

## PVSITES Overview

**Webinar: PVSITES project contribution to BIPV market. Introduction to project demo sites, catalogue or products and software tool**

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- PVSITES introduction
- PVSITES objectives & challenges
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- PVSITES Products in the market

# PVSITES introduction - Quick facts

**Funding EU:** 5.47 M€ (+ 1.4 M€ Switzerland)

01/01/2016 – 30/06/2020

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**Coordinator:** Tecnalia R&I

## 15 partners

Spain (4)  
France (3)  
Switzerland (2)  
Portugal (1)  
Germany (1)  
Italy (1)  
Netherlands (1)  
Belgium (1)  
UK (1)



# PVSITES Objectives and challenges

**General objective: To drive BIPV technology to large market deployment led by EU industry**

To be achieved by:

- Identifying and addressing BIPV market / business requirements
- Demonstrating in real buildings (TRL5 to TRL6-7) an **ambitious portfolio of BIPV solutions** in terms design and simulation, architectural integration, performance, cost-effectiveness, grid integration, energy management, LCA, training and awareness

## 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

# PVSITES challenges

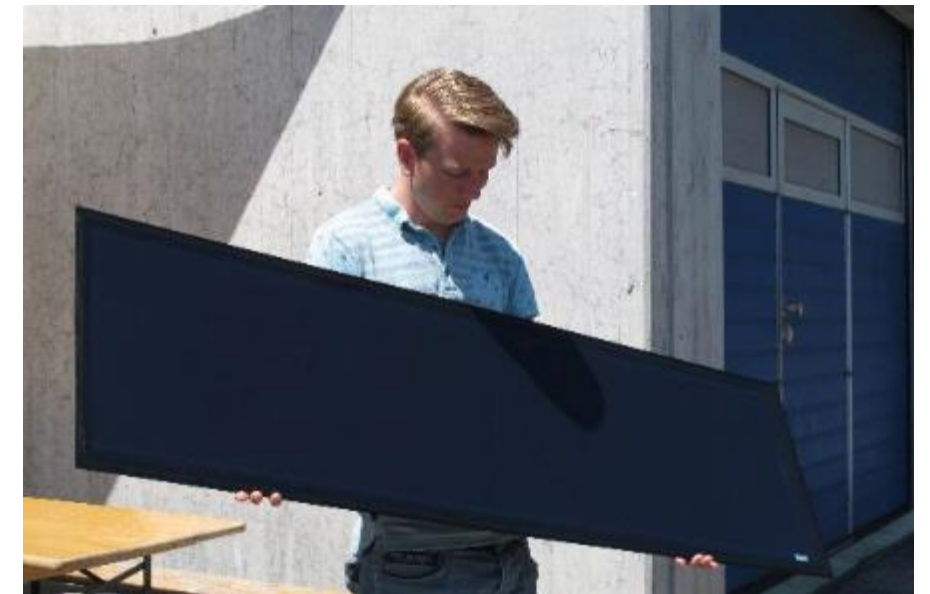
**Challenge:** Enhanced flexibility of design, outstanding aesthetical value, multifunctionality and increased performance

**Solution:** A wide portfolio of BIPV products based on c-Si and CIGS technologies complying with market requests



Glass–glass crystalline silicon based solutions (ONYXSolar), developed in PVSITES

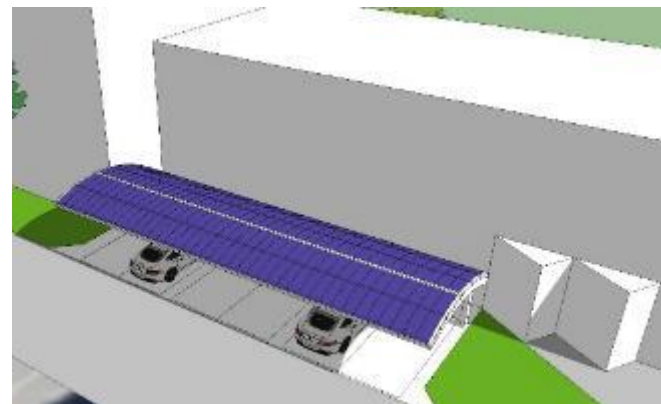
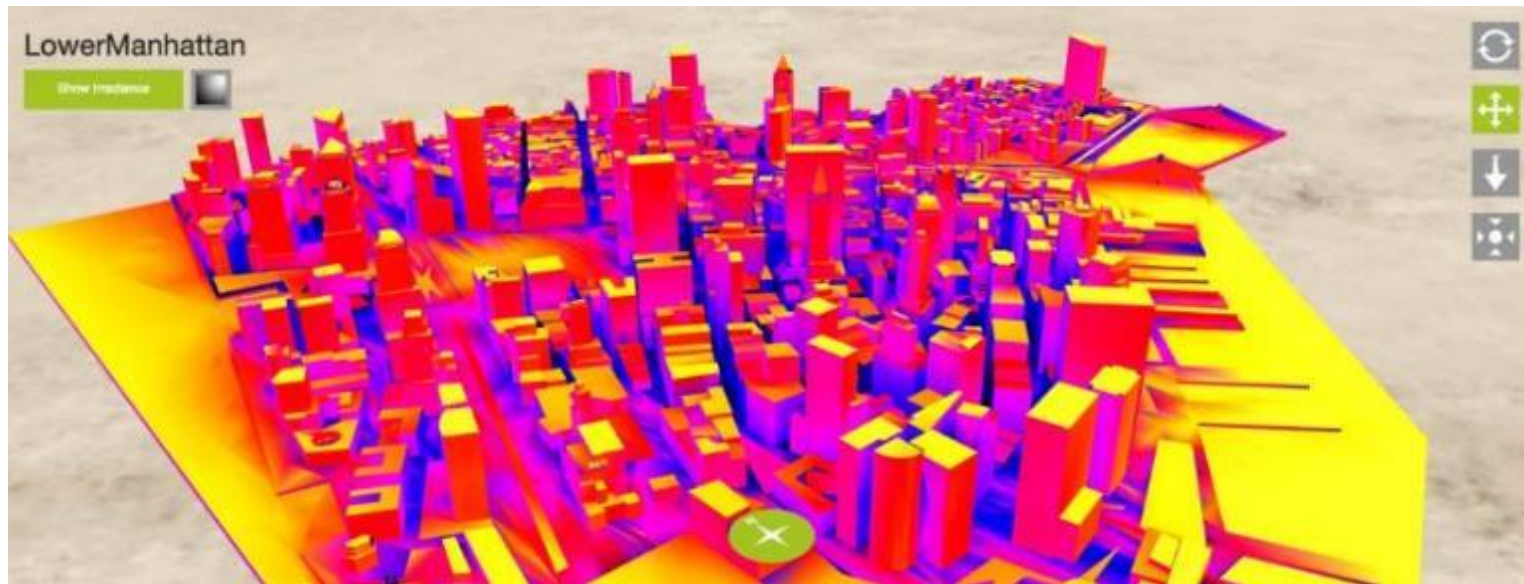
CIGS on metal BIPV modules (FLISOM), developed in PVSITES



# PVSITES challenges

**Challenge:** Software tool for the joint simulation of BIPV products and building energy performance

**Solution:** An accurate, user-friendly, integrated SW tool for the simulation of BIPV products performance and their impact on building energy demands



