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PVsites

Templates for a technical description of the PVSITES BIPV products portfolio - First version

Project report

BEAR, TECNALIA, NOBATEK, FLISOM, ONYX, CEA

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Summary

The present document constitutes the first deliverable on PVSITES BIPV products portfolio. All the products and families of products demonstrated in the project will form part of a BIPV products portfolio which will be available in different formats. A first implementation will consist in an online matrix whose elements will be each product and its related information. Secondly, each product will be turned into a BIM object (WP7) and will constitute an input data for the BIPV software tool to be developed in WP7. Third, the collection of products and product information will be the basis for dissemination materials (physical catalogues, flyers, etc.), to be developed in WP9. This deliverable establishes the necessary contents for the gathering of information about the products. The actual gathering will be progressively performed as the development and modelling phases advance (month 13 to 24, updating up to month 36), given that the necessary data to feed the tool will come from those activities. Some of this information was already gathered in D2.1 (Technical specifications for BIPV modules) and D2.5 (Specifications for energy conversion and management systems). This document will be updated twice: D2.7 (Month 24) and D2.8 (Month 36). The actual implementation of the online tool will take place as part of WP9 between months 36 and 42.

Acknowledgements

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The present report was mainly prepared by PVSITES project partner BEAR-iD, with additional contributions from TECNALIA, NOBATEK, FLISOM, ONYX and CEA. The report was originally submitted to the European Commission as Project Deliverable D2.6 in January 2017.

Disclaimer

About the PVSITES project

PVSITES is an international collaboration co-funded by the European Union under the Horizon 2020 Research and Innovation program. It originated from the realisation that although building-integrated photovoltaics (BIPV) should have a major role to play in the ongoing transition towards nearly zero energy buildings (nZEBs) in Europe, the technology in new constructions has not yet happened. The cause of this limited deployment can be summarised as a mismatch between the BIPV products on offer and prevailing market demands and regulations.

The main objective of the PVSITES project is therefore to drive BIPV technology to a large market deployment by demonstrating an ambitious portfolio of building integrated solar technologies and systems, giving a forceful, reliable answer to the market requirements identified by the industrial members of the consortium in their day-to-day activity.

Coordinated by project partner Tecnalia, the PVSITES consortium started work in January 2016 and will be active for 3.5 years, until June 2019. This document is part of a series of public reports summarising the consortium's activities and findings, available for download on the project's website at www.pvsites.eu.

The PVSITES consortium:

Tecnalia Research & Innovation	CTCV	FormatD2
Onyx Solar	Flisom	Vilogia
BEAR-iD	Cricursa	R2M Solution Research to Market
Nobatek	CEA	CADCAMation
Film Optics	Acciona Infraestructuras	WIP - Renewable Energies

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1 EXECUTIVE SUMMARY

1.1 Description of the deliverable content and purpose

The present document constitutes the first deliverable on PVSITES BIPV products portfolio. All the products and families of products demonstrated in the project will form part of a BIPV products portfolio which will be available in different formats. A first implementation will consist in an online matrix whose elements will be each product and its related information. Secondly, each product will be turned into a BIM object (WP7) and will constitute an input data for the BIPV software tool to be developed in WP7. Third, the collection of products and product information will be the basis for dissemination materials (physical catalogues, flyers, etc.), to be developed in WP9. This deliverable establishes the necessary contents for the gathering of information about the products. The actual gathering will be progressively performed as the development and modeling phases advance (month 13 to 24, updating up to month 36), given that the necessary data to feed the tool will come from those activities. Some of this information was already gathered in D2.1 (Technical specifications for BIPV modules) and D2.5 (Specifications for energy conversion and management systems). This document will be updated twice: D2.7 (Month 24) and D2.8 (Month 36). The actual implementation of the online tool will take place as part of WP9 between months 36 and 42.

This first document contains the templates that will be used by partners to provide all the relevant information about the BIPV products (modules and inverters).

1.2 Relation with other activities in the project

Table 1.1 depicts the main links of this deliverable to other activities (work packages, tasks, deliverables, etc.) within PVSITES project. The table should be considered along with the current document for further understanding of the deliverable contents and purpose.

Table 1.1 Relation between current deliverable and other activities in the project

Project activity	Relation with current deliverable
WP3, WP4, WP5	The direct information about the products comes from the development and simulation phases in WP3 and WP4 (for c-Si and thin film products respectively) and WP5 (for inverters).
WP7	The information collected will also fed the creation of BIM objects within WP7.
WP9	Within WP9, the actual implementation of the portfolio tool will be performed.

