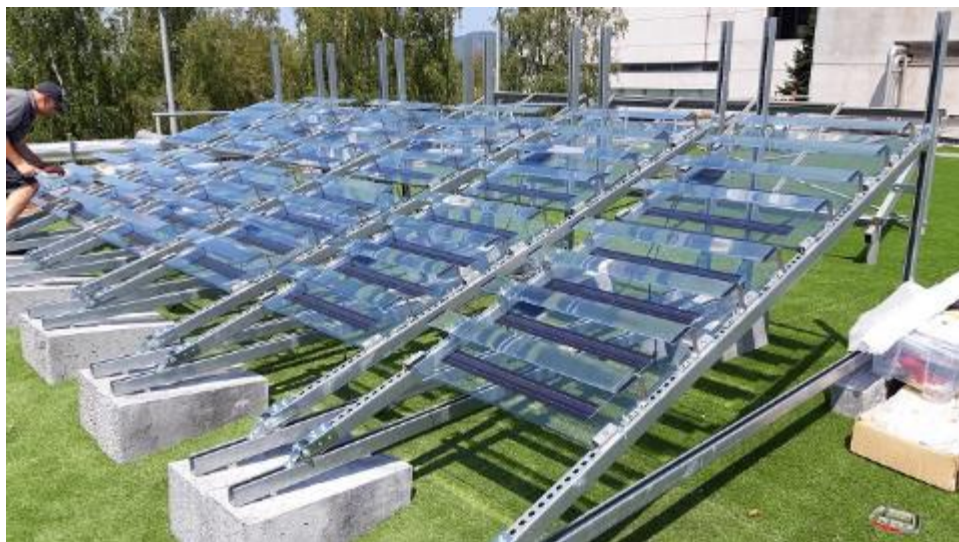




# Key technologies – modules in test-benches



**Modules in outdoor testing @ Acciona, Tecnalia, CEA**





# Key technologies – modules in test benches

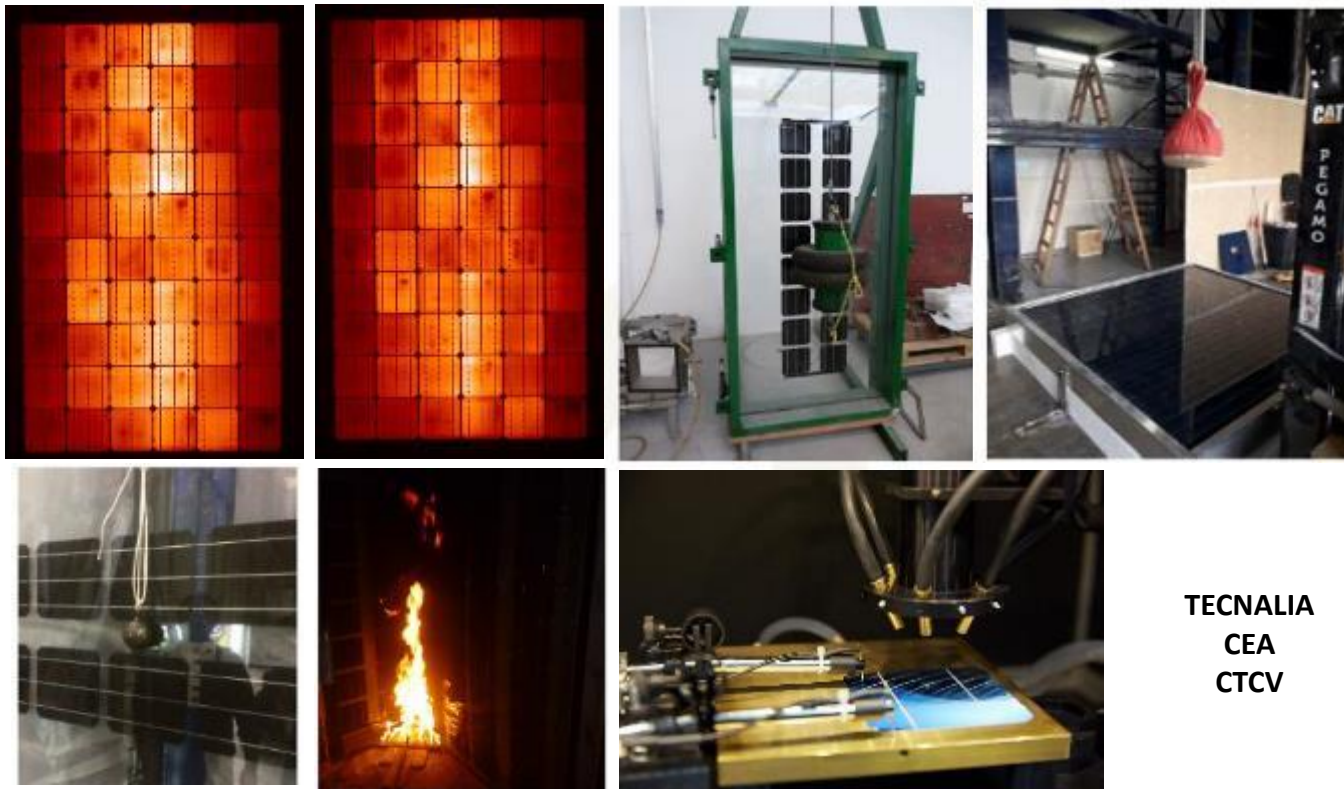


**ACCIONA, CEA, TECNALIA**



# Key technologies – modules and standards

## Application of the new BIPV standard, EN 50583 (2016)

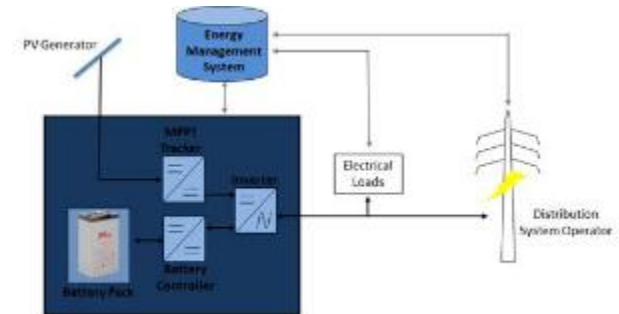


TECNALIA  
CEA  
CTCV

# Key technologies – energy conversion & management

- **PV storage inverter with high DC coupling (Tecnalia) and single-stage SiC based PV inverter (CEA)**