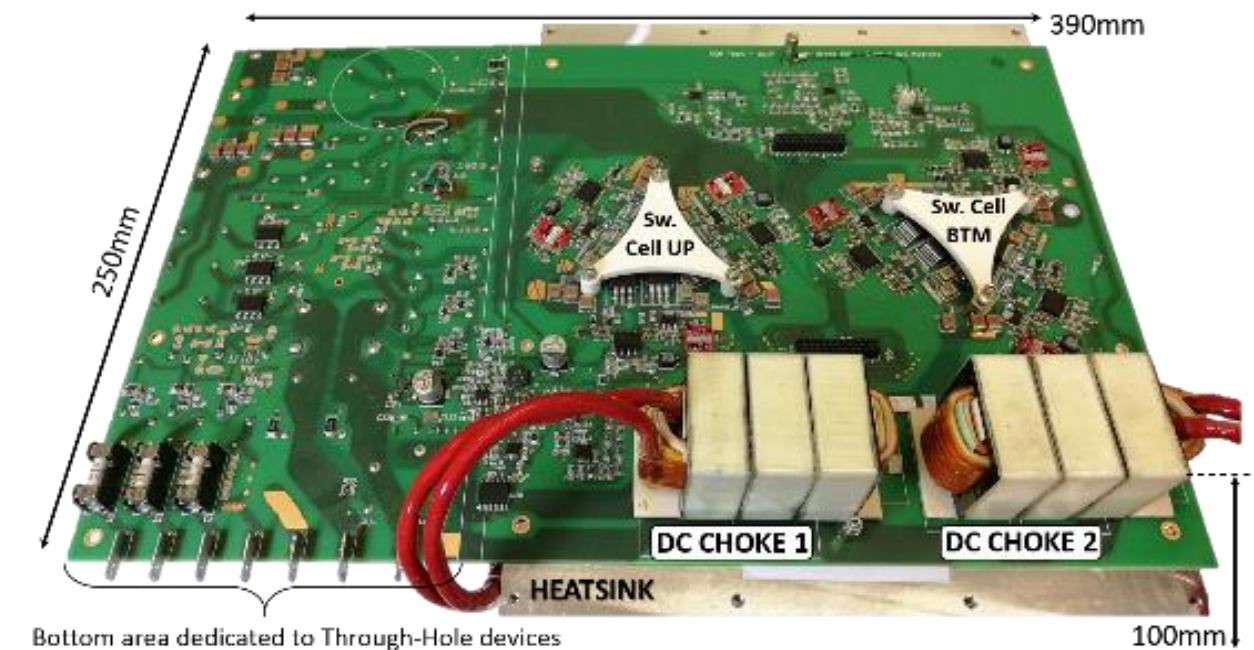
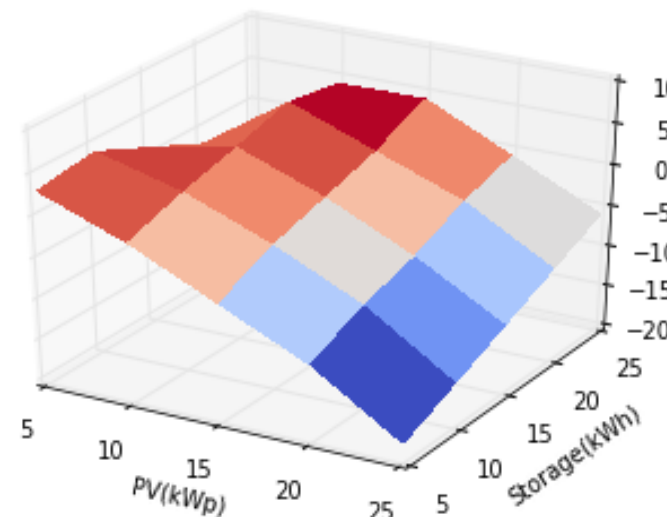
# PVSITES challenges

**Challenge:** More predictable, manageable, grid-friendly and profitable BIPV generation

**Solution:** A combination of flexible and high efficiency grid interface for BIPV systems and new building energy management strategies.



DC/AC converter,  
TECNALIA



CEA's inverter printed circuit-board with  
surface-mounted electronic components

# PVSITES challenges

**Challenge:** To demonstrate reliability of advanced BIPV solutions through effective incorporation onto real buildings

**Solution:** High impact, replicable demonstrations and training activities in real buildings and experimental facilities throughout Europe



Carport, Zürich (SW)

