Ref. Ares(2025)9367240 - 31/10/2025

Seamless-PV

D8.4 – Report on the design of each demo case

Task 8.3 Design of demonstration installations and use cases

Co-funded by the European Union

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Project funded by

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

Document control sheet

Project	**SEAMLESS-PV – Development of advanced manufacturing equipment and processes aimed at the seamless integration of multifunctional PV solutions, enabling the deployment of IPV sectors**
Topic identifier	HORIZON-CL5-2022-D3-01-03
Grant Agreement N°	101096126
Coordinator	Fundación Tecnalia Research and Innovation
Duration	01/01/2023 – 31/12/2026
Work package	WP8: Pilot lines and IPV product demonstration activities
Work package leader	TECNALIA
Task	Transversal to tasks from T8.3 and subtasks 8.3.1->8.3.4
Task leader	TECNALIA

Document title	D84 Report on the design of each demo cases
Document Ref	SEAMLESS-PV-D84_Report on the design of each demo cas-v00.docx
Lead Beneficiary	All
Dissemination level	Public (PU)
Authors	Dominique DERAMAIX (FD2)
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Reviewer(s)	Daniel Valencia-Caballero (TEC), Javier del Pozo (TEC)
Due date	30/04/2025 (M28)
Submission date	31/10/2025 (M34)

History of versions

Version	Date	Author - Beneficiary	Approved by	Comments
v00	18/12/2024	D. Deramaix – FD2		1st draft
V01	29/01/2025	D. Deramaix – FD2	Giulio Poggiaroni (ETA)	2d draft
v02	21/10/2025	D. Deramaix – FD2	Daniel Valencia (TEC), Javier del Pozo (TEC)	3d draft and final version reviewed and submitted

SEAMLESS-PV PROJECT

A novel manufacturing process for integrated photovoltaics

Integrated photovoltaics (IPVs) have demonstrated their success and impact in their use as building-integrated photovoltaics. They are also considered promising in several other sectors. Their adaptation to other industries or devices could offer surprising benefits. Unfortunately, the very need for adaptable IPV solutions hinders their expansion as their current manufacturing processes cannot create IPV solutions customised to each sector. The EU-funded SEAMLESS-PV project aims to tackle this by developing revolutionary tools for photovoltaic manufacturing as well as new IPV products that offer improved efficiency, adaptability and integrability while at the same time showcasing their cost-effectiveness in comparison to competitors.

The title of SEAMLESS-PV project is "*Development of advanced manufacturing equipment and processes aimed at the seamless integration of multifunctional PV solutions, enabling the deployment of IPV sectors*". SEAMLESS-PV is a Horizon Europe Innovation Action started in January 2023 that will continue through December 2026.

More information can be found at:

https://www.seamlesspv.eu/

https://cordis.europa.eu/project/id/101096126

EXECUTIVE SUMMARY

The present deliverable (D8.4 Report on the design of each demo case) describes the design of the demonstration installations being developed within the SEAMLESS-PV project.

This document describes all products developed in WP6 for their preliminary design and their use in all demo cases. This document is divided into 4 main sections linked to the use of IPV solutions:

- BIPV: Building Integrated PV with 5 demo pilots: façade or roof integration.
- IIPV: Infrastructure Integrated PV with 1 demo pilot: noise barrier.
- VIPV: Vehicle Integrated PV with 2 demos: car and truck.
- AGRI-PV: Agri-Photovoltaics with 2 demos: open field type and greenhouse

Acknowledgements

The work described in this publication has received funding from the European Union's Horizon Europe research and innovation program under grant agreement N° 101096126.

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1 INTRODUCTION

1.1 Description of the deliverable content and purpose

This document contains a description of the demo sites' design and the products developed for each demo case.

The main objective of this activity is to demonstrate a set of new IPV solutions in different sectors. The demo pilots will evaluate the compliance with full specifications and performance evaluation in real operating conditions, proving that the SEAMLESS-PV manufacturing approach delivers sound and cost-competitive IPV products.

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 SEAMLESS-PV project. The table should be considered along with the current document for further understanding of the deliverable contents and purposes.

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

Project activity	Relation with the current deliverable
WP6	D6.1 Preliminary design of IPV solutions
WP8	D8.5 Monitoring guidelines and specific measurement & validation plan for each demo case

1.3 List of acronyms

Table 1.2 List of acronyms

Acronyms	Meaning
AGRI-PV	Agri-photovoltaics
BC	Back Contact (solar cell)
BIPV	Building integrated Photovoltaics
BOM	Bill of materials
ECA	Electrically Conductive Adhesive
EVA	Ethylene Vinyl Acetate
IIPV	Infrastructure-integrated PV
PO	Polyolefin
PVNB	Photovoltaic Noise Barrier
VIPV	Vehicle Integrated PV

2 DESIGN OF DEMO CASES

The deliverable is related to Task 8.3, which involves the design of demonstration installations and use cases. Four subtasks will cover the design activities: BIPV architecture, IIPV infrastructure, VIPV vehicle, and AGRI-PV for agriculture. This report will describe the design process and the final design selected for demonstration.

This task takes the IPV products design developed in WP6 as a starting point, to achieve the optimal conditions for demonstration of viability, performance, reliability and cost-effectiveness according to project objectives.

2.1 BIPV – Building Integrated PV

2.1.1 Demo 1: Residential building retrofit in Italy (façade)

- Demo building location: Italy - Municipality of Sesto Fiorentino (Florence metropolitan area)
- Owner: Municipality of Sesto Fiorentino
- Partners: CASA spa, ONYX, CSEM
- Product: Coloured glass-glass module with reduced rejection rate
- Implementation: Facade retrofit
- Orientation: South-East
- Surface: ~150 m2
- Installed power: ~26 kW

