Appendix B:

Technical Templates

D.2.2. First selection of BIPV products

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Contents

Technical templates

T1. GENERAL DESCRIPTION, DESIGN AND MATERIALS

TECHNICAL TEMPLATE REFERENCE	
Technical subject	General description, design and materials of BIPV products.
Partner	ACCIONA INFRAESTRUCTURAS S.A.
Author	Jorge Escribano Troncoso.

BFIRST PRODUCT CODE		
Project	BFIRST. Task 2.2. Contents of the portfolio	Sub-Task 2.2.1
Category	Ventilated façade/ Curtain wall/ Skylight/ Roofing shingle/ Shading system.	CP-VF/ CW/ SL/ SS/ RS.
Denomination	Original denomination of product.	CP-XX-Y.
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 elements has to 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.
Details of designs description.

DETAILED DESCRIPTION	
Definition and location	Descriptive value
Construction unit	Ventilated façade/ Curtain wall/ Skylight/ Roofing shingle/ Shading system/ Others
Technological unit	Photovoltaics/ Thermal/ Hybrid Thermal-PV/ Others
Architectural location	Façade/ Roof/ Others
Geometrical design	Descriptive value
Dimensions	Length, width, height/ Standardized variants
Geometrical shape	Rectangular/ Square/ Hexagonal/ Flat/ Concave/ Standardized variants/ Others
Others	…
Materials	Descriptive value
Configuration	Double glassing/ hollow casing/ one pieced unit/ Others
Layers	Description of layer from the topside to the backside of the unit: Superstratum (Glass/ Others) + Intermediate layers (PV Fibre-reinforced layer/ Air gap/ Others) + Substratum (Glass/ Aluminium/ Composites/ Concrete/ Stone/Slate/ Others)
Frame structure	Frameless/ Aluminium/ Composite/ Wood/ Others
PV technology	Si-monocristaline/ Si-monocristaline/ Si-amorphous/ Thin film/ Others
PV encapsulate	PV Fibre-reinforced layer/ EVA/ Others
Superficial treatments	Optical treatments/ Textured superficies/ Fireproof treatments/ Others
Thermal collector system	Thermal collector + pipe circuit + thermal fluids (Air/ Water/ Others)/ Others
Thermal isolation	Vacuum/ Inert gas/ Rockwool/ Others
Acoustic isolation	Vacuum/ Inert gas/ Rockwool/ Metallic panels/ Others
Others	…
Physical features	Descriptive value
Weight	Estimated weight
Rigidity	Rigid/ Flexible/ Others
Opacity	Opaque/ Translucent/ Silk screen printing/ Lattice working/ Adjustable/ Other
Mobility	Mobile parts/ Solar tracking/ Automatisms/ Others
Others	…
Active energy features	Descriptive value
Photovoltaics power	Nominal power per BIPV unit/ Nominal power per m2 of construction unit
Thermal power	Solar thermal efficiency
Solar tracking	Gain for solar tracking
Others	
Passive energy features	Descriptive value
Optical transmittance	Optical features
Thermal transmittance	Thermal features
Others	…
Reactive energy features	Descriptive value
Reactive mechanisms	Reactive mechanisms to activate passive measures
Others	…
Observations: Explanations/ Reference conditions/ Data source/ Copyrights/ Others	

T2. MECHANICAL PERFORMANCE

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Mechanical performance of BIPV Products
Partner	Tecnalia
Author	Igor Arrizabalaga, JM Vega de Seoane

BFIRST PRODUCT CODE		
Denomination	Original denomination of product.	CP-XX-Y.

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
Fibre fraction in weight	…	%	-	-	-	-
Voids content		%				
Tensile strength		MPa				
Flexural or bending strength		MPa				
Tensile modulus		GPa				
Bending modulus		GPa				
Poisson coefficients		-				
Inter-laminar shear strength (ILSS)		MPa				
Fibre fraction in weight		%				
Voids content		%				
Tensile strength		MPa				

Observations:

T3. ARCHITECTURAL INTEGRATION

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Architectural integration of BIPV products
Partner	BEAR, ACCIONA
Author	Tjerk Reijenga, Jorge Escribano Troncoso

BFIRST PRODUCT CODE		
Denomination	Original denomination of product.	CP-XX-1to5.