1.3 Reference material

Grant Agreement PVSITES project, 691768

D2.1: Technical specifications for BIPV modules

D2.5: Specifications for energy conversion and management systems

1.4 Abbreviation list

BIPV: Building-integrated photovoltaics

CIGS: Copper Indium Gallium (di) Selenide

C-Si: Crystalline silicon

PV: Photovoltaics

WP: Work Package

Bc: Bare cell

Tz: Transparent zone

Cz: Cell zone

2 INTRODUCTION

2.1 BIPV products portfolio online tool

As explained above, all the products and families of products demonstrated in the project will form part of a BIPV products portfolio which will be available on different formats. A first implementation will consist in an online matrix whose elements will be each product and all its related information. Secondly, each product will be turned into a BIM object (WP7) and will constitute an input data for the BIPV software tool to be developed in WP7. Third, the collection of products and product information will be the basis for dissemination materials to be developed in WP9.

The portfolio will contain all the information available on the product: PV technology, nominal power, possible architectural applications, customization, life cycle, price, etc. As for operation mechanisms, it will implement a search tool in order to select the optimum product at project design level; it will perform preliminary production estimates as a function of location, orientation, tilt, etc. to facilitate a first evaluation of economic viability (though more accurate, project specific predictions will be available through BIPV software tool, WP7). This tool will also contribute to the labour of the installation professionals by means of setting up maintenance and dismantling guidelines within the portfolio.Task 2.1, as well as work packages focused on BIPV systems technology (WP 3, 4, 5 and 6), lifecycle analysis and demonstration activities (WP8) will feed from this portfolio and self-consistently provide feedback to it.

The online portfolio and the BIPV software tool to be developed in WP7 are highly complementary in the sense that the portfolio will provide general information, data sheets and some degree of optimization and customization by the user (project design architects), while the BIPV software will allow detailed calculations on the performance of both the BIPV systems and the building in specific integration works, together with detailed analysis of economic viability. Final users of the software are design architects, thermal engineers, installers, construction products manufacturers, etc.

Protocols will be defined in order to add, correct, delete and comment information in the portfolio to improve contents and search methods. The selection of structure, contents and operational protocols will be performed by BEAR, Onyx, Flisom, Nobatek and TECNALIA. The specific gathering of information to be fed into the tool will be the responsibility of TECNALIA. Periodic reports on structure and contents will be issued. The specific implementation of the online portfolio will be made by in WP9, as part of dissemination & communication activities.

3 PRODUCTS AND TEMPLATES

3.1 Structure

The technical templates for the BIPV modules (products X1 to X12) are structured in 11 groups of information:

- General description, design and materials of BIPV modules.
- Mechanical performance of BIPV modules.
- Architectural integration of BIPV modules.
- Electrical performance of BIPV modules.
- Thermal performance of BIPV modules.
- Optical performance of BIPV modules.
- Estimation of PV production of BIPV modules.
- Simulation of passive performance of BIPV modules.
- Maintenance and dismantling.
- Life cycle assessment.
- Economical evaluation of BIPV products.

For inverters (X13 and X14), 6 different templates have been generated:

- General description and design.
- Installation.
- Electrical performance.
- Monitoring and control.
- Maintenance and dismantling.
- Life cycle assessment.

Each template will be filled with the most relevant information about PVSITES BIPV modules and inverters. During the M13-M24 period, the corresponding information will be gathered to fill the templates (Result D2.7). This information will be updated in the M25-M36 period. (Result D2.8).

Table 2.1 depicts the BIPV products within PVSITES project which are covered by this document. Note that during the development process X2 and X4 were combined. To avoid misunderstanding, the numbers already given to the products have not been changed.

Table 3.1: Overview of PVSITES products

Code	Product	Manufacturer	Demo site	Test benches
X1	CIGS roofing shingle on metal substrate	Flisom	Demonstrated in single-detached dwelling – Belgium	
X2/X4	CIGS large area flexible roofing membrane and bendable elements	Flisom	Demonstrated on industrial rooftop-Switzerland / on carport-Switzerland / in façade-Switzerland / in industrial roof in Spain	
X3	Experimental/Innovative CIGS alternatives	Flisom		NEST
X5	C-Si glazed products with hidden bus bars and L interconnections	Onyx	Demonstrated in residential building-France	
X6	Glass-glass products with back contact c-Si cells	Onyx	Demonstrated in office building - Spain	
X7	Curved glass-glass, CIGS technology	Onyx	-	CEA
X8	Framing system for c-Si large area glass	Onyx		CEA
X9	C-Si semitransparent low concentration and Solar control BIPV system – skylight configuration	Onyx, Tecnalia, Film Optics		CEA
X10	C-Si semitransparent low concentration and Solar control BIPV system – facade configuration	Onyx, Tecnalia, Film Optics		ACCIONA
X11	C-Si semitransparent low concentration and Solar control BIPV system – shading element configuration	Onyx, Tecnalia, Film Optics	-	-
X12	Glazed modules treated for improved passive properties	Onyx	-	-
X13	Inverter with storage system and DC coupling	Tecnalia	Demonstrated in FD2 and Vilogia buildings.	
X14	SiC based inverter	CEA	Demonstrated in Tecnalia and Cricursa buildings.	