Figure 2.1: Demo 1 – Picture of the building

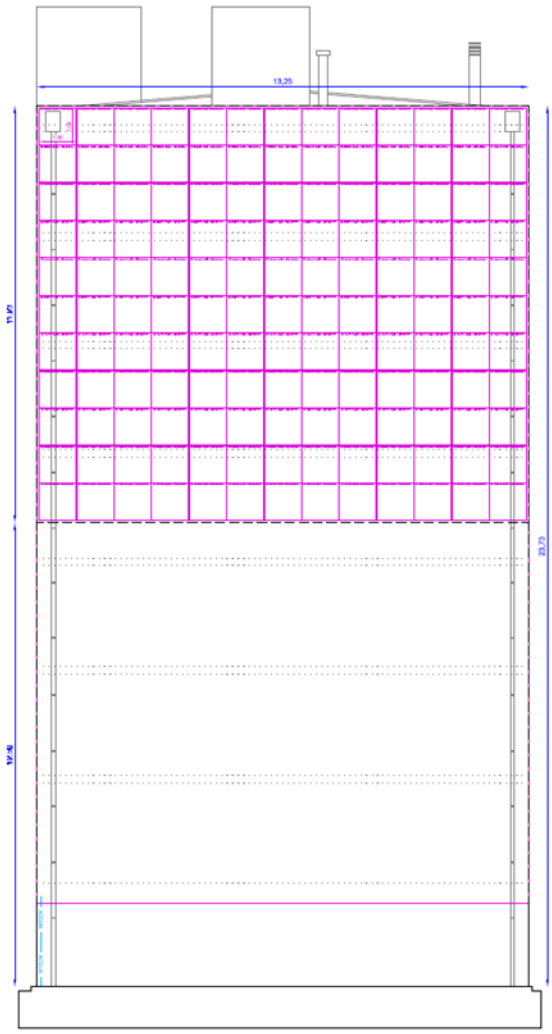

Figure 2.2: Demo 1 – Sketch of the position of panels on the building

The BIPV modules will be installed on the top of the south façade of a residential building in Florence (Figure 2.1), which will be retrofitted with BIPV modules, ensuring a high aesthetic value due to a coloured interlayer developed by CSEM and tested by ONYX with satisfactory results achieved.

The BIPV unit dimensions will be 1 m x 1 m with a weight of 30kg per module. The weight per module was a limitation in the design in order to facilitate the installation and handling of the modules.

These modules will have the following characteristics:

- Extra clear front glass.
- c-Si solar cells (M10)
- Coloured interlayer: Dark grey
- Black frit rear glass.

The chosen colour will be dark grey, as shown in the following figure:

SOLAXESS
WHITE & COLOR SOLAR TECHNOLOGY

STANDARD COLORS (11.2023)

Name	Article code	Color	Approximative color codes (satin glass)			Indicative Performance Retained (%)
			RAL Classic	RAL Design	NCS 1950	
White	ADV-SX-W 01				1005-R80B	55%
Light Grey	ADV-SX-GRC 01			260 80 05		75%
Dark Grey	ADV-SX-GRS 01				6005-R80B	90%
Terracotta	ADV-SX-TC 01		8002		6020-Y50R	82%
Dark Brown	ADV-SX-BR 01			040 30 10		88%
Grey-Beige	ADV-SX-BG 01				4005-G80Y	80%
Barbados Beige	ADV-SX-BDB 01			090 70 10	3005-Y20R	68%
Light Terracotta	ADV-SX-TCC 01				4010 Y50R	71%
Pine Green	ADV-SX-VE 01		6028	160 40 20		80%
Verdigris	ADV-SX-VGR 01			160 70 10		61%
Falu Red	ADV-SX-ROS 01		3009		5040-Y80R	64%
Terra Orange	ADV-SX-TO 01			040 60 40	3040 Y 80R	53%

Figure 2.3: Demo 1 – Standard colours for panels

2.1.2 Demo 2: Residential building retrofit in Switzerland (façade)

- Demo building location: Switzerland – Wangenstrasse 27, 3360 Herzogenbuchsee
- Owner: Private individuals
- Partner: 3S
- Product: TeraSlate® Solarfassade Flair und Adapto (variable size), including high efficiency and colours.
- Implementation: Façade retrofitting
- Orientation: 3 orientations
- Surface: 160 m²
- Installed power: 27.6 kWp

For Demo 2, BIPV modules with green colour, including low-glare and partially with customised sizes, will be installed on an existing façade of a residential building – a combination of the product TeraSlate® Flair and TeraSlate® Adapto.

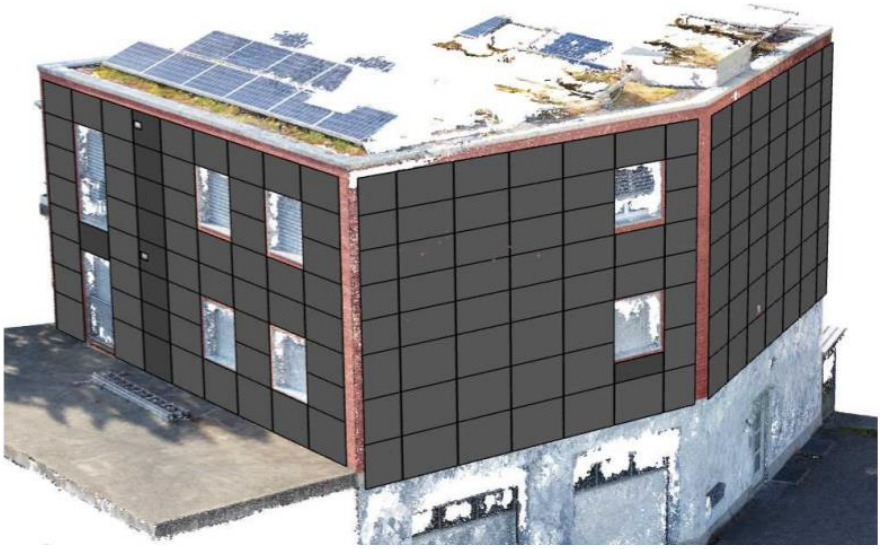

Figure 2.4: Demo 2 - Picture of the building with planned PV modules

The building has three floors. The modules will be installed on the first and second floors on three sides of the building, fixed with 3S standard hooks.

The colour product is called TeraSlate® Flair. This is a solar module for façades in 10 standard colours with high efficiency. At the same time, these modules have a special surface treatment for low-glare to minimise light reflection in sensitive environments and improve the colour effect. The colour technology has been further evaluated and tested in the frame of SEAMLESS-PV.