Roof, Stambruges (BE),  
residential

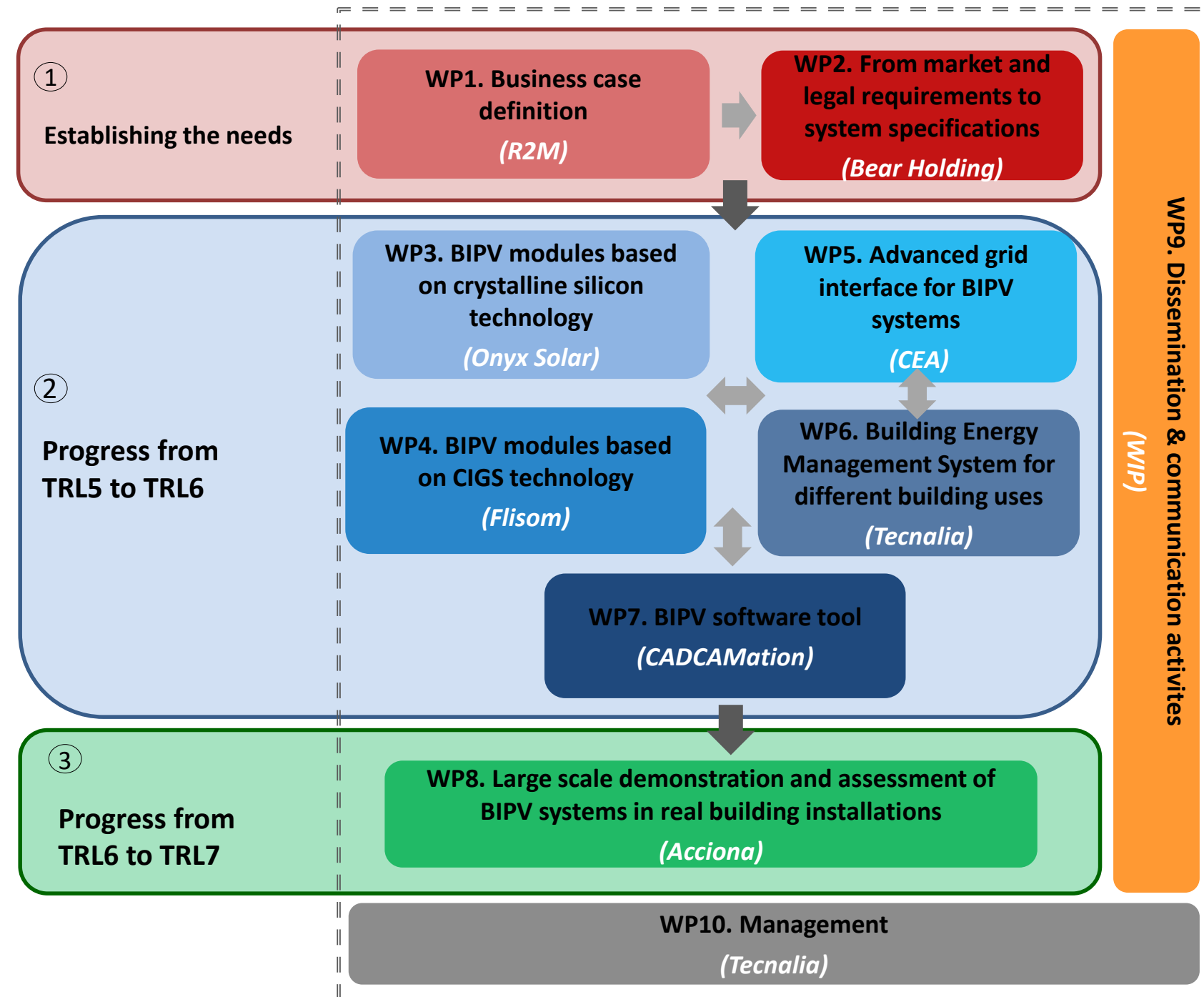


Opaque facade, Wattignies (FR),  
social housing



# PVSITES implementation

## WorkPlan



# PVSITES Achievements

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## Market related activities:

- Market and stakeholder analysis conducted.
- Assessment of regulatory framework
- Application of the new BIPV standard, EN 50583 (2016)
- Analysis of exploitable results (26 ERs, with commerc., IPR paths).
- Standardization needs for project results.
- Business models for BIPV.
- Global risk assessment.
- ...

Modules

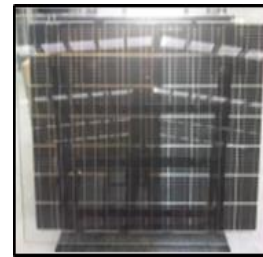
BOS

Other  
products

# PVSITES Achievements - modules

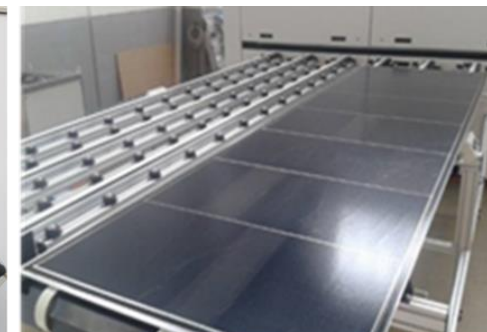
- **Glass – glass c-Si solutions (Onyx) and curved CIGS (collab.with Flisom)**

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



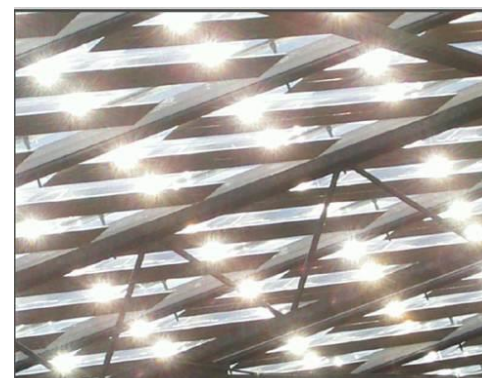
- **Flexible CIGS on metal substrates (Flisom)**

