PVSITES project

Dr. Maider Machado - Tecnalia

Acceleration of BIPV by international collaboration
IEA PVPS Task 15 at 32nd EU PVSEC - Munich
21st June 2016
# General data

## Building-integrated photovoltaic technologies and systems for large scale market deployment

<table>
<thead>
<tr>
<th>Acronym:</th>
<th>PVSITES</th>
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<tbody>
<tr>
<td>Grant Agreement:</td>
<td>691768</td>
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<tr>
<td>Work Programme:</td>
<td>H2020</td>
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<tr>
<td>Call:</td>
<td>H2020-LCE-2015-2</td>
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<td>Topic:</td>
<td>LCE-03-2015</td>
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<td>Subtopic:</td>
<td>PV integrated in the built environment</td>
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<td>Funding EU:</td>
<td>5.47 M€</td>
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<td>Funding Switzerland:</td>
<td>1.4 M€</td>
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<tr>
<td>Start date:</td>
<td>1st January 2016</td>
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<tr>
<td>End date:</td>
<td>30th June 2019</td>
</tr>
<tr>
<td>Coordinator:</td>
<td>Tecnalia R&amp;I</td>
</tr>
<tr>
<td>Webpage:</td>
<td><a href="http://www.pvsites.eu">www.pvsites.eu</a></td>
</tr>
<tr>
<td>Contact:</td>
<td>Dr. Maider Machado – <a href="mailto:maider.machado@tecnalia.com">maider.machado@tecnalia.com</a></td>
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**Scope**

- To pave the way towards a BIPV wider market uptake led by EU industry...

- ... By demonstrating in real buildings (TRL 5 to 6-7) an ambitious portfolio of BIPV solutions in terms of design and simulation, architectural integration, performance, cost-effectiveness, grid integration, energy management, LCA, training and awareness.
International collaboration

15 partners:

- Spain (4)
- France (3)
- Switzerland (2)
- Portugal (1)
- Germany (1)
- Italy (1)
- Netherlands (1)
- Belgium (1)
- UK (1)
# International collaboration

<table>
<thead>
<tr>
<th>Coordinator</th>
<th>Grid interface</th>
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<tbody>
<tr>
<td>Low-c product</td>
<td>Regulatory framework</td>
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<td>Grid interface &amp; BEMS</td>
<td>Testing needs</td>
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<td>Testing. Simulation.</td>
<td>Indoor &amp; outdoor testing</td>
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<td>Demo building</td>
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<td>C-Si products manufacturer</td>
<td>Demo installations management</td>
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<tr>
<td>Architectural integration</td>
<td>Demo building</td>
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<tr>
<td>Architectural integration</td>
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<td>Simulation. Monitoring.</td>
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<td>Fresnel lenses</td>
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<td>Testing, LCA</td>
<td>Business models, IPR...</td>
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<td>Thin film products manufacturer</td>
<td>BIPV software development &amp; training</td>
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<td>Demo buildings</td>
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<tr>
<td>Curved glass</td>
<td>Dissemination &amp; Communication manager</td>
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<td>Demo building</td>
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# International collaboration

<table>
<thead>
<tr>
<th>Market analysis</th>
<th>Spec, design</th>
<th>Software development</th>
<th>Module &amp; components manufacturing</th>
<th>Energy conversion &amp; management</th>
<th>Testing, Demonstration activities</th>
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<tbody>
<tr>
<td>Life cycle analysis (CTCV)</td>
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<td>Dissemination and communication (WIP)</td>
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All | All | All | All | All | All
International collaboration

PVSITES External Advisory Board

• Mr. Michiel Ritzen (Zuyd University of Applied Sciences, NL)
• Dr. David Moser (Eurac, IT)
• Mr. Emiliano Perezagua (PV Consulting Services, ES)
• Mr. Jan Clyncke (PVCYCLE, BE)
• Arch. Dr. Ing. Emmanuel Dufrasnes (École Nationale Supérieure d’Architecture de Strasbourg, FR)
• Mr. Robert Hecker (Ed Züblin AG, GE)
Market challenges

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

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

More predictable, manageable, grid-friendly and profitable BIPV generation

Demonstration of reliability of BIPV solutions through effective incorporation onto real buildings
Implementation

1. Establishing the needs
   - WP1. Business case definition (R2M)
   - WP2. From market and legal requirements to system specifications (Bears Holding)

2. Progress from TRL5 to TRL6
   - WP3. BIPV modules based on crystalline silicon technology (Onyx Solar)
   - WP4. BIPV modules based on CIGS technology (Flisom)
   - WP5. Advanced grid interface for BIPV systems (CEA)
   - WP6. Building Energy Management System for different building uses (Tecnalia)
   - WP7. BIPV software tool (CADCAMation)

3. Progress from TRL6 to TRL7
   - WP8. Large scale demonstration and assessment of BIPV systems in real building installations (Acciona)
   - WP10. Management (Tecnalia)
Objectives:

• To set the foundation for effective development & exploitation
• Characterising markets, stakeholders and needs
• Understanding regulatory framework & standardisation needs
• Assessing features of exploitable results
• Managing, protecting and finding agreements on results
• Identifying appropriate business models & setting commercialisation plans
• Characterising different risks and identifying solutions to mitigate
Implementation – WP1

29 exploitable products and services identified!
16 products / 6 services / 7 knowledge and IP
Survey on BIPV market and stakeholder analysis

www.pvsites.eu
Objectives:

• To develop complete **technical specifications** attending to business models, market and legal requirements.
• To incorporate **bio-climatic** requirements and **energy-efficiency** considerations, as well as **aesthetical** considerations.
• To define structure, contents and operational protocols of a multi-format **portfolio** gathering all the information generated on the products.
Objectives:

- To provide a multiple answer to the market needs of c-Si technology-based products (semitransparent and opaque glass-glass)
- Enhanced aesthetical appearance, high efficiency levels, passive properties than traditional construction products
- Customization (geometry and formats)
- Compliance with targeted cost-effectiveness: **Target price:** 250-400 €/m² maximum (deviation of materials parity of approx. 100 €/m²); **Payback Time:** 5-7 years
Implementation – WP3
Implementation – WP3

+ Glass-glass modules with back-contact solar cells

+ Coating treatments for enhanced passive performance
Implementation – WP3

CEA-Acciona outdoor test sites
Implementation – WP4

Objectives

- Demonstration of BIPV products based on lightweight, flexible, monolithically connected CIGS solar modules on polymer films produced with roll-to-roll manufacturing methods.
- Solar roof tiles and façade elements with 10%-14% module efficiency modules integrated on metal sheets using cost effective encapsulation/lamination/bonding materials and processes.
- Large area BIPV elements on metal sheets and roofing membranes of different sizes, up to 3m², for integration in roofs and façades.
- Curved glass-glass encapsulation of CIGS modules
- Compliance with standards
- **Target cost:** 200-350 €/m2 by 2018, 100-150 €/m2 by 2021. **Payback time** 5 to 7 years.
Implementation – WP4

- Residential BIPV roof tiles
- Industrial BIPV metal roofing
- Commercial BIPV façade
Implementation – WP4

Curved glass-glass laminated CIGS modules
Objectives:

- Definition, progress and validation of interface of the BIPV generators with the grid.
- For the integration of electrical storage systems, selection of best candidates for integration into BIPV systems. A design solution which integrates the storage system on DC level will be developed.
- For the reduction of costs and increasing the flexibility in system design, a novel low cost robust PV inverter will be developed, based in SiC technology.
Implementation – WP4

NEST experimental building - Switzerland
Implementation – WP6

Objectives:

- **Simulation tool** for sizing **PV storage systems** and estimating their ROI.
- **Analysis and characterization of manageable electrical loads** in buildings for active load management.
- Refinement of **low-cost and reliable** BIPV generation and electrical consumption **forecasting tools**.
- Progress on **building energy management strategies** to maximize BIPV value.
Implementation – WP7

Objectives:

- To develop an integrated, holistic and user-friendly software tool in order to predict both BIPV products and building energy performance in real operation conditions.
- To develop BIM objects for each of the products proposed in PVSITES project.
- To validate software from data coming from the experimental buildings and test benches (WP3 and WP4) and BIPV products demonstration in real buildings (WP8).
Implementation – WP7

Glazing configurator

Module configurator

Wiring configurator

Inverter configurator
Implementation – WP7
Implementation – WP7
Implementation – WP7
Objectives:

- To evaluate BIPV elements **energy production, building energy performance** in conjunction with economic viability and associated business models; TRL 7.
- To produce **high-quality monitoring results**, for the validation of the SW tool.
- To provide a privileged frame for in situ training activities towards designers, construction companies, installers, etc.
Implementation – WP8

6 demonstration installations across Europe (BE, ES (2), CH (2), FR)
Implementation – WP8

FD2 demo building, CIGS roofing shingles, (Belgium)
Implementation – WP8

Tecnalia demo building, ventilated façade, back-contact cells (Spain)
Implementation – WP8

Circursa demo building, industrial roof CIGS elements, (Spain)
Implementation – WP8

Flisom demo building, carport, CIGS elements (Switzerland)
Implementation – WP8

Flisom demo building, industrial façade, CIGS elements, (Switzerland)
Implementation – WP8

Vilogia demo building, ventilated façade, opaque c-Si, (France)
Objectives:

- To identify target groups, communication tools and distribution channels for the project dissemination and communication activities.
- To promote BIPV as a reliable technology to the market.
- To disseminate a portfolio of BIPV systems and their potential.
- To engage the BIPV community into adopting PVSITES products.
- To guarantee that the results from the project will be accessible for knowledge transfer and capacity building.
Acknowledgments

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PVSITES team
Thanks for the attention