Figure 2.5: TeraSlate® Flair - standard colours

The customised module sizes product is called TeraSlate® Adapto. In addition to the four standard module sizes, custom-made 3S TeraSlate® solar modules in various sizes can be used to create uniform facade surfaces with a perfect appearance. If the façade cannot be realised with the four standard module sizes across the entire surface, the variable, rectangular module dimensions offer architects and planners plenty of scope when designing a 3S solar façade. The addition of custom-made solar modules enables a solar façade that meets both aesthetic and economic requirements. The custom-made size has been successfully transferred and further developed from the old product family MegaSlate® to the new product family TeraSlate® in the frame of SEAMLESS-PV.

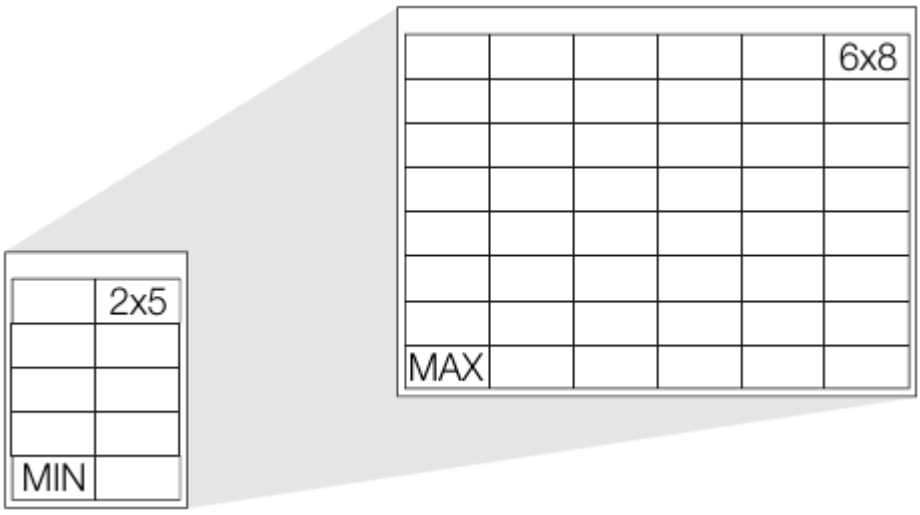

Figure 2.6: TeraSlate® Adapto - Customizable solar modules

2.1.3 Demo 3: Façade retrofit in an office building in Italy

- Demo building location: Italy – Cosio Valtellino (SO) - Via dei Molini 22
- Owner: Zecca Prefabbricati SpA
- Partner: PIZ srl
- Product: e-PIZ, Multifunctional BIPV veture kit
- Implementation: Façade retrofitting
- Orientation: 4 orientations
- Surface: 135 m²
- Installed power: 20 kWp

Figure 2.7: Demo 3 - Picture of the building

Demo 3 consists of a photovoltaic cladding that will be installed in an office building in Cosio Valtellino, Italy.

The building has 3 stories with a complex shape.

The PV cladding will be placed on first and second floor on the opaque head walls on the four sides (around 34 m^2 of surface for each side)

The PV cladding is called e-PIZ 54 and is an integration of the PIZ Rock Metabio H54 panel with the 3S glass-glass PV module.

Figure 2.8: Demo 3 - e-PIZ 54 prototypes

The PIZ Rock Metabio H54 panel consists of a 45 mm thick insulation layer coupled with an 8 mm thick mortar layer. The 3S glass-glass PV module comprises two layers of glass: a 3 mm fully tempered (Thermally toughened glass) front layer, and a 2.1 mm semi-tempered (Heat strengthened glass) rear layer. These are integrated with silicon half-cut solar cells and a double EVA encapsulant sheet. A junction box (JB) containing all the essential electrical components is attached to the module's rear. Transparent silicon is used to bond the mortar layer to the rear glass surface of the glass-glass PV module.

These modules produce energy while delivering high thermal and effective acoustic insulation. The system boasts a thermal resistance value of 1.18 m²K/W and a weighted sound reduction index of 13 dB.

The e-PIZ 54 modules are equipped with an integrated fixing and mounting system and feature a pre-defined path for electrical wiring, simplifying installation and reducing the overall installation time. The reduced weight of the product permits installers to move panels manually, avoiding the use of machinery.

Each module can have customised dimensions, like 916 mm x 512 mm, as for the demo site, up to 1200 mm x 600 mm, with a weight of 35 kg/m² and a nominal peak power of approximately 170-180 W/m².

The customisation can also be done by varying the finishing: an option is to use transparent glass, which reveals the solar cells and the distinctive PIZ pattern, or coloured glass that covers the entire surface. In the demo site, the PV cladding will be done using a PV layer with coloured front glass (grey colour). The building is expected to look like in the following render picture.

Figure 2.9: Demo 3 – Demo site render

2.1.4 Demo 4: Roof integration over a residential single-dwelling building in Belgium

- Demo building location: Belgium – 7034 Obourg – Rue des Bruyères 210 f
- Owner: Private individual
- Partner: Optimal Computing srl
- Product: solar roofing shingle
- Implementation: roof retrofitting
- Orientation: South-West
- Surface: 37 m²
- Installed power: 5 kWp

Figure 2.10: Demo 4 - Picture of the demo building

The lightweight roofing shingle Demo 4 consists of a photovoltaic lightweight roofing shingle that will be installed in a detached house in Belgium.

The roofing shingle designed for the project is made out of glass fibre reinforced composite, which makes it a lightweight solution. It holds 4 strings of 4 Maxeon3 solar cells in its flat part, achieving 52 Wp nominal peak power. The shingle itself is 620 mm x 710 mm, and is 2mm thick, weighing approximately 2.5 kg.

The design (Figure 2.11) consists of a flat part containing the solar cells, with two vertical parts on the sides that fit into a gutter in order to collect the water that slips from the tiles. The vertical parts of the shingle are 32 mm high at their tallest point, and the top of the flat part of the shingle is not occupied by solar cells, in order to allow for the overlapping of the shingles.