3.2 Contents

3.2.1 Templates for BIPV modules (from X1 to X12)

Table 3.2: BIPV modules: General description, design and materials

GENERAL DESCRIPTION, DESIGN AND MATERIALS

TECHNICAL TEMPLATE REFERENCE	
Technical subject	General description, design and materials of BIPV modules.
Partner	
Author	

PRODUCT CODE	
Project	PVSITES. Task 2.6. BIPV products portfolio
Category	Ventilated façade/ Curtain wall/ Skylight/ Roofing shingle/ Shading system
Denomination	Original denomination of product.
Partner/s	…
Author/s	…

PICTURES

REALISTIC DRAWING

Graphic design image (CAD 3D Rendered Solid Image in colour, with Isometric SO view and Perspective 1).

Observations:

Very brief description.

EXPLODED DRAWING

Exploded drawing (CAD 3D Lineal Image in black, with Isometric SO view and Perspective 1. Every part of the BIPV element must be separated from the rest, and named with the use of arrows and a legend in the “Observation” box detailing materials and other features).

Observations:

Legend.

DESIGN PLANS

Front view (CAD 2D Lineal Image in black).	Intermediate vertical section (CAD 2D Lineal Image in black).
Intermediate horizontal section (CAD 2D Lineal Image in black).	Intermediate front section/ Others (CAD 2D Lineal Image in black).

Observations.

Description of design details.

DETAILED DESCRIPTION	
Definition	Descriptive value
Construction unit	Ventilated façade/ Curtain wall/ Skylight/ Roofing shingle/ Shading system/ Other
Architectural location	Façade/ Roof/ Other
Geometrical design	Descriptive value
Dimensions	Length, width, height/ Standardized variations
Geometrical shape	Rectangular/ Square/ Hexagonal/ Flat/ Concave/ Standardized variations/ Other
Other	…
Materials	Descriptive value
Configuration	Double glazing/ monolithic unit/ Other
Layers	Description of layers from the topside to the backside of the unit: Superstrate (Glass/ Other) + Intermediate layers + Substrate (Glass/ Aluminium/ Other)
Frame structure	Frameless/ Aluminium / Wood/ Other
PV technology	Si-monocrystalline/ Si-amorphous/ Thin film/ Other
Encapsulation material	EVA/ PVB/ Other
Surface treatments	Optical coating/ Textured surfaces/ Fireproof treatments/ Other
Thermal insulation	Vacuum/ Inert gas/ Rockwool/ Other
Acoustic insulation	Vacuum/ Inert gas/ Rockwool/ Metallic panels/ Other
Other	…
Physical features	Descriptive value
Weight	Estimated weight (or weight per square meter)
Rigidity	Rigid/ Flexible/ Other
Opacity	Opaque/ Translucent/ Silk screen printing/ Lattice working/ Adjustable/ Other
Mobility	Mobile parts/ Solar tracking/ Automatisms/ Others
Other	…
Active energy features	Descriptive value
Photovoltaic power	Nominal power per BIPV unit/ Nominal power per m^2
Additional gain	Other gains (concentration, etc.)
Others	
Passive energy features	Descriptive value
Optical transmittance	Optical features
Thermal transmittance (U value)	Thermal features
Other	…
Observations: Explanations/ Reference conditions/ Data source/ Copyrights/ Other	

Table 3.3: BIPV modules: Mechanical performance

MECHANICAL PERFORMANCE

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Mechanical performance of BIPV modules
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product

DESIGN/DATASHEET VALUES						
BIPV UNIT						
General characteristics	Descriptive value					
Manufacturer	…					
Model	…					
Shape	…					
Physical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Height/ Length/ Thickness	…	mm	…	mm	…	mm
Weight	…	kg	…	kg/m2	-	-
Others	-	-	-	-	-	-
Mechanical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Tensile strength		MPa				
Flexural or bending strength		MPa				
Tensile modulus		GPa				
Bending modulus		GPa				
Poisson coefficients		-				
Inter-laminar shear strength (ILSS)		MPa				
Observations:						