- High efficiency
- High reliability
- Cost reduction
- Flexibility in system design
- Scalability



- **Building Energy Management Systems (BEMS) (Tecnalia, Acciona, R2M)**

- Planner tool for CAPEX optimization
- Low-cost and reliable BIPV generation and building electrical consumption forecasting tools
- Optimal use of BIPV excess
- Active load management capability

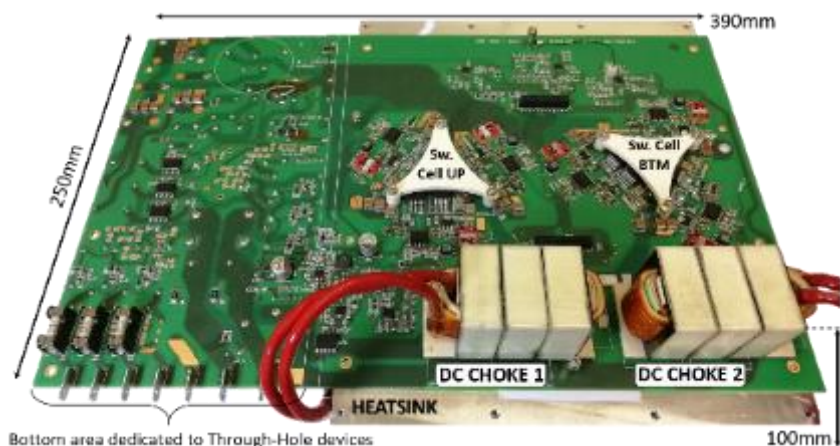


# Key technologies – energy conversion & management

- Best **storage solutions for BIPV** defined
- Grid interface using storage system with DC coupling (TECNALIA)