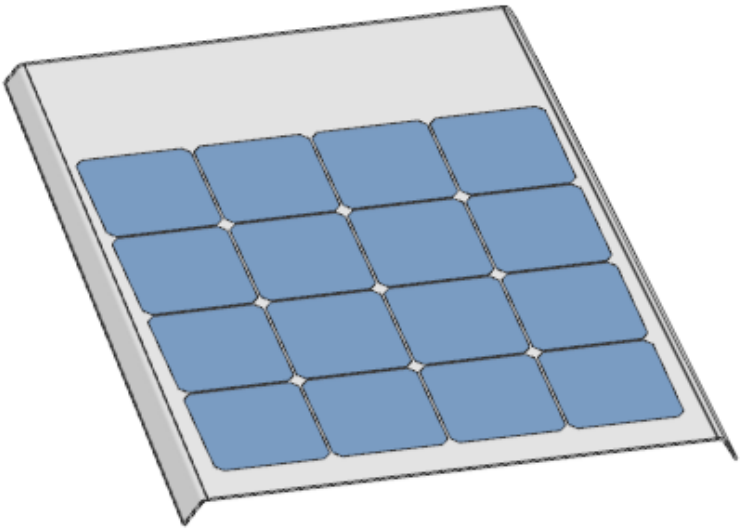

Figure 2.11: Demo 4 - Roofing shingle design

The trapezoidal shape of both the flat part containing the solar cells and the vertical parts that fit into the gutter enables the tiles to fit in with each other, as conventional tile systems do.

The roofing shingles will be painted black in order to achieve a seamlessly integrated design. This black colouring, paired with the back-contact solar cells, will achieve a full black aesthetic (Figure 2.12).

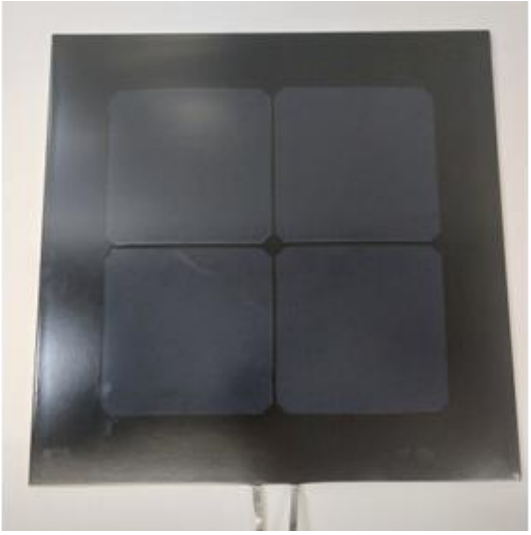

Figure 2.12: Demo 4 - Full black sample using back-contact Maxeon3 solar cells

In order to install the tiles, firstly, the roof needs to be prepared adequately, using waterproofing membranes. Then, both primary and secondary wooden battens will be installed (vertically and horizontally), with the previously mentioned metallic gutters on top.

Once the roof preparation is done (membranes, battens and gutters), the roofing shingles will be installed. Fixing hooks are nailed into the battens to hold the tiles in place. The hooks support the bottom part of the shingle while pressing down on the top of the next shingle. To guarantee the watertightness of the roof, a rubber is needed on the overlap between shingles (Figure 2.13).

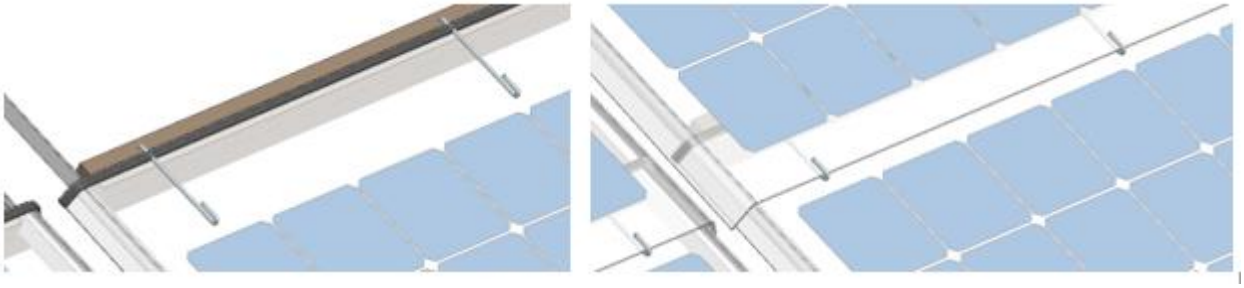

Figure 2.13: Demo 4 – Roofing shingle fixing system (hooks and rubber joints)