Table 3.4: BIPV modules: Architectural integration

PVsites

ARCHITECTURAL INTEGRATION

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Architectural integration of BIPV products
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product

DEFINITION AND LOCATION	
Definition	Descriptive value
Construction unit	Ventilated façade/ Curtain wall/ Skylight/ Roofing shingle/ Shading system
Location	Descriptive value
Architectural location	Façade/ Roof/ Closing/ Other

CONSTRUCTION UNIT FEATURES						
Physical properties	Length	Unit 1	Width	Unit 2	Height	Unit 3
Shape	Rectangular/ Square/ Hexagonal/ Flat/ Concave/ Standardized variations/ Other					
Dimensions	…	mm	…	mm	…	mm
Standardized variations	…	mm	…	mm	…	mm
Weight	…	kg		kg/m^2		
Other						
Materials and devices	Descriptive value					
Configuration	Double glazing/ Monolithic glazing/ Other					
Frame structure	Frameless/ Aluminium/ Wood/ Other					
PV technology	Si-mono-crystalline/ Si-poly-crystalline/ CIGS/ Thin Film/ Other					
Location of pipes, diameters	Dimensions, drawing					
Thermal insulation	Vacuum/ Inert gas/ Rockwool/ Other					
Thermal bridge	Yes/no					
Other						
Aesthetical features	Descriptive value					
Opacity	Opaque/ Translucent/ Silk screen printing/ Adjustable/ Other					
Colours of cells	Colour					
Colours of background	Colour					
Colours of frame	Colour					
Surface treatments	Other surface treatments					
Other						

INTEGRATION AND MAINTENANCE MEASURES	
Construction	
Mounting system	Description of mounting system
Secondary construction	Description of secondary construction needed for mounting
Other	
Procedure	
New construction permits needed	Part of building permit, separate, other
Retrofitting permits needed	Building permit needed
Other	
Maintenance	Descriptive value
Inspection	Physical inspection or remote monitoring
Sequence of inspection	Time/ Yearly/ Other
Maintenance for the system	Yes/ No
Sequence of maintenance	Time/ Yearly/ Other
Accessibility of system	Description of the way to access the system
Safety procedure	Description of safety procedure needed
Other	
Removal	Descriptive value
Accessibility for removal	Description
Ease of removal	Description
Safety procedure needed	Description
Other	

PICTURES
Integration method
2D or 3D drawings and details: Integration drawing/ Mounting and removal procedures/ Other.
Observations: Legends/ Explanations/ Testing and measuring reference conditions / Data sources/ Copyrights/ Other.

Table 3.5: BIPV modules: Electrical performance

PVsites

ELECTRICAL PERFORMANCE

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Electrical performance of BIPV modules
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product

DESIGN/DATASHEET VALUES						
PHOTOVOLTAIC CELL/ ARRAY						
General characteristics	Descriptive value					
Manufacturer						
Cell Type						
Shape						
Colour						
Front layer						
Frame						
Connection Box						
Cables						
Connectors						
Series-parallel connection						
Physical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Height/ Length/ Thickness		mm		mm		mm
Other						
Electrical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Rated power		Wp		Wp/m^2		-
Efficiency		%		-		-
Tolerance		%		-		-
Vpm: max. power voltage		V		-		-
Ipm: max. power current		A		-		-
Voc: open circuit voltage		V		-		-
Isc: short circuit current		A		-		-
Thermal parameters	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
NOCT: stand. oper. temp.		ºC		-		-
Isc (α) Temp. coefficient		%/ºC		mA/ºC		-
Voc (β) Temp. coefficient		%/ºC		mV/ºC		-
P (γ) Temp. coefficient		%/ºC		W/ºC		-
Operating range	Descriptive value					
Temperature		ºC				
Maximum System Voltage		V				
Protection						
Maximum Wind /Snow Load		Pa				
Max. Reverse Current (IR)		A				
Observations:						

POWER MANAGEMENT SYSTEM (demos)						
General characteristics	Descriptive value					
Manufacturer						
Model						
Physical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Height/ Length/ Thickness		mm		mm		mm
Weight		kg		-		-
IP protection						
Other						
Electrical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Efficiency (EN50530 EU)		%		-		-
Input voltage range		V		-		-
MPPT voltage range		V		-		-
Max DC input		V				
Max input current		A				
Maximum output power		W				
Power factor (PF)		MIN		TYP		MAX
Nominal output voltage		V				
Max output current		A				
Number of phases		ud.				
Observations:						