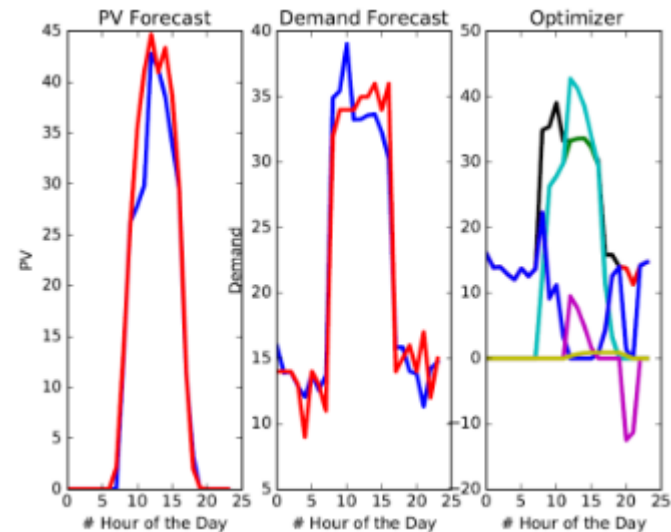
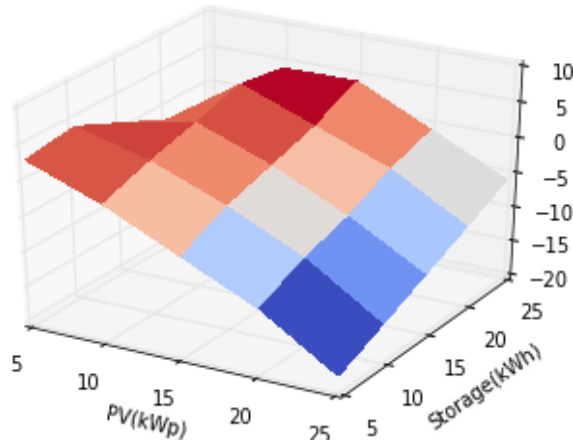


- SiC based inverter – current source inverter topology (CEA)