- 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



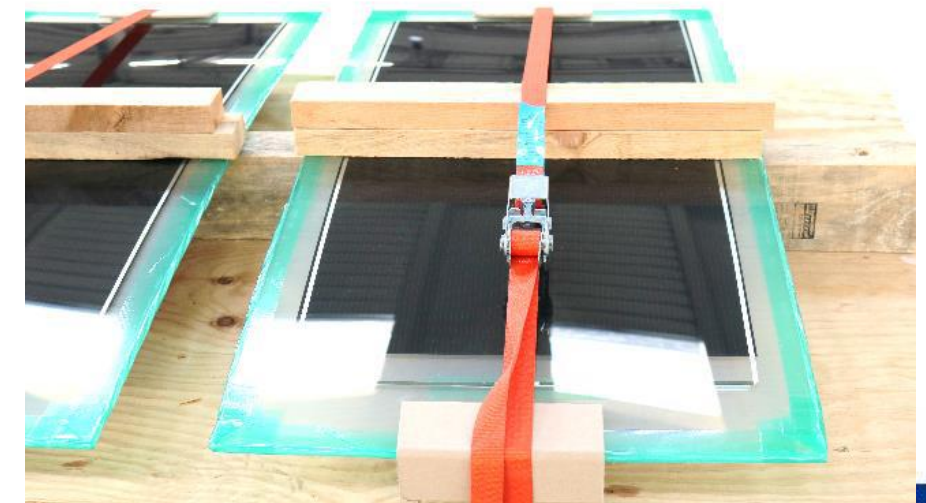
# PVSITES Achievements - modules

## Glass–glass crystalline silicon based solutions (ONYXSolar)



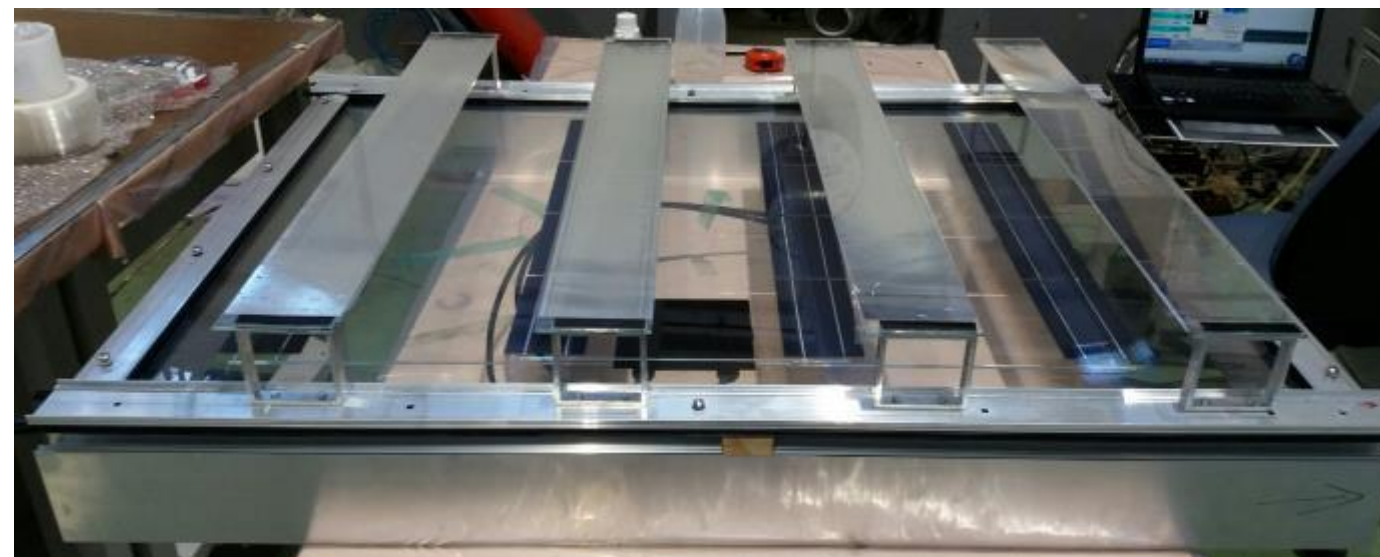
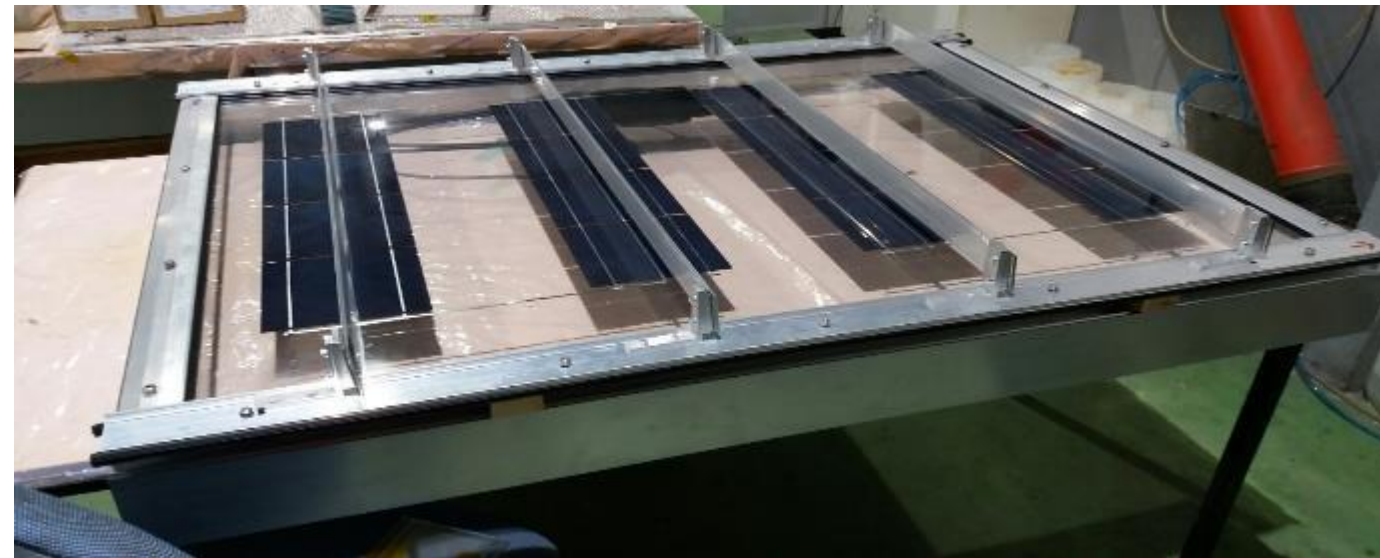
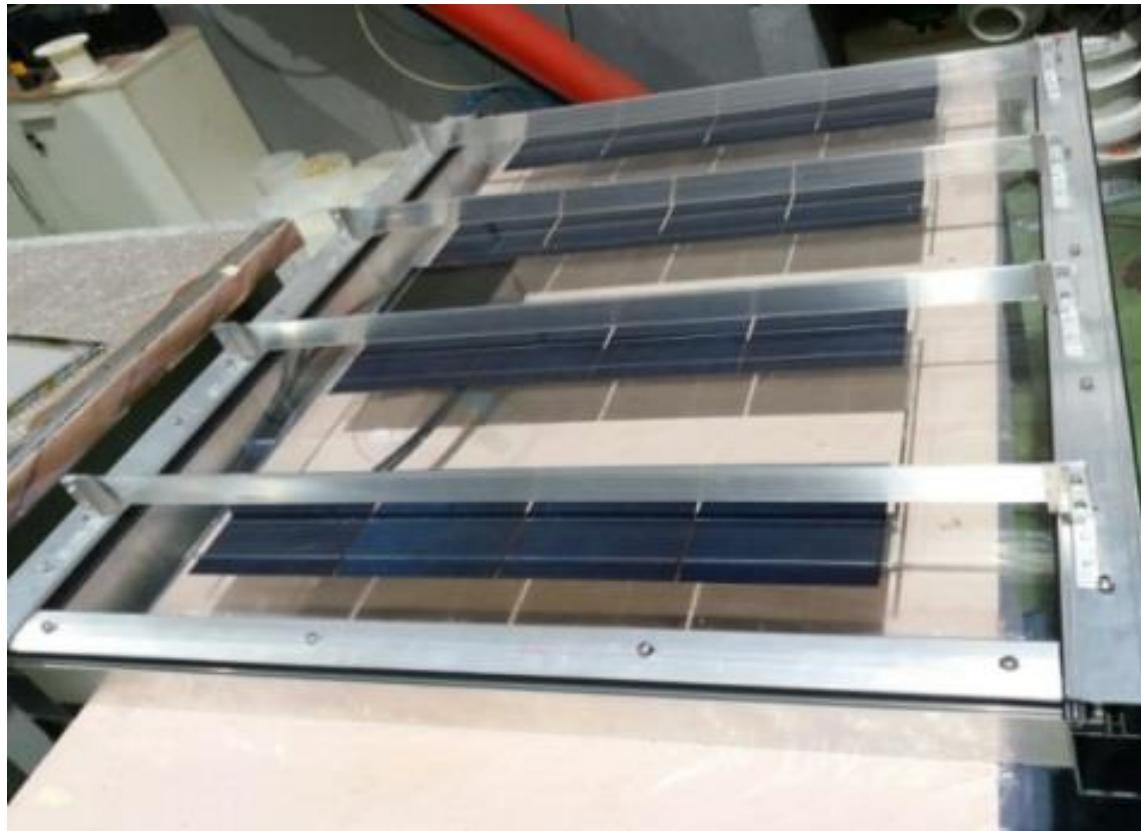
# PVSITES Achievements - modules