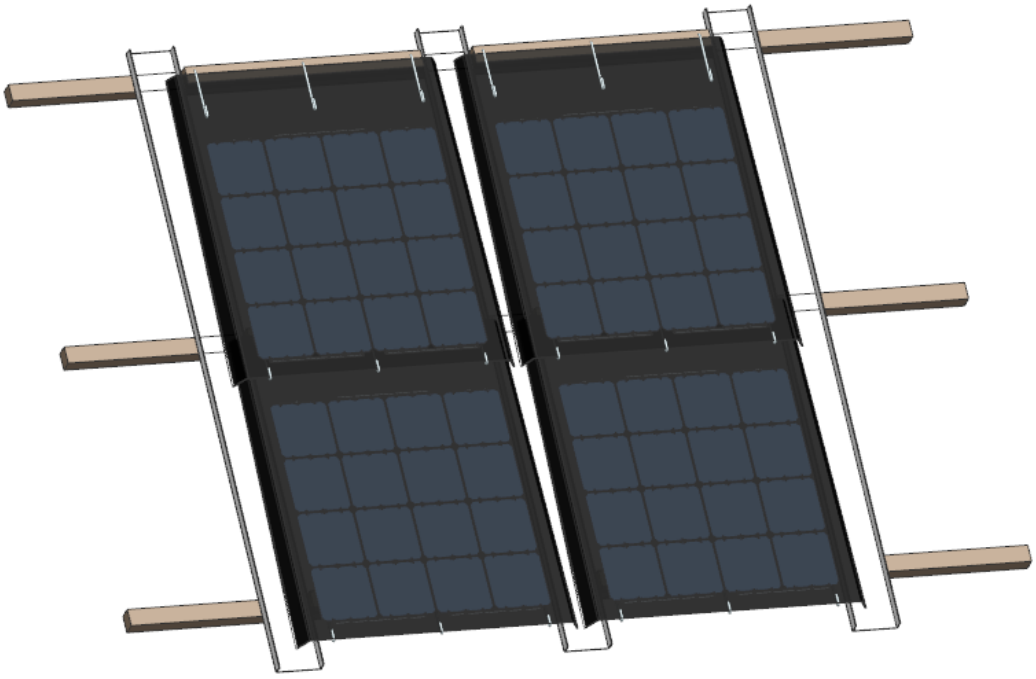

Figure 2.14: Demo 4 – Roofing shingle schematic 3D design

2.1.5 Demo 5: FACT experimental building in France

- Demo building location: France – Le Bourget du Lac
- Owner: CEA-INES
- Partner: CEA-INES
- Product: Full black glass-glass laminated with pre-packed short strings
- Implementation: Facade
- Orientation: South
- Surface: 60 m²
- Installed power: 12 kWp

FACT building is an experimental building set up in CEA-INES experimental platform. This platform is not open to the public. The requirements and authorisations to modify the buildings are less stringent than for standard usage of buildings. The building is only used to evaluate technical solutions based on innovative solutions to reduce carbon emissions and increase energy efficiency.

The FACT building is versatile. It is dedicated to testing diverse envelope components, as opaque or transparent elements for façades, building envelope components integrated with active systems as photovoltaics, for example, lightweight or massive facades with different thicknesses and structures. The roof, with a 75 m^2 surface, will be used to evaluate innovative systems for renewable energy production or innovative horizontal envelope systems (green roof, cool roof, etc). Inside, the building is composed of testing rooms which can be modified in order to have different geometries. Thanks to the versatile structure, it is possible to perform tests in one test cell (9 m^2) or in a unique open space (50 m^2 for each floor). Depending on the test protocol, the indoor comfort is fully controlled, and the integrated energy systems are precisely monitored.

In the SEAMLESS-PV project, we will use the South façade to install PV modules. The whole surface will be used, and the total surface will be close to 60 m². This situation is illustrated in Figure 2.15 on the left drawing.

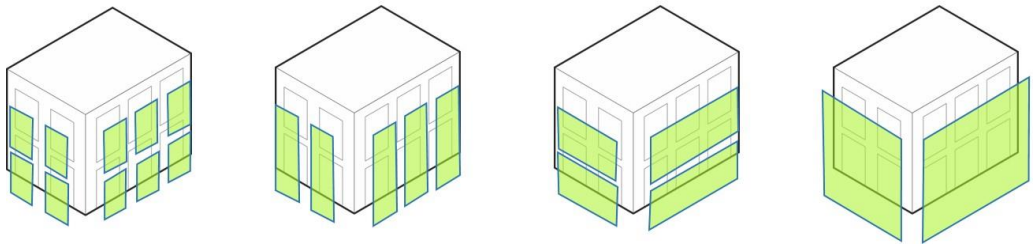

Figure 2.15: Demo 5 – Schematic of the experimental building

The design of the façade will respect the actual drawing. We will identify the six parts by adapting the size of the PV panels to be installed. These PV panels will be produced with the flexible pilot lines developed in the project, based on the use of prelaminated strings, where one constraint of the design is its unit size. In this sense, it is needed to find the best coverage of the façade to maximise energy production with the existing typical dimensions of the building and the achievable size of PV modules.

The FACT building is illustrated in Figure 2.16, showing the metal structure of the building and the final aspect with façade removable claddings.

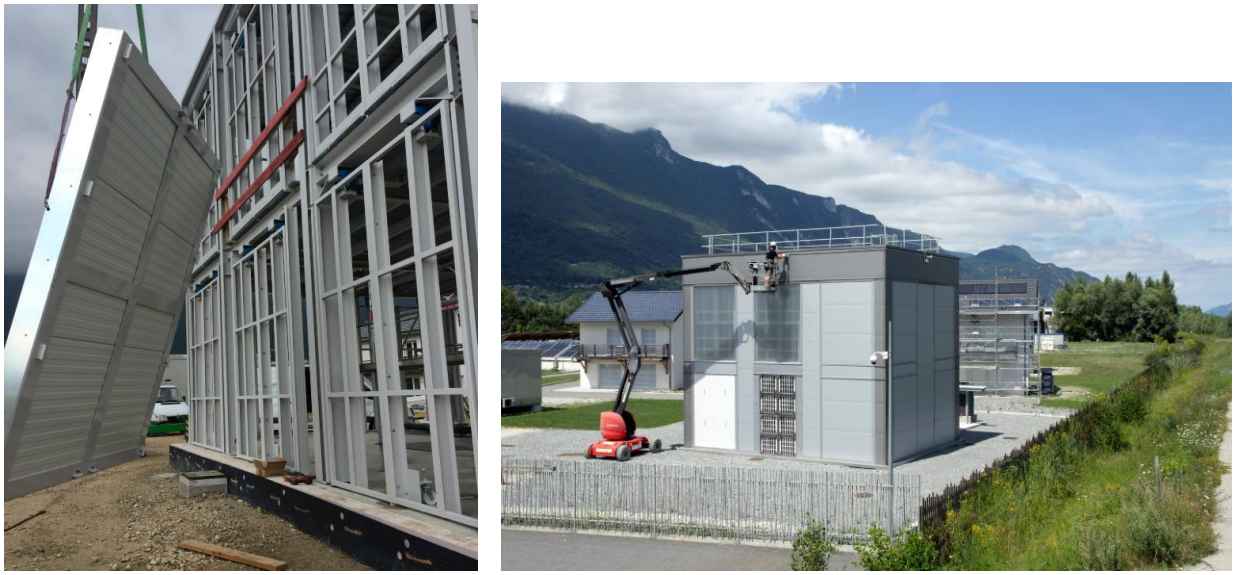

Figure 2.16: Demo 5 - Structure and global view of FACT buildings

The actual design requires several sizes of BIPV modules, so it is planned to manufacture four different sizes that properly adapt to the façade design. A mechanical structure is under preparation to allow the installation in the manner of a curtain wall added in front of the existing façade. Modules will use a glass/glass structure to fit with the existing standards and local requirements dedicated to construction. The aesthetics will be considered with homogeneous full-black modules. Monitoring of the façade will provide information about the thermal behaviour of the façade and the produced energy.