PICTURE
CONFIGURATION AND MATERIALS
Observations:

GEOMETRICAL DIMENSIONS
Observations:

POWER MANAGEMENT SYSTEM	
Observations:	

Table 3.6: BIPV modules: Thermal performance

PVsites

THERMAL PERFORMANCE

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Thermal performance of BIPV modules
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product

DESIGN/DATASHEET VALUES						
BIPV UNIT						
General characteristics	Descriptive value					
Manufacturer						
Model						
Shape						
Physical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Height/ Length/ Thickness	…	mm	…	mm	…	mm
Weight	…	kg	…	kg/m2	-	-
Others	-	-	-	-	-	-
Thermal characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Thermal conductivity	…	W/mK	…	W/mK	…	W/mK
Thermal transmittance	…	W/m^2K	…	W/m^2K	…	W/m^2K
Density	…	g/cm^3	…	g/cm^3	…	g/cm^3
Emissivity	…		…			
Observations:						

Table 3.7: BIPV modules: Optical performance

PVsites

OPTICAL PERFORMANCE

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Optical performance of BIPV modules
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product

DESIGN/DATASHEET VALUES						
PHOTOVOLTAIC CELL/ ARRAY						
General characteristics	Descriptive value					
Manufacturer	…					
Cell type	…					
Shape	…					
Colour	…					
Electrical configuration	…					
Geometrical configuration	…					
Physical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Height/ Length/ Thickness	…	mm	…	mm	…	inch
Diameter	…	mm	-	-	-	-
Others	-	-	-	-	-	-
Optical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Visible reflectance (bc)	…	%	-	-	-	-
Solar reflectance (bc)	…	%	-	-	-	-
Visible absorptance (bc)	…	%	-	-	-	-
Solar absorptance (bc)	…	%	-	-	-	-

Observations:
Spectral reflectance from spectrophotometric measurements (300-2500 nm) of a bare cell. Spectrophotometer must be equipped with an integrating sphere. Integrated values using ASTM G-173 standard spectrum. Visible integration: 380-780 nm. Solar integration: 300-2500 nm. Absorptance is calculated from reflectance values. Acronym (bc): bare cell.

BIPV UNIT						
General characteristics	Descriptive value					
Manufacturer						
Model						
Shape						
Physical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Height/ Length/ Thickness	…	mm	…	mm	…	mm
Weight	…	kg	…	kg/m^2	-	-
Other	-	-	-	-	-	-
Optical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Visible transmittance	…	%	-	-	-	-
Solar transmittance	…	%	-	-	-	-
Visible reflectance (tz)	…	%	-	-	-	-
Solar reflectance (tz)	…	%	-	-	-	-
Visible reflectance (cz)	…	%	-	-	-	-
Solar reflectance (cz)	…	%	-	-	-	-
Visible absorptance (tz)	…	%	-	-	-	-
Solar absorptance (tz)	…	%	-	-	-	-
Visible absorptance (cz)	…	%	-	-	-	-
Solar absorptance (cz)	…	%	-	-	-	-
Emissivity	…		-	-	-	-
Solar factor	…		-	-	-	-

Observations:
Spectral transmittance and reflectance from spectrophotometric measurements (300-2500 nm) of encapsulated module. Transmittance and reflectance measurements must be performed with a 150 mm integrating sphere. Integrated values should be calculated using ASTM G-173 standard spectrum. Visible integration: 380-780 nm. Solar integration: 300-2500 nm. Absorptance is calculated from transmittance and reflectance values. Solar factor calculated by weighting areas. Acronym (tz): transparent zone. Acronym (cz): cell zone.

Table 3.8: BIPV modules: Estimation of PV production

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ESTIMATION OF PV PRODUCTION

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Estimation of PV production of BIPV systems
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product

SIMULATING CONDITIONS						
ANNUAL GLOBAL IRRADIANCE	Orient E	Orient SE	Orient S	Orient SW	Orient W	Unit
Grandglise (Belgium)	…	…	…	…	…	kW/m^2
Zürich (Switzerland)	…	…	…	…	…	kW/m^2
Barcelona (Spain)	…	…	…	…	…	kW/m^2
Wattignies (France)	…	…	…	…	…	kW/m^2
San Sebastián (Spain)	…	…	…	…	…	kW/m^2
MEDIUM TEMPERATURE	Med	Min	Max	-	-	Unit
Grandglise (Belgium)	…	…	…	-	-	ºC
Zürich (Switzerland)	…	…	…	-	-	ºC
Barcelona (Spain)	…	…	…	-	-	ºC
Wattignies (France)	…	…	…	-	-	ºC
San Sebastián (Spain)	…	…	…	-	-	ºC
MEDIUM WIND SPEED	Med	Min	Max	-	-	Unit
Grandglise (Belgium)	…	…	…	-	-	m/s
Zürich (Switzerland)	…	…	…	-	-	m/s
Barcelona (Spain)	…	…	…	-	-	m/s
Wattignies (France)	…	…	…	-	-	m/s
San Sebastián (Spain)	…	…	…	-	-	m/s