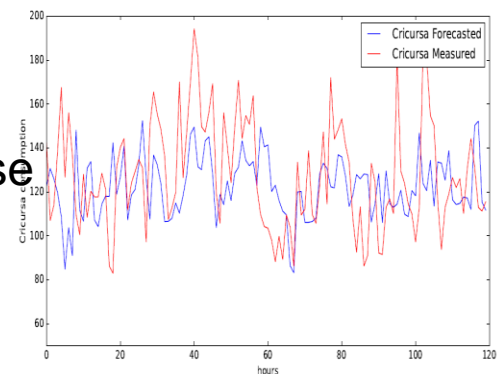


# Key technologies – energy conversion & management

- Planner tool PV storage systems



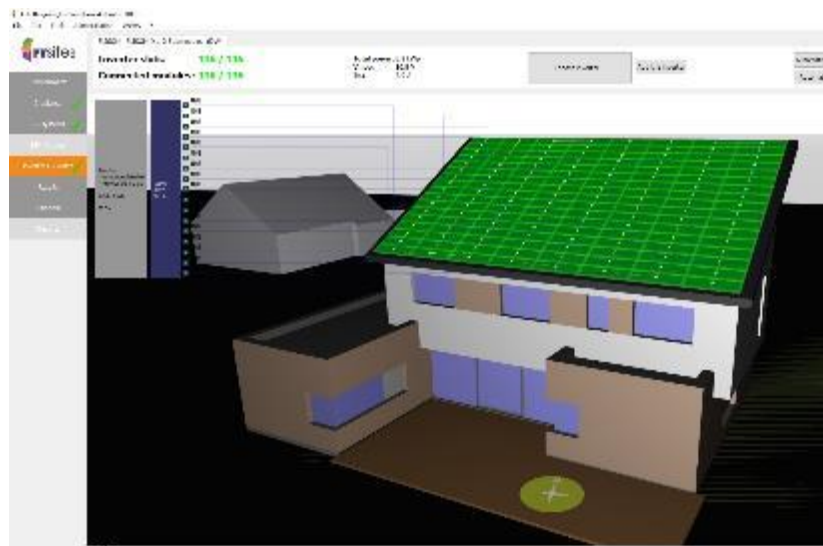
- Refinement of **BIPV** generation and building electrical consumption **forecasting tools**
- Building Energy Management System** for each use case



# Key technologies –software development

**Integrated tool for BIPV and building energy performance simulation  
(CADCAMation, Tecnalia, Bear, Nobatek)**

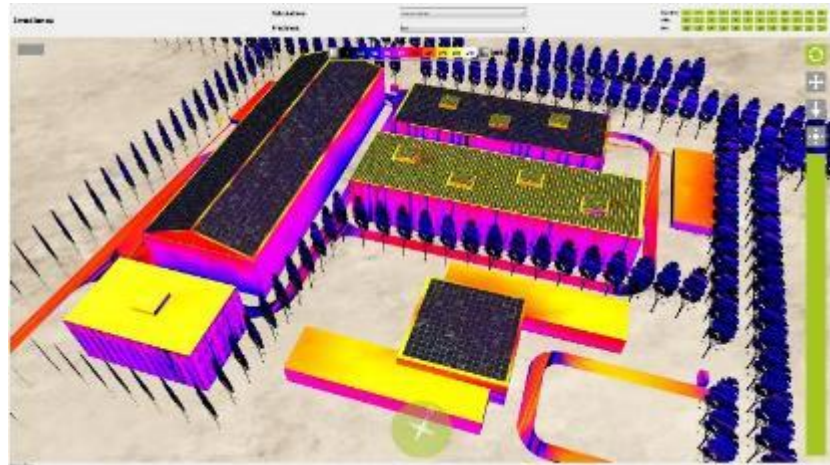
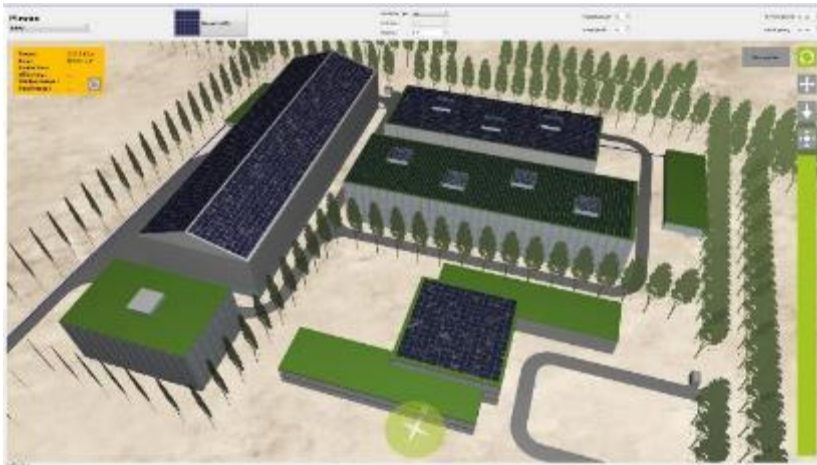
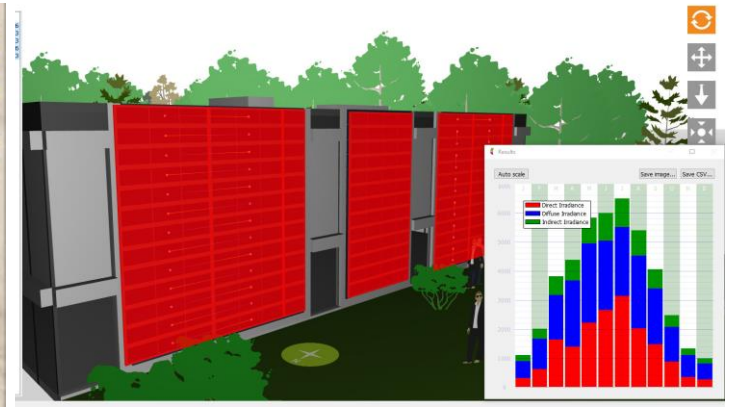
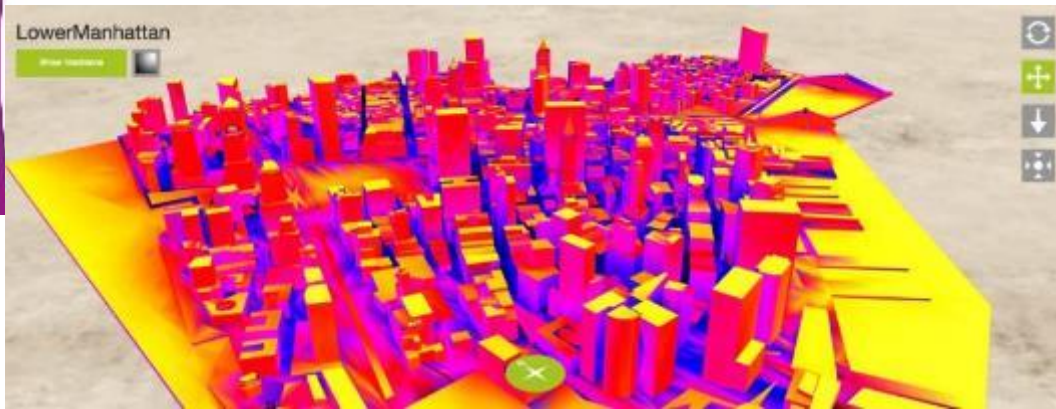
SOA holistic platform – BIM objects - Validation