DEFINITION AND LOCATION	
Definition	Descriptive value
Construction unit	Ventilated façade/ Curtain wall/ Skylight/ Roofing shingle/ Shading system
Technological unit	Photovoltaic/ Thermal/ PV/T element
Location	Descriptive value
Architectural location	Façade/ Roof/ Closing/ Others

CONSTRUCTION UNIT FEATURES						
Physical properties	Length	Unit 1	width	Unit 2	Height	Unit 3
Shape	Rectangular/ Square/ Hexagonal/ Flat/ Concave/ Standardized variants/ Others					
Dimensions	…	mm	…	mm	…	mm
Standardized variants	…	mm	…	mm	…	mm
Weight	…	kg				
Others						
Materials and devices	Descriptive value					
Configuration	Double glassing/ hollow casing/ one pieced unit/ Others.					
Frame structure	Frameless/ Aluminium/ Composite/ Wood/ Others.					
PV technology	Si-mono-crystalline/ Si-mono-crystalline/ Si-amorphous/ Thin film/ Others.					
Thermal collector system	Thermal collector + pipe circuit + thermal fluids (Air/ Water/ Others)/ Others.					
Location of pipes, diameters	Dimensions, drawing.					
Thermal isolation	Vacuum/ Inert gas/ Rockwool/ Others.					
Thermal bridge	Yes/ no.					
Others						
Aesthetical features	Descriptive value					
Opacity	Opaque/ Translucent/ Silk screen printing/ Lattice working/ Adjustable/ Other.					
Colours of cells	Colour.					
Colours of background	Colour.					
Colours of frame	Colour.					
Superficial treatments	Other superficial treatments.					
Others						

INTEGRATION AND MAINTENANCE MEASURES	
Construction	
Mounting system	Description of mounting system.
Secondary construction	Description of secondary construction needed for mounting.
Water tightness of system	Yes/ no. Description.
Others	
Procedure	
New construc. permits needed	Part of building permit, separate, others.
Retrofitting permits needed	Building permit needed.
Others	
Maintenance	Descriptive value
Inspection	Physical inspection or remote monitoring.

Sequence of inspection	Time/ Yearly/ Others.
Maintenance for the system	Yes/ No.
Sequence of maintenance	Time/ Yearly/ Others.
Accessibility of system	Description of the way to access the system.
Safety procedure	Description of safety procedure needed.
Others	
Removal	Descriptive value
Accessibility for removal	Description
Ease of removal	Description
Safety procedure needed	Description
Others	

PICTURES

Integration method

2D or 3D drawings and details: Integration drawing/ Mounting and removal procedures/ Others.

Observations:
Legends/ Explanations/ Testing and measuring reference conditions / Data sources/ Copyrights/ Others.

T4. ELECTRICAL PERFORMANCE

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Electrical Performance of BIPV Products
Partner	ATERSA/ TECNALIA/ ACCIONA
Author	Enrique Daroqui/ Eduardo Román Medina/ Jorge Escribano Troncoso

BFIRST PRODUCT CODE		
Denomination	Original denomination of product.	CP-XX-Y.

DESIGN/DATASHEET VALUES						
PHOTOVOLTAIC CELL/ ARRAY						
General characteristics	Descriptive value					
Manufacturer						
Cell Type						
Shape						
Colour						
Front glass						
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		inch
Others						
Electrical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Rated power		Wp		Wp/m2		-
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						
General characteristic	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						
Others						
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				
Num Phases		ud.				
Observations:						

PICTURE
CONFIGURATION AND MATERIALS
Observations:

GEOMETRICAL DIMENSIONS
Observations:

POWER MANAGEMENT SYSTEM	
Observations:	

T5. THERMAL PERFORMANCE

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Mechanical performance of BIPV Products
Partner	Tecnalia
Author	JM Vega de Seoane

BFIRST PRODUCT CODE		
Denomination	Original denomination of product.	CP-XX-Y.

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
Heat capacity	…	J/gK	…	J/gK	…	J/gK
Density	…	g/cm^3	…	g/cm^3	…	g/cm^3
Emissivity (value over 1)	…	0/1	…	0/1		0/1

Observations:

- An operation temperature range will be defined in order to perform the thermal characterization of the composite material: “Value X” corresponds to “Temperature X”.

T6. OPTICAL PERFORMANCE

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Optical performance of BIPV Products
Partner	Tecnalia
Author	Maider Machado

BFIRST PRODUCT CODE		
Denomination	Original denomination of product.	CP-XX-Y.