ESTIMATION OF ELECTRICAL POWER PRODUCTION						
BIPV UNIT	Orient E	Orient SE	Orient S	Orient SW	Orient W	Unit
Grandglise (Belgium)	…	…	…	…	…	kWh
Zürich (Switzerland)	…	…	…	…	…	kWh
Barcelona (Spain)	…	…	…	…	…	kWh
Wattignies (France)						kWh
San Sebastián (Spain)	…	…	…	…	…	kWh
ARCHITECTURAL UNIT	Orient E	Orient SE	Orient S	Orient SW	Orient W	Unit
Grandglise (Belgium)	…	…	…	-	-	kWh
Zürich (Switzerland)	…	…	…	-	-	kWh
Barcelona (Spain)	…	…	…	-	-	kWh
Wattignies (France)						kWh
San Sebastián (Spain)	…	…	…	-	-	kWh
PRODUCTION PER M^2	Orient E	Orient SE	Orient S	Orient SW	Orient W	Unit
Grandglise (Belgium)	…	…	…	-	-	kWh/m^2
Zürich (Switzerland)	…	…	…	-	-	kWh/m^2
Barcelona (Spain)	…	…	…	-	-	kWh/m^2
Wattignies (France)						kWh/m^2
San Sebastián (Spain)	…	…	…	-	-	kWh/m^2
PRODUCTION PER kWp	Orient E	Orient SE	Orient S	Orient SW	Orient W	Unit
Grandglise (Belgium)	…	…	…	-	-	kWh/kWp
Zürich (Switzerland)	…	…	…	-	-	kWh/kWp
Barcelona (Spain)						kWh/kWp
Wattignies (France)	…	…	…	-	-	kWh/kWp
San Sebastián (Spain)	…	…	…	-	-	kWh/kWp

Observations (description of demos):

CORRECTION DUE TO CELL OCCUPANCY						
Occupancy	Opaque A	Unit	Transp A	Unit	Transp Rat	Unit
Configuration 1	…	m^2	…	m^2	…	%
Configuration 2	…	m^2	…	m^2	…	%
Configuration 3	…	m^2	…	m^2	…	%
Configuration 4	…	m^2	…	m^2	…	%
Configuration 5	…	m^2	…	m^2	…	%
Configuration 6	…	m^2	…	m^2	…	%

Observations:

- Legend: Opaque A: opaque area of the module. Transp A: transparent area of the module. Transp Rat: transparency ratio, perceptual transparent area of the module.
- Transparency ratios have been generated to correct the production estimation in function of the transparency degree of the BIPV module. They will have to be applied over the power estimation values gathered in the table above “Estimation of electrical power production” for every location, orientation and inclination.
- The transparency degree depends on the number of cells, the size of cells, the distance between cells and the distance to the framework. These characteristics will constitute the concept of “Configuration X”.

Table 3.9: BIPV modules: Simulation of passive performance

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SIMULATION OF PASSIVE PERFORMANCE

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Simulation of passive performance of BIPV systems
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product.

PILOT BUILDING	
Definition	Descriptive value
Use	…
Area	…
Orientation	…
DESIGN PLANS	

Graphic picture from Design Builder	Ground floor plan
First floor plan	Roof floor plan

Observations.
Modelling parameters of pilot building.

REFERENCE DEMAND OF THE PILOT BUILDING										
Location	Grandglise		Zürich		Barcelona		Wattignies		S Sebastián	
Energy demand	Value	Unit	Value	Unit	Value	Unit	Value	Unit	Value	Unit
Heating annual demand	…	kWh	…	kWh	…	kWh	…	kWh	…	kWh
Cooling annual demand	…	kWh	…	kWh	…	kWh	…	kWh	…	kWh
Total annual demand	…	kWh	…	kWh	…	kWh	…	kWh	…	kWh
Solar lighting										
Solar annual profit	…	kWh	…	kWh	…	kWh	…	kWh	…	kWh

Observations.
- Reference demand of pilot building without BIPV system installed.