2.2 IIPV – Infrastructure Integrated PV

2.2.1 Demo 6: PVNBs at Bizkaia Connected Corridor living lab

- Demo location: Spain – Bizkaia. Road AP8 "Variante Sur Metropolitana" Kilometer point: From km 113+120 to km 113+640, Latitude 43°13'14.11"N Longitude 2°54'44.32".
- Owner: Infrastructure and Territorial Development Department of the Provincial Government of Biscay
- Partners: BECSA-ONYX-TECNALIA
- Product: new Photovoltaic Noise Barrier (PVNB) with optimised acoustic & PV performance
- Implementation: noise barrier at A-8/AP-8 highway
- Orientation: 45° NE
- Surface: 150 m²
- Installed power: 22-24 kWp

Figure 2.17: Demo 6 – Situation

The Bizkaia Connected Corridor BCC is a living lab for testing intelligent infrastructures. Here, it will be installed a demonstrator of an acoustic barrier with energy generation capacity by means of photovoltaic panels, with a length of 75 m and a height of 3 meters.

Figure 2.18: Demo 6 – Aerial view situation

Figure 2.19: Demo 6 - NBPV position situation (orange line)

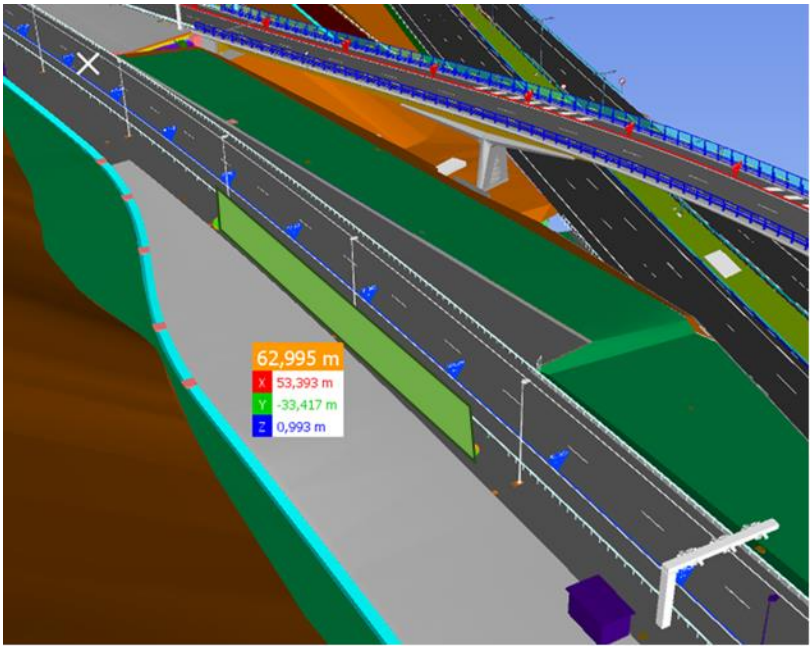

Figure 2.20: Demo 6 - PVNB 3D view

ONYX, TEC and BECS propose a PVNB divided into two main parts: the PV part and the commercial acoustic screen.

On the one hand, the PV part:

- Asymmetrical thickness glasses: Front glass of 8 mm and rear glass of 6 mm. This asymmetrical configuration ensures an improvement in acoustic insulation.
- Large dimensions to avoid joints and loss of acoustic insulation (2500 mm x 2000 mm), achieving an installation of a total of 75 m.
- c-Si bifacial solar cells, to increase the power output and find a balance between the transparency level and power generation.

To achieve a balance between the transparency level, the orientation of this transparency and the power generation, ONYX designed three modules, of which one was chosen to be manufactured and installed on the final demonstration. Initially, ONYX designed three modules. Finally, one of each was selected as the main balance between transparency level, the power generation and other geometrical characteristics (Figure 2.21).

Figure 2.21: Demo 6 - Photovoltaic glass - General view developed by ONYX

In order to protect the edges of the PV laminated glass, BECS has developed a perimetral frame, so it can be installed on site as a traditional acoustic barrier.

The proposed frame is a U-shaped profile which will be designed according to external forces such as wind, and it will also have a hollow chamber to pass the wiring and locate the junction boxes. In the vertical profiles, an interior machining is contemplated to contain and hide the boxes.

The remaining space between frames (a few millimetres) is filled with a cover to ensure acoustic insulation.

General plans of the PVNB are depicted in Figure 2.22.