## Glass-glass based solutions (ONYXSolar + FLISOM)



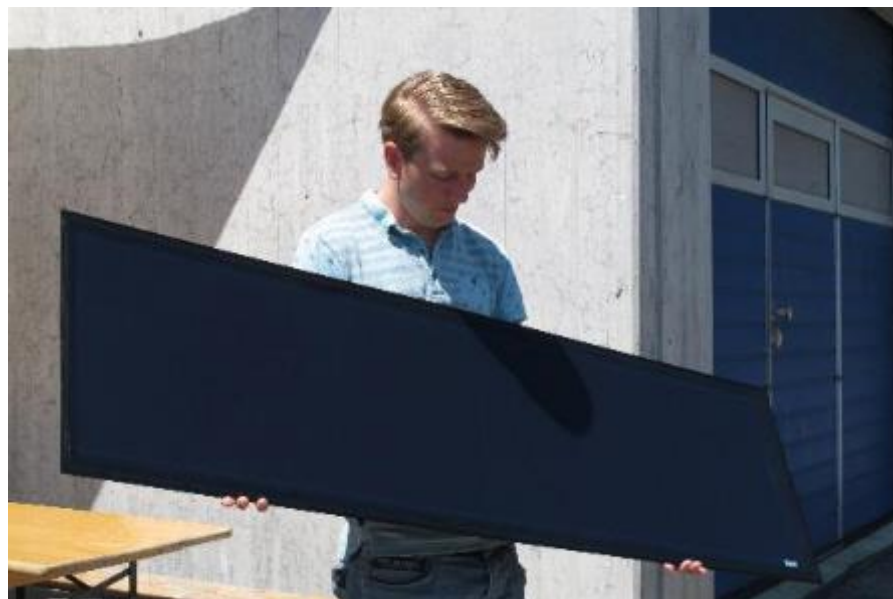
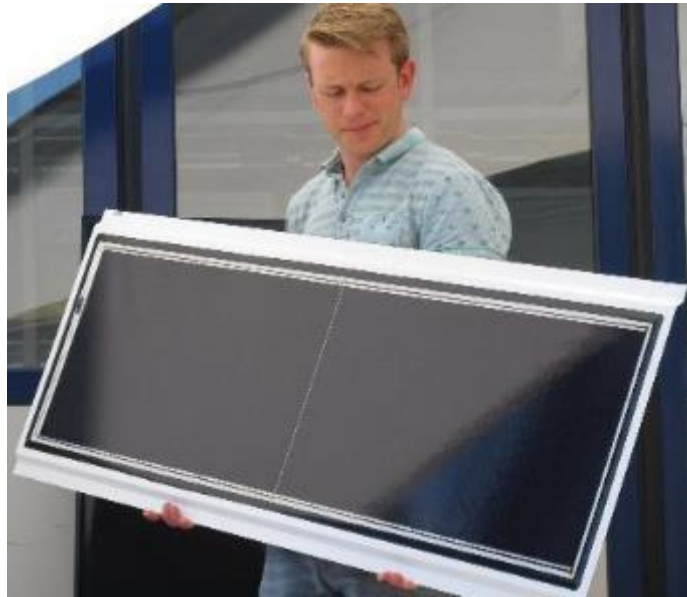
# PVSITES Achievements - modules

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



# PVSITES Achievements - modules

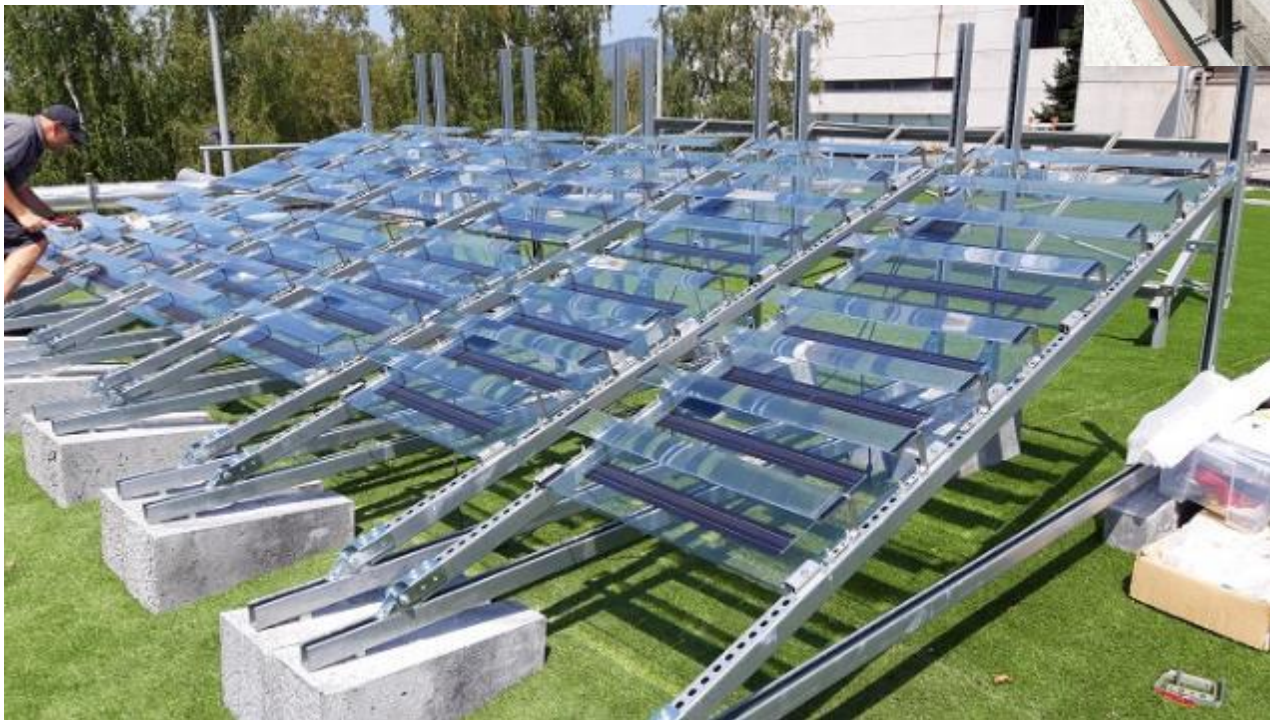
## CIGS on metal BIPV modules (FLISOM)