DEMAND AND PRODUCTION OF PILOT BUILDING WITH BIPV SYSTEM										
Location	Grandglise		Zürich		Barcelona		Wattignies		S Sebastián	
Energy demand	Value	Unit	Value	Unit	Value	Unit	Value	Unit	Value	Unit
Heating annual demand	…	kWh	…	kWh	…	kWh	…	kWh	…	kWh
Cooling annual demand	…	kWh	…	kWh	…	kWh	…	kWh	…	kWh
Total annual demand	…	kWh	…	kWh	…	kWh	…	kWh	…	kWh
Electrical production										
PV annual generation	…	kWh	…	kWh	…	kWh	…	kWh	…	kWh
Solar lighting										
Solar annual profit	…	kWh	…	kWh	…	kWh	…	kWh	…	kWh
Graphs										

Heating	Cooling
Solar profit	Energy saving

Table 3.10: BIPV modules: Maintenance and dismantling

PVsites

MAINTENANCE AND DISMANTLING

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Maintenance and dismantling of products and installations
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product

MAINTENANCE		
BY THE USER	Periodicity (months)	Description
Action 1		
Action 2		
Action 3		
BY PROFESSIONALS	Periodicity (months)	Description
Action 1		
Action 2		
Action 3		
Observations.		

DISMANTLING
Description of dismantling (product lifetime, professionals involved, recyclable and reusable parts, etc)

Table 3.11: BIPV modules: Life Cycle Assessment

PVsites

LIFE CYCLE ASSESSMENT

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Life cycle assessment of products and installations
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product

LCA INDICATORS						
	Value 1	Unit 1				
Global warming						
Acidification						
Eutrophication						
Photochemical oxidation formation						
Abiotic depletion						
Ozone layer depletion						
Human Toxicity						
Ecotoxicity						
Particulate matter						
Land use						
Water resource depletion						
Others						
Observations.						

LIFE CYCLE INTERPRETATION
Observations.

Table 3.12: BIPV modules: Economic evaluation

ECONOMIC EVALUATION

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Economic evaluation and benefits of BIPV modules
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product

ECONOMIC BALANCE						
Investment	Value 1	Unit 1				
Investment power system	…	euro				
Investment BOS	…	euro				
Engineering costs	…	euro				
Mechanical installation costs	…	euro				
Electrical installation costs	…	euro				
Avoided cost for building materials (-)	…	euro				
Avoided installation cost for other materials (-)	…	euro				
Subtotal investment	…	euro				
Incentives (-)	…	%				
TOTAL INVESTMENT (A)	…	euro				
Annual costs	Value 1	Unit 1				
Maintenance cost	…	euro/year				
Financial cost	…	euro /year				
TOTAL ANNUAL COSTS	…	euro /year				
Generation	SE	Unit 1	S	Unit 2	SW	Unit 3
Surface	…	m^2	…	m^2	…	m^2
Inclination	…	degree	…	degree	…	degree
Orientation	…	degree	…	degree	…	degree
Yield	…	kWh	…	kWh	…	kWh
kWh cost	…	euro	…	euro	…	euro
Electricity export	…	euro/year	…	euro/year	…	euro/year
Total electricity export	…	euro/year	…	euro/year	…	euro/year
GLOBAL BALANCE	SE	Unit 1	S	Unit 2	SW	Unit 3
Energy production	…	euro/kWh	…	euro/kWh	…	euro/kWh
Total energy production	…	euro	…	euro	…	euro
Annual cost (-)	…	euro	…	euro	…	euro
NET YEARLY PROFIT (B)	…	euro	…	euro	…	euro
Simple payback (A/B)	…	year	…	year	…	year
Observations.						

3.2.2 Templates for inverters (X13, X14)

Table 3.13: Inverters: General description and design

PVsites

GENERAL DESCRIPTION AND DESIGN

TECHNICAL TEMPLATE REFERENCE	
Technical subject	General description and design of inverters
Partner	
Author	

PRODUCT CODE	
Project	PVSites. Task 5.X
Denomination	Original denomination of product.
Partner/s	…
Author/s	…

PICTURES
REALISTIC DRAWING
Graphic design image (CAD 3D Rendered Solid Image in colour, with Isometric SO view and Perspective 1).
Observations: Very brief description.

SCHEMATICS AND LAYOUT

General schematics	Board 1 schematics
Board 2 schematics	Board n schematics
Board 1 layout	Board 2 layout
Board n layout	Board 1 3D rendered solid image

Board 2 3D rendered solid image	Board n 3D rendered solid image

BILL OF MATERIALS

Item	Description	Part reference (board-layer)	Footprint	Price per unit (€)	Quantity	Price (€)
…	…	…	…	…	…	…

Observations.