# Key technologies –software development

BIM-based SW tool (available at <http://pvsites.enerbim.com/>)



# PVSITES products in the market

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## PVSITES in the market – exploitation success

- Planner tool adapted and license sold by TECNALIA for use in radio-frequency stations to an ESCO.
- Demonstration of forecasting tools and BMS, licensing to a large Energy company in Spain in progress (TECNALIA).
- Exploitation agreement for TECNALIA storage inverter in progress with ELSON Electronics.
- BIMSOLAR platform already on-line (free version)
- The collaboration between **R2M Solution** and **Onyx Solar** in the PVSITES project has led to a new commercial development, with R2M Solution now being the official Onyx Solar distributor in Italy and France.
- ONYX SOLAR and FLISOM products already in the market

# PVSITES products in the market

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## PVSITES in the market – CIGS products



180 kW BAPV retrofitting of bitumen roofs in the Netherlands  
With e Flex CIGS product (FLISOM)



# PVSITES products in the market

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## PVSITES in the market – CIGS products



250 kW installation of e Flex CIGS product (FLISOM) in a flowers market in Johannesburg (SA)

# PVSITES products in the market

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## PVSITES in the market – c-Si products



Black frit PVSITES modules in Atic in Castle Lane Street, close to Buckingham Palace, London (Onyx Solar)

# PVSITES products in the market

## PVSITES in the market – c-Si products



16 kW BIPV glass-glass blue tinted curtain wall (ONYX Solar) at Balenciaga storefront (Miami, USA)