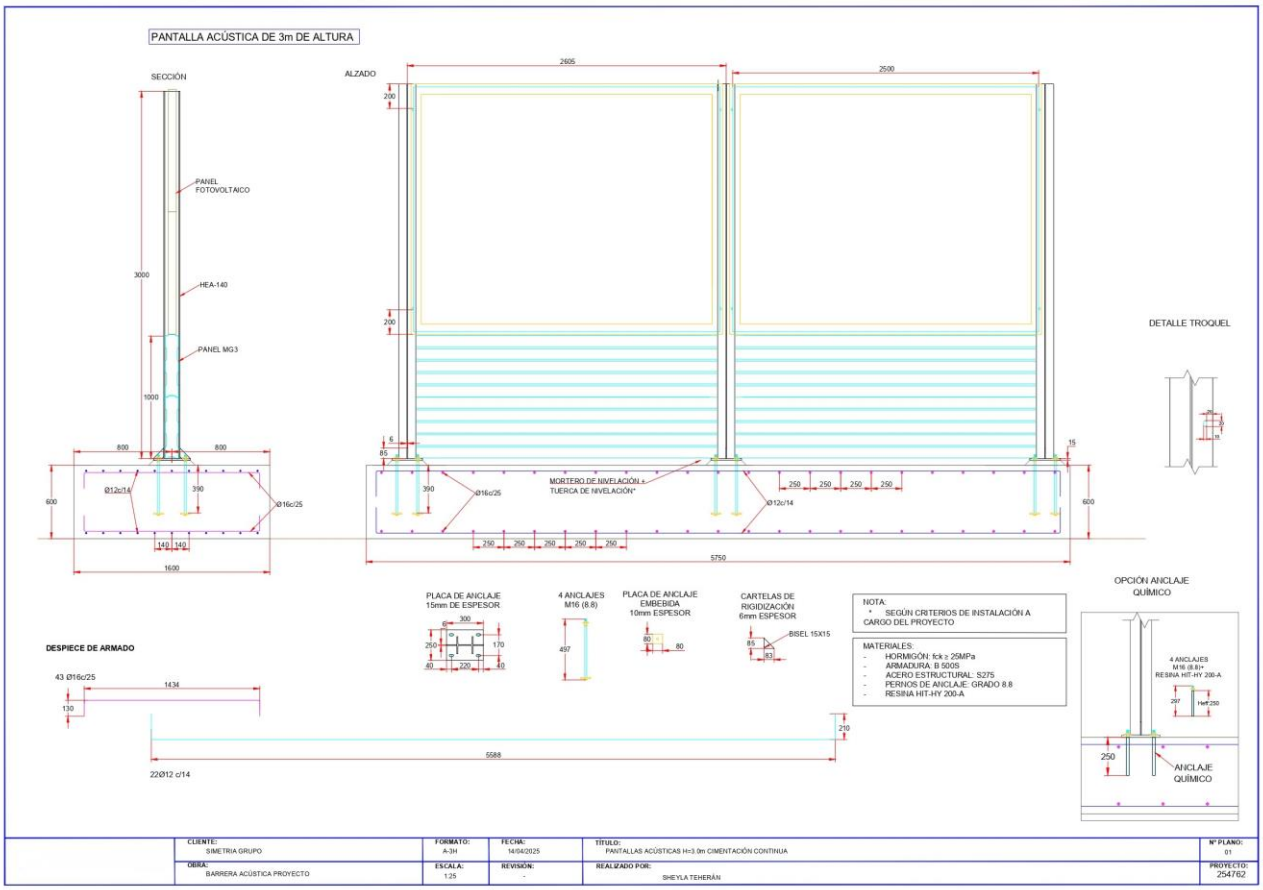

Figure 2.22: Demo 6 – Long Shot of the Acoustic Screens

2.3 VIPV – Vehicle Integration PV

2.3.1 Demo 7A: Car - Electric passenger cars

- Demo location: Netherlands and/or Belgium
- Owner: Lightyear Layer BV
- Partner: LYL
- Product: Vehicle-integrated photovoltaics (i.e. panel and power electronics) on an electric vehicle.
- Implementation: Glass-free panels and power electronics integrated on Lightyear 0 or another electric car.
- Surface: Depends on the laminates that will be provided to Lightyear Layer BV. The minimum expected surface area of the panels on the roof, hood, and trunk of electric passenger cars is 1 m^2 each.
- Installed power: Depends on the type of car implemented for the demonstration (i.e. Lightyear 0 or another electric vehicle).

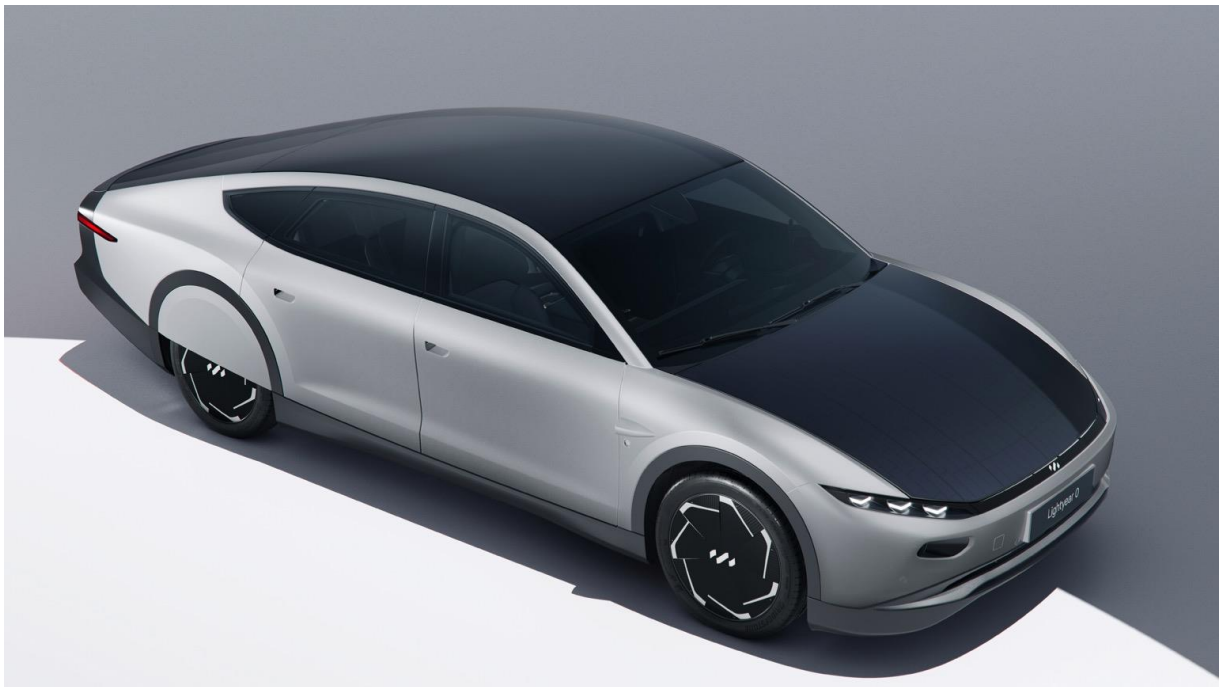

Figure 2.23: Demo 7 - The Lightyear 0

The Lightyear 0. This is one of the electric vehicles in which glass-free solar panels and their accompanying power electronics can be integrated for Demo 7.