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)	…	%, s&i	-	-	-	-
Solar reflectance (bc)	…	%, s&i	-	-	-	-
Visible absorptance (bc)	…	%, s&i	-	-	-	-
Solar absorptance (bc)	…	%, s&i	-	-	-	-

Observations:
Spectral reflectance from spectrophotometric measurements (300-2500 nm) of a bare cell. Spectrophotometer must be equipped with a 150 mm 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 (s&i): spectral and integrated. 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/m2	-	-
Others	-	-	-	-	-	-
Optical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Visible transmittance	…	%, s&i	-	-	-	-
Solar transmittance	…	%, s&i	-	-	-	-
Visible reflectance (tz)	…	%, s&i	-	-	-	-
Solar reflectance (tz)	…	%, s&i	-	-	-	-
Visible reflectance (cz)	…	%, s&i	-	-	-	-
Solar reflectance (cz)	…	%, s&i	-	-	-	-
Visible absorptance (tz)	…	%, s&i	-	-	-	-
Solar absorptance (tz)	…	%, s&i	-	-	-	-
Visible absorptance (cz)	…	%, s&i	-	-	-	-
Solar absorptance (cz)	…	%, s&i	-	-	-	-
Emissivity	…	%, s&i	-	-	-	-
Solar factor	…	%, s&i	-	-	-	-

Observations:
Spectral transmittance and reflectance from spectrophotometric measurements (300-2500 nm) of encapsulated module. Samples are light-diffusing, so both 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 (s&i): spectral and integrated. Acronym (tz): transparent zone. Acronym (cz): cell zone.

T7. ACOUSTIC PERFORMANCE

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Acoustic performance of BIPV Products
Partner	TECNALIA/ ACCIONA
Author	Maider Machado, Raquel Cortinat Sánchez, Jorge Escribano Troncoso.

BFIRST PRODUCT CODE		
Denomination	Original denomination of product.	CP-XX-Y.

ACOUSTIC PERFORMANCE						
STRUCTURAL BASE	Base 1	Unit 1	Base 2	Unit 2	Base 3	Unit 3
Physical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
m'1: Density of base element	374	kg/m^2	211	kg/m^2	177	kg/m^2
Rw: Sound reduction index	57	dB	51	dB	49	dB
BIPV UNIT						
Physical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Height/ width/ area	…	m	…	m	…	m^2
m2: Weight	…	kg	-	-	-	-
m'2: Density of BIPV unit	…	kg/m^2	-	-	-	-
CONSTRUCTION SYSTEM: STRUCTURAL BASE + MATERIAL/AIR CHAMBER + BIPV UNIT						
Acoustic characteristics	Base 1	Unit 1	Base 2	Unit 2	Base 3	Unit 3
d: Thickness of chamber	…	m	…	m	…	m
f_0: Resonance frequency	…	Hz	…	Hz	…	Hz
ΔR_w: Improvement of sound reduction index	…	dB	…	dB	…	dB

Observations:

- Acoustic features of the construction systems depend not only on the BIPV products, but also on the structural base element where they are placed on. In this regard, it has to be calculated the improvement of the sound reduction index (ΔR_w) corresponding to the addition of the BIPV unit, with respect to the sound reduction index (R_w) of the structural base element. Three structural base elements, usual in construction, has been considered:
-

  Base 1: structural base element of concrete blocks (140 mm).
  Base 2: structural base element of hollow bricks (140 mm).
  Base 3: structural base element of fireproof bricks (190 mm).

- The improvement of the sound reduction index should be preferentially deduced in laboratory: sound reduction index as defined in ISO 140-3 (1995), "Acoustics-measurement of sound insulation in buildings and of building elements. Part 3: Laboratory measurements of airborne sound insulation of building elements" and ISO 717-1 (2013), "Acoustics. Rating of sound insulation in buildings and of building elements. Part 1: Airborne sound insulation".

- Otherwise, improvement of the sound reduction index might be estimated by means of the theoretical method proposed in the norm "UNE EN 12354-1. Estimation of acoustic performance of buildings from the performance elements":
  Calculation of resonance frequency, for construction systems with insulating layer within the chamber between the base element and the BIPV unit, and with acoustic insulation between 20dB≤R_w≤60dB.

  f_0 = 160*[(0,111/d)*((1/m'1) + (1/m'2))]^(1/2)

  Where: "d" is the thickness of the chamber, "m'1" is the density of the structural base element, and "m'2" is the density of the BIPV unit.

Calculation of the improvement of sound reduction index in function of resonance frequency:

Tabla D.3
Mejora del índice ponderado de reducción acústica de un recubrimiento, en función de la frecuencia de resonancia

Frecuencia de resonancia f_0 del recubrimiento en Hz	ΔR_w en dB
≤ 80	$35 - R_w/2$
100	$32 - R_w/2$
125	$30 - R_w/2$
160	$28 - R_w/2$
200	– 1
250	– 3
315	– 5
400	– 7
500	– 9
630 – 1 600	– 10
> 1 600	– 5
NOTA 1 – Para frecuencias de resonancia inferiores a 200 Hz, el valor mínimo de ΔR_w es 0 dB.	
NOTA 2 – Pueden deducirse valores intermedios de las frecuencias de resonancia por la interpolación sobre el logaritmo de la frecuencia.	
NOTA 3 – R_w denota el índice ponderado de reducción acústica para la pared o el forjado desnudos en dB.	