# PVSITES Achievements - modules in test-benches

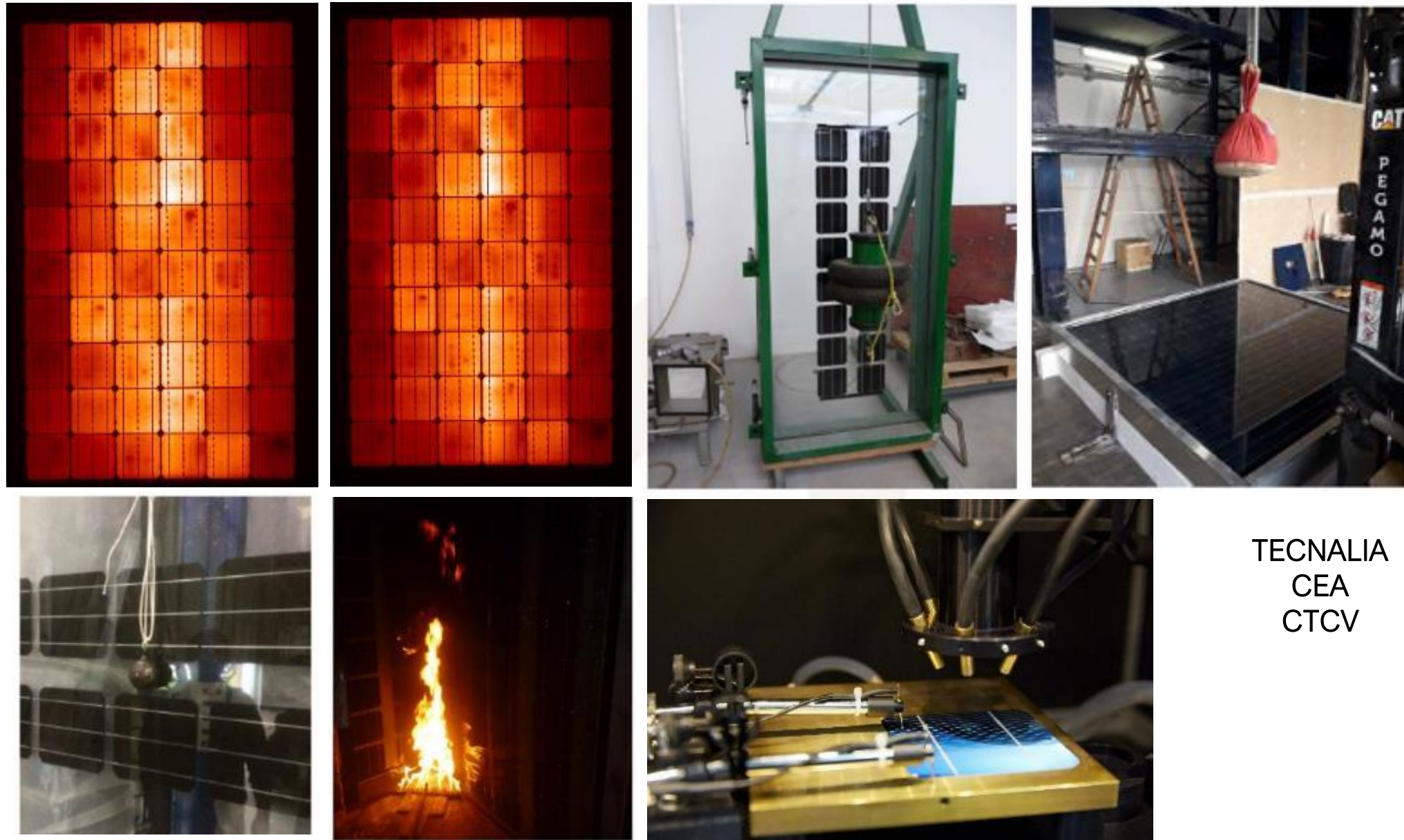


**Modules in outdoor testing @ Acciona, Tecnalia, CEA**



# PVSITES Achievements - modules and standards

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

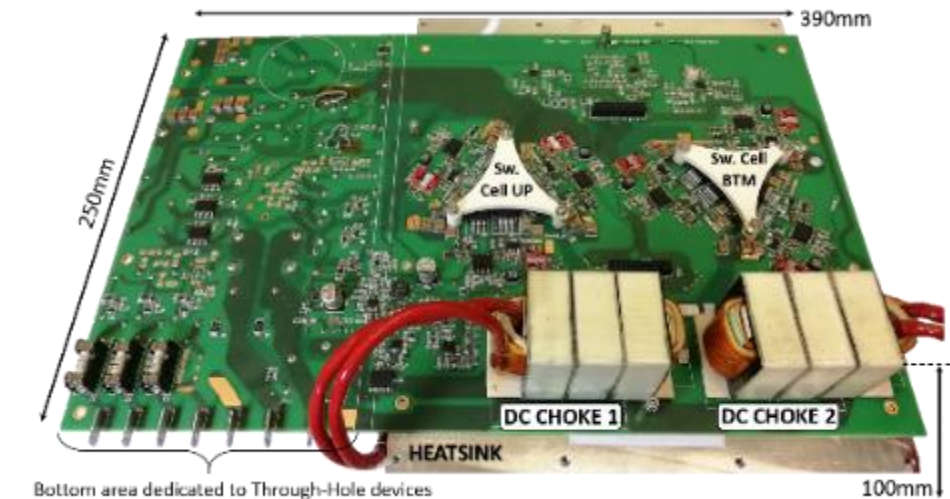
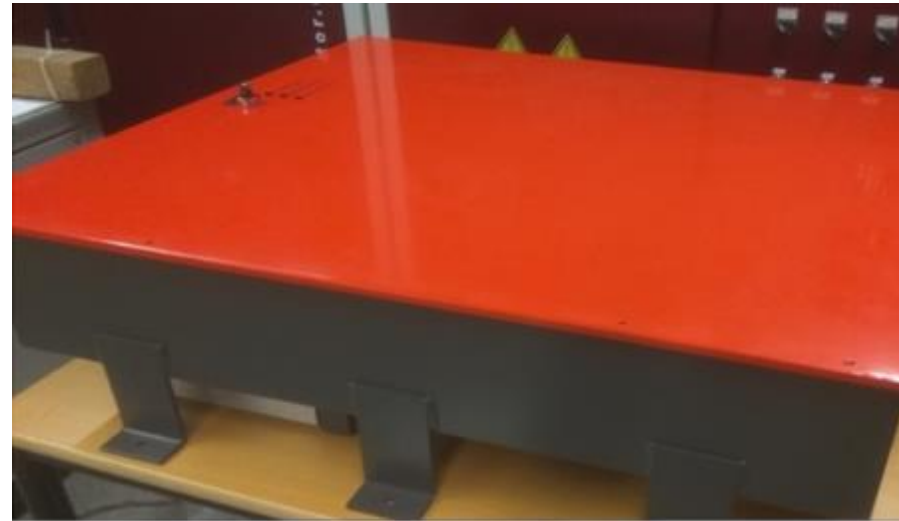


TECNALIA  
CEA  
CTCV

# PVSITES Achievements – energy conversion & management

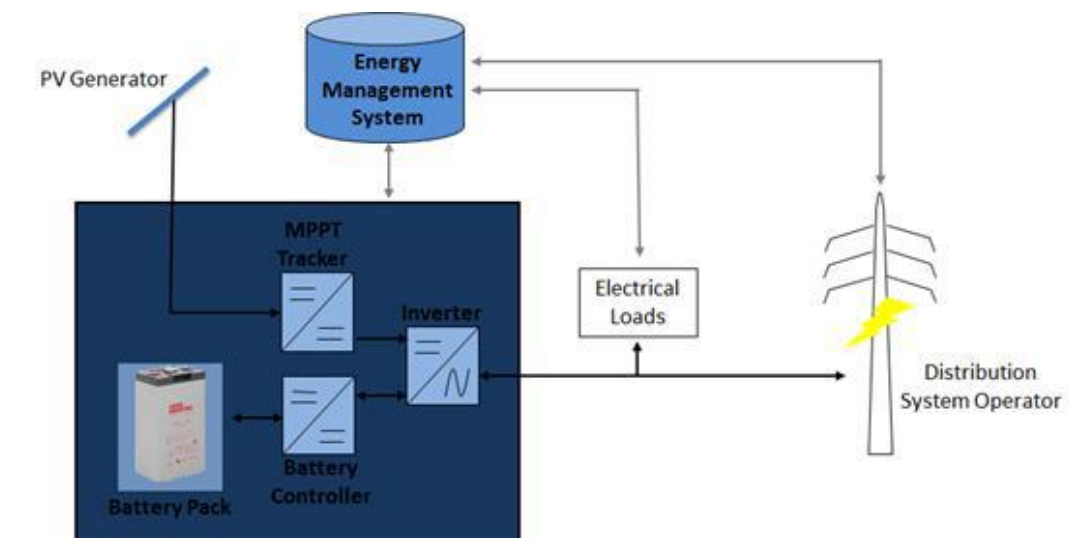
- **PV storage inverter with high DC coupling (Tecnalia) and single-stage SiC based PV inverter (CEA)**