2.3.2 Demo 7B: Small truck and Cargo Box

Small truck and Cargo Box

- Demo location: Spain – urban areas and inter-town connection roads.
- Owner/Partner: BRANKA Solutions S.L. in collaboration with Liderkit (cargo box manufacturer)
- Supporting partners: TECNALIA, MASS
- Product: Lightweight Solarface® PV panels with back-contact solar cells.
- Implementation: Roof and upper side-walls integration on small truck cargo box
- Surface: Roof: 2000 × 3225 mm; Left side wall: 3500 × 700 mm; Right side wall: 2500 × 700 mm.
- Installed power: Approx. 2 kWp

The demonstration unit consists of a small truck equipped with a lightweight cargo box manufactured by Liderkit, a company specialising in cargo box solutions, including refrigerated units. The objective is to demonstrate the seamless integration of Solarface® composite photovoltaic panels into the structure of the cargo box, combining energy generation with lightweight construction, aesthetic integration, and preservation of thermal insulation.

The PV modules are based on back-contact solar cells, interconnected into strings using the tabber-stringer developed by MASS, and encapsulated by BRANKA using its proprietary Solarface® prepreg composite process. The roof of the cargo box integrates six modules with a total active surface of ~6.5 m². The side walls accommodate three modules on the left wall and two modules on the right wall, the latter reduced due to the presence of a lateral access door. Each module delivers around 175-200 Wp, resulting in a total installed capacity of about 2 kWp.

A key feature of this demonstrator is the ultra-lightweight design of the Solarface® modules, with a weight under 3 kg/m², which allows full compatibility with vehicle payload requirements. The integration is executed in a flush and seamless manner, ensuring a smooth surface with no external cabling. All electrical routing and connections are embedded inside the sandwich core of the cargo box, ensuring durability, safety, and a visually clean design.

In the case of refrigerated cargo boxes, the PV system will directly contribute to powering auxiliary refrigeration devices and charging the vehicle's battery system, thereby reducing fuel or electricity consumption and improving overall energy efficiency. The design also considers the preservation of thermal insulation properties, ensuring that PV integration does not compromise the box's ability to maintain internal temperature stability.

This demo will allow the evaluation of lightweight Solarface® VIPV technology in real operation conditions on delivery trucks, quantifying energy savings, monitoring thermal behaviour, and validating seamless vehicle-integrated PV manufacturing processes developed within SEAMLESS-PV.

Figure 2.24: Isothermal Cargo Box type (Liderkit)

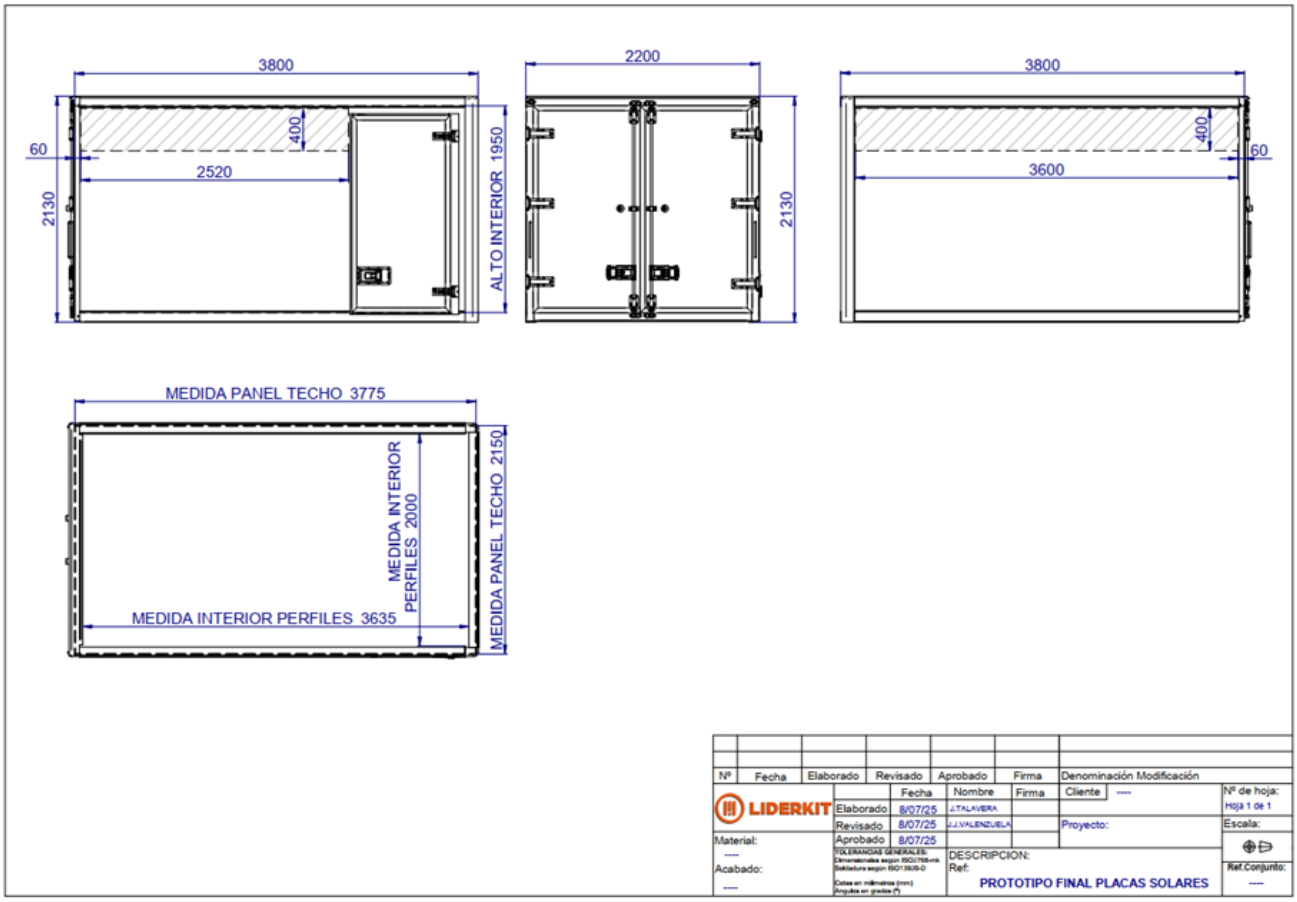

Figure 2.25: Isothermal Cargo Box dimensional drawing (Liderkit)