- The acoustical analysis of the construction systems could only be applied to the BFIRST designs: VF01, VF02, VF03, CW01 y CW02. The rest of products would not present significant acoustic features.

T8. MANUFACTURING PROCESSES

TECHNICAL TEMPLATE REFERENCE	
Technical subject	T8. Manufacturing processes of BIPV Products
Partner	TECNALIA
Author	Olatz Ollo & Igor Arrizabalaga

BFIRST PRODUCT CODE		
Denomination	Original denomination of product.	CP-XX-Y.

MANUFACTURING PROCESS PARAMETERS						
MANUFACTURING MATERIALS/TOOLS						
General characteristics	Descriptive value					
Mould material						
Mould surface finishing						
Fibre configuration	UD, woven fabric, mat, etc.					
Fibre type	Glass, carbon, aramid, etc.					
Resin type	Polyester, epoxy, etc.					
Resin system						
Release agent type	…					
Valves	…					
Pipes	…					
Vacuum bag						
Other auxiliary materials	Breather, distribution mesh, membranes, etc.					
Physical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Fibre length/width	…	mm	…	mm	…	-
Fibre aerial weight	…	g/m2	-	-	-	-
Resin/hardener quantity	…	g	…	g	-	-
Valves diameter/amount	…	mm	…		-	-
Pipes diameter	…	mm	-	-	-	-
Observations: Though the fibre and resin selection has to be done taking into account both physical aspects and properties of the final part (mechanical, thermal, optical, etc.), the process strategy (amount and distribution of valves, pipes) depends on the dimensions and geometry of the part. Moreover, suitable pipes have to be chosen according to the dimensions of the selected valves.						
BIPV UNIT						
Physical characteristics	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Geometry and design						
Process characteristics and strategy	Value 1	Unit 1	Value 2	Unit 2	Value 3	Unit 3
Fibre aerial weight	…	g/m^2	…		…	
Fibre dimensions		mm				
Resin/hardener quantity	…	g	…	g	-	-
Release agent amount	…	No. of coats	-	-	-	-
Amount of fibre layer (front side)	…	No. of coats	-	-	-	-
Distribution mesh quantity and arrangement	…	No. of coats	-	-	-	-
Amount and distribution of breather and membranes	…	No. of coats	-	-	-	-

Resin inlet points	…	No. of coats	-	-	-	-
Vacuum Pressure	…	bar	-	-	-	-

Observations:

MANUFACTURING PROCESS

EXAMPLES

Pictures: Artistic sketches/ Design plans/ Exploded drawings/ Manufacturing procedure/ Installing procedure/ Simulation data/ Graphics/ Simulation screens/ Graphic design image/ Others.

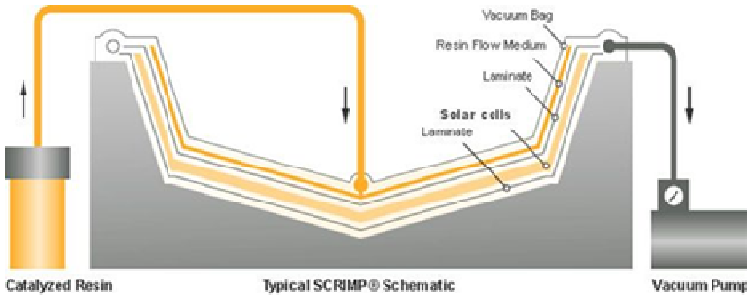

Figure 1. Manufacturing process scheme

Figure 2. Process layout

Observations:

T9. ESTIMATION OF PV PRODUCTION

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Estimation of PV production of BIPV systems.
Partner	ACCIONA INFRAESTRUCTURAS S.A.
Author	Jorge Escribano Troncoso

BFIRST PRODUCT CODE		
Denomination	Original denomination of product.	CP-XX-Y.