Details of designs description.

DETAILED DESCRIPTION	
Functionality description	Descriptive value
Technology description	Descriptive value
Number of PV inputs	-
Number of MPP trackers	-
Battery regulator	y/n
Nominal AC Power	(kW)
Maximum PV power	(kW)
Maximum battery power	(kW)
Dimensions	Lengthxwidthxheight (mm)
Weight	(kg)
Enclosure	Descriptive value
Protection degree	Descriptive value
HMI	Descriptive value
Communication	Descriptive value
CAPEX	€
OPEX	€/year
Lifetime	years
Other	…

Observations:

Explanations/ Reference conditions/ Data source/ Copyrights/ Other

Table 3.14: Inverters: Installation

PVsites

INSTALLATION

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Installation of PV inverters
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product

INSTALLATION AND MAINTENANCE MEASUREMENTS	
Dimensions	Width x length x height (mm)
Weight	(kg)
Enclosure	Descriptive value
Protection degree (IEC 60529)	Descriptive value
Climatic class (IEC 60721-3-4)	Descriptive value
Mounting system	Descriptive value
Acoustic emission	dB(A)
Refrigeration	Descriptive value
Operating temperature	ºC
Relative humidity	%
General protections	Descriptive value
Installation procedure	Descriptive value
Safety procedure	Descriptive value
PV connectors	Descriptive value
Battery connectors	Descriptive value
AC connectors	Descriptive value
Communication connectors	Descriptive value
HMI	Descriptive value
Other	

PICTURES

Installation method

2D or 3D drawings and details: Mounting procedures/ Other.

Observations:
Legends/ Explanations/ Data sources/ Copyrights/ Other.

Table 3.15: Inverters: Electrical performance

PVsites

ELECTRICAL PERFORMANCE

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Electrical performance of inverters
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product

DESIGN/DATASHEET VALUES	
Maximum Efficiency	%
Overall efficiency (50530)	%
Input voltage Range	V
MPPT voltage Range	V
Max DC Input Power	kW
Min DC Input Power	W
Max Input Current	A
Maximum Output Power	kVA
Power factor (PF)	
Nominal Output Voltage	V
Max Output Current	A
Number of Phases	
Frequency	Hz
Reactive power control	%
Stand-by consumption	W
Night consumption	W
Residual Current Detector (RCD)	y/n
Low Voltage Ride through (LVRT)	y/n
Anti-islanding protection	Descriptive value
Intended islanding operation	Descriptive value
Grid current distortion (THD)	%
Direct current injection	mA
PV array insulation resistance detection	y/n
CE conformity	y/n

Conversion efficiency curves

Observations:

Table 3.16: Inverters: Monitoring and control

PVsites

MONITORING AND CONTROL

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Monitoring and control of inverters
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product.

DESIGN/DATASHEET VALUES	
Communication protocol	Descriptive value
OUTPUT MONITORING DATA	
Parameter 1	Descriptive value (Data type/Unit/ Time resolution and period)
Parameter 2	Descriptive value (Data type/Unit/ Time resolution and period)
Parameter n	Descriptive value (Data type/Unit/ Time resolution and period)
INPUT COMMANDS	
Command 1	Descriptive value (Data type/Unit/Code)
Command 2	Descriptive value (Data type/Unit/Code)
Command n	Descriptive value (Data type/Unit/Code)
Observations:	

Table 3.17: Inverters: Maintenance and dismantling

PVsites

MAINTENANCE AND DISMANTLING

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Maintenance and dismantling of products and installations
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product

MAINTENANCE		
BY THE USER	Periodicity (months)	Description
Action 1		
Action 2		
Action 3		
BY PROFESSIONALS	Periodicity (months)	Description
Action 1		
Action 2		
Action 3		
Observations.		

DISMANTLING
Description of dismantling (product lifetime, professionals involved, recyclable and reusable parts, etc)

Table 3.18: Inverters: Life Cycle Assessment

PVsites

LIFE CYCLE ASSESSMENT

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Life cycle assessment of products and installations
Partner	
Author	

PRODUCT CODE	
Denomination	Original denomination of product

LCA INDICATORS						
	Value 1	Unit 1				
Global warming						
Acidification						
Eutrophication						
Photochemical oxidation formation						
Abiotic depletion						
Ozone layer depletion						
Human Toxicity						
Ecotoxicity						
Particulate matter						
Land use						
Water resource depletion						
Other						
Observations.						

LIFE CYCLE INTERPRETATION
Observations.