# PVSITES products in the market

## PVSITES in the market – c-Si products



Awarded Most Innovative Curtain Wall project " in the US

# PVSITES products in the market

## PVSITES in the market – c-Si products



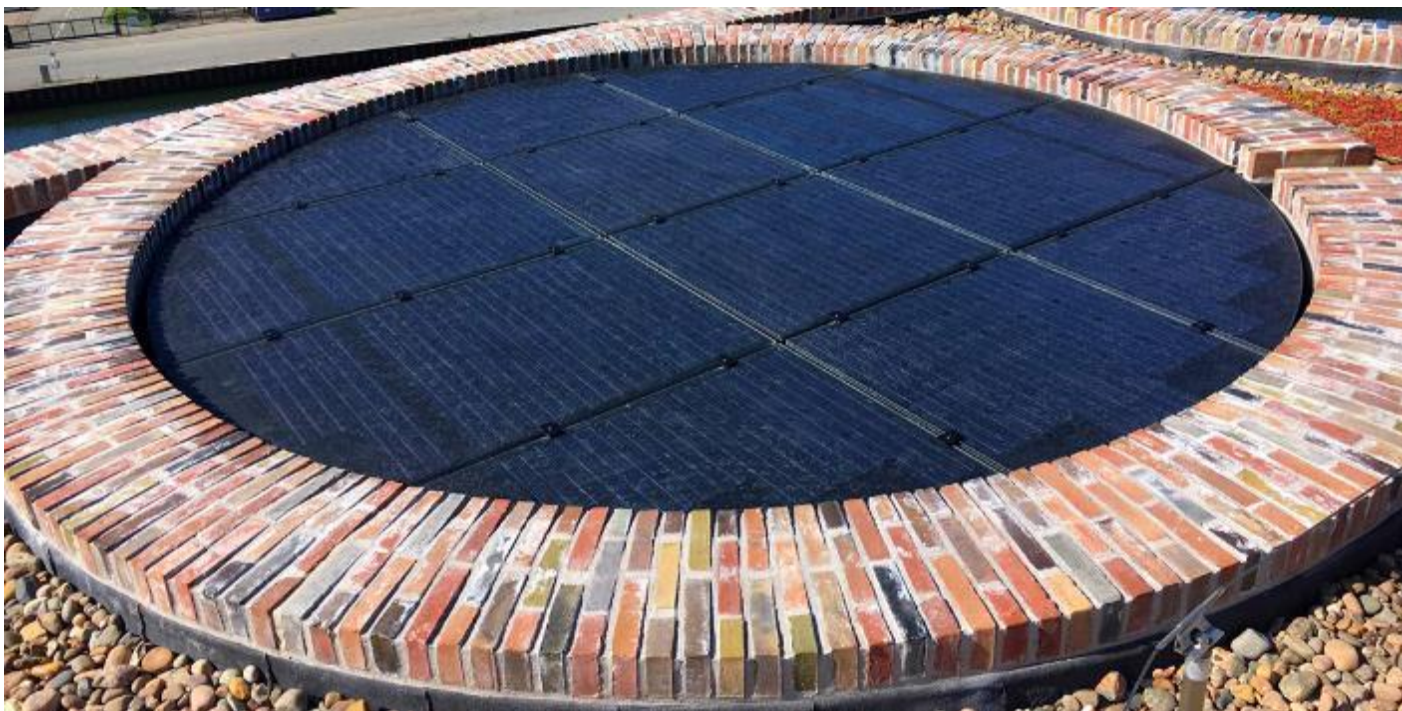
Canopy in Czech Republic, blue tinted glass (ONYX SOLAR)





# PVSITES products in the market

## PVSITES in the market – c-Si products



Kirk Kapital HQ, Denmark (Lego) PV skylight by Onyx Solar, 450 m<sup>2</sup>, 51 kWp, 11 circles. Opaque glass, where the front of the glass is acid etch and the rear layer includes a black frit





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