SIMULATING CONDITIONS						
Annual global irradiance	Orient E	Orient SE	Orient S	Orient SW	Orient W	Unit
Demo-site location	…	…	…	…	…	kW/m^2
Cádiz	…	…	…	…	…	kW/m^2
Bucharest	…	…	…	…	…	kW/m^2
Berlin	…	…	…	…	…	kW/m^2
Medium temperature	Med	Min	Max	-	-	Unit
Demo-site location	…	…	…	-	-	ºC
Cádiz	…	…	…	-	-	ºC
Bucharest	…	…	…	-	-	ºC
Berlin	…	…	…	-	-	ºC
Medium wind speed	Med	Min	Max	-	-	Unit
Demonstrator location	…	…	…	-	-	m/s
Cádiz	…	…	…	-	-	m/s
Bucharest	…	…	…	-	-	m/s
Berlin	…	…	…	-	-	m/s

ESTIMATION OF ELECTRICAL POWER PRODUCTION						
PHOTOVOLTAICS PRODUCTION (Inclination: x. Transparency: 0%)						
BIPV unit	Orient E	Orient SE	Orient S	Orient SW	Orient W	Unit
Demo-site location	…	…	…	…	…	kWh
Cádiz	…	…	…	…	…	kWh
Bucharest	…	…	…	…	…	kWh
Berlin	…	…	…	…	…	kWh
Architectural unit	Orient E	Orient SE	Orient S	Orient SW	Orient W	Unit
Demo-site location	…	…	…	-	-	kWh
Cádiz	…	…	…	-	-	kWh
Bucharest	…	…	…	-	-	kWh
Berlin	…	…	…	-	-	kWh
Production per surface unit	Orient E	Orient SE	Orient S	Orient SW	Orient W	Unit
Demo-site location	…	…	…	-	-	kWh/m^2
Cádiz	…	…	…	-	-	kWh/m^2
Bucharest	…	…	…	-	-	kWh/m^2
Berlin	…	…	…	-	-	kWh/m^2
Production per power unit	Orient E	Orient SE	Orient S	Orient SW	Orient W	Unit
Demo-site location	…	…	…	-	-	kWh/kWp
Cádiz	…	…	…	-	-	kWh/kWp
Bucharest	…	…	…	-	-	kWh/kWp
Berlin	…	…	…	-	-	kWh/kWp

Observations:
- Demonstrator location: Zamudio (Spain)/ Pikermi (Greece)/ Mons (Belgium). EU climatic zone 1: Helsinki. EU climatic zone 2: Amsterdam. EU climatic zone 3: Madrid.
- Orientations: E, SE, S, SW and W. Inclinations: 0º/ 15º/ 30º/ 45º/ 60º/ 75º/ 90º/ Other.
- Architectural unit: 100 m^2 of façade/ roof/ others.
- Transparency: 0 %. See the table below, "Correction of transparency", to estimate the production for different transparency degrees.
- Data: yearly sum of solar irradiation incident on x-inclined x-oriented PV modules, and meteorological variables. Irradiation source: METEONORM, or similar. Simulation software: PV-Syst, or similar.

CORRECTION OF TRANSPARENCY						
Transparency degree	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".

T10. SIMULATION OF PASSIVE PERFORMANCE

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Simulation of Passive Performance of BIPV systems
Partner	ACCIONA INFRAESTRUCTURAS S.A.
Author	Jorge Escribano Troncoso

BFIRST PRODUCT CODE		
Denomination	Original denomination of product.	CP-XX-Y.

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.

DEMAND OF REFERENCE OF THE PILOT BUILDING						
Location	Cadiz		Bucharest		Berlin	
Energy demand	Value 1	Unit 1	Value 2	Unit 3	Value 3	Unit 3
Heating annual demand	…	kWh	…	kWh	…	kWh
Cooling annual demand	…	kWh	…	kWh	…	kWh
Total annual demand	…	kWh	…	kWh	…	kWh
Solar lighting						
solar annual profit	…	kWh	…	kWh	…	kWh
Observations. - Demand of reference of pilot building without BIPV system installed.						

DEMAND AND PRODUCTION OF PILOT BILDING WITH BIPV SYSTEM						
Location	Cadiz		Bucharest		Berlin	
Energy demand	Value 1	Unit 1	Value 2	Unit 3	Value 3	Unit 3
Heating annual demand	…	kWh	…	kWh	…	kWh
Cooling annual demand	…	kWh	…	kWh	…	kWh
Total annual demand	…	kWh	…	kWh	…	kWh
Electrical production						
PV annual generation	…	kWh	…	kWh	…	kWh
Solar lighting						
solar annual profit	…	kWh	…	kWh	…	kWh
Graphs						

Heating	Cooling
Solar profit	Energy saving

T11. ECONOMIC EVALUATION AND BENEFITS

TECHNICAL TEMPLATE REFERENCE	
Technical subject	Economic Evaluation and Benefits of BIPV Products
Partner	BEAR, ACCIONA
Author	Tjerk Reijenga, Jorge Escribano Troncoso

BFIRST PRODUCT CODE		
Denomination	Original denomination of product.	CP-XX-1to5.

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.						