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



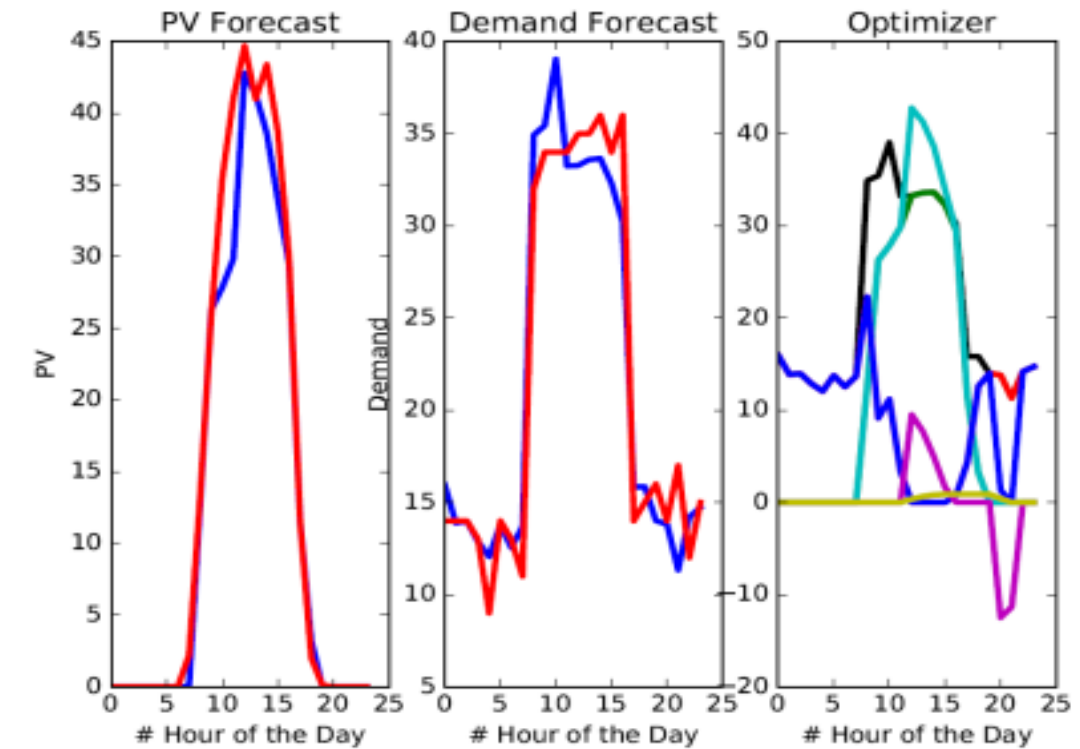
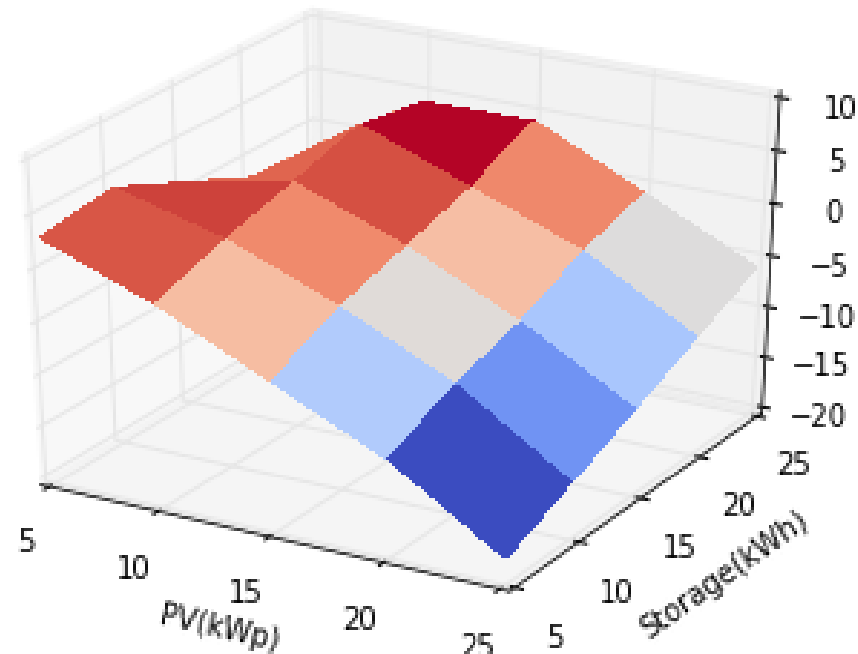
- **Building Energy Management Systems (BEMS) (Tecnalia, Acciona, R2M)**

- 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

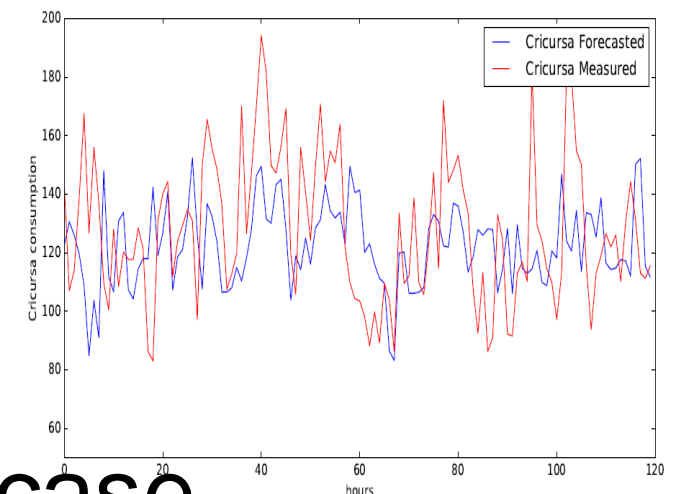


# PVSITES Achievements – energy conversion & management

- Planner tool PV storage systems

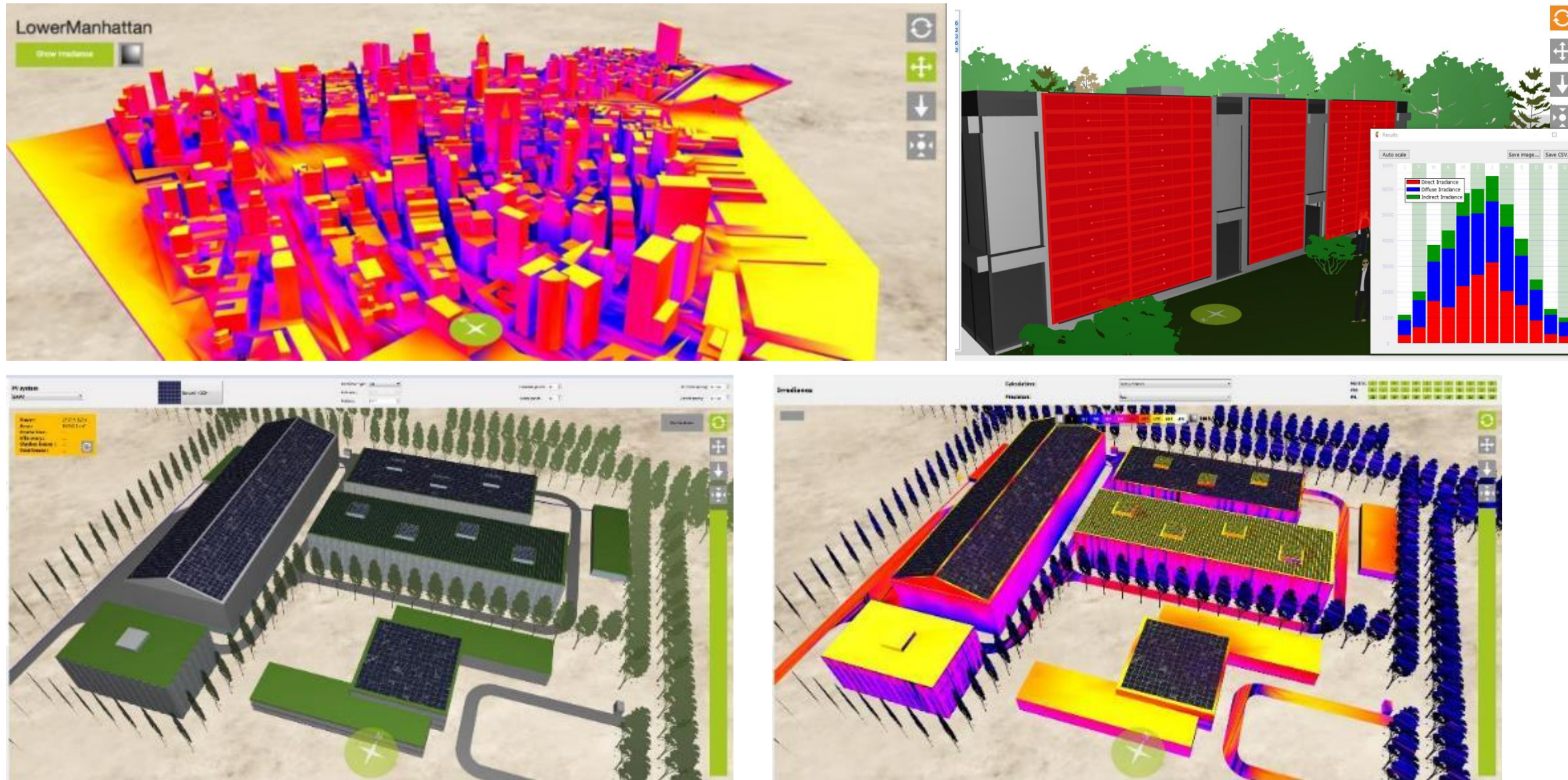


- Refinement of **BIPV** generation and building electrical consumption **forecasting tools**
- Building Energy Management System** for each use case



# PVSITES Achievements – software development

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



**Integrated tool for BIPV and building energy performance simulation**

# PVSITES Achievements – real demonstrations (ES, FR, BE, SW)



# PVSITES Achievements – residential demo (BE)

## Residential building, Stambruges (Belgium)



# PVSITES Achievements – carport demo (SW)

## Carport, Zürich (Switzerland)



# PVSITES Achievements – carport demo (SW)

## Carport, Dübendorf (Switzerland)



# PVSITES Achievements – industrial building demo (ES)

**BIPV industrial roof  
CRICURSA, Spain**



Building installation result

# PVSITES Achievements – social housing demo (FR)

**BIPV ventilated  
façade**

Wattignies (FR)



**Building installation result**

# PVSITES Achievements – office building demo (ES)



**Office building – ventilated facade**

**Building installation result**



# PVSITES products in the market

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## 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

## CIGS products



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

# PVSITES products 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

## 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

## c-Si products



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

# PVSITES products in the market

## c-Si products

Awarded Most  
Innovative Curtain Wall  
project " in the US



# PVSITES products in the market

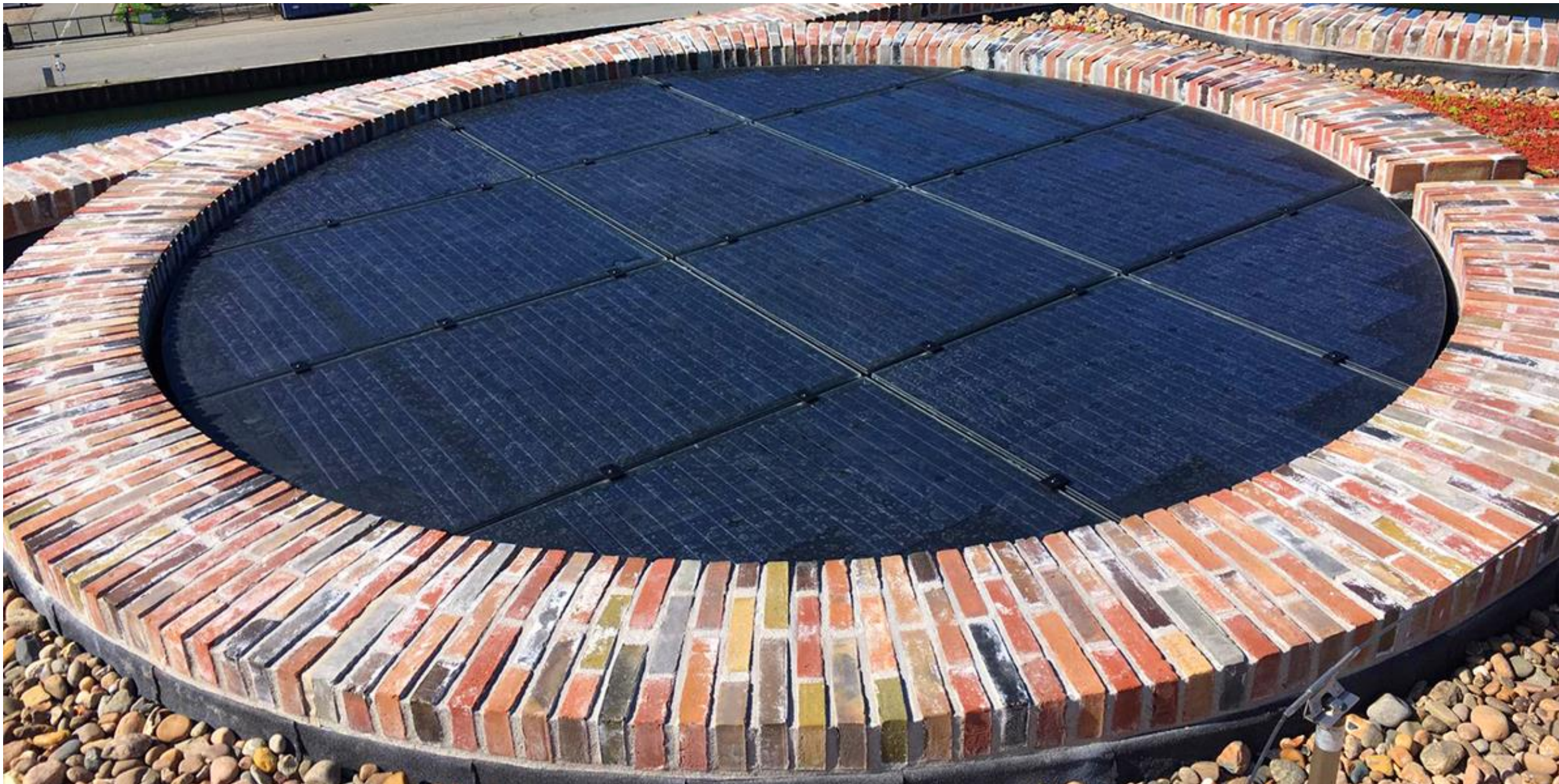
## c-Si products



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

# PVSITES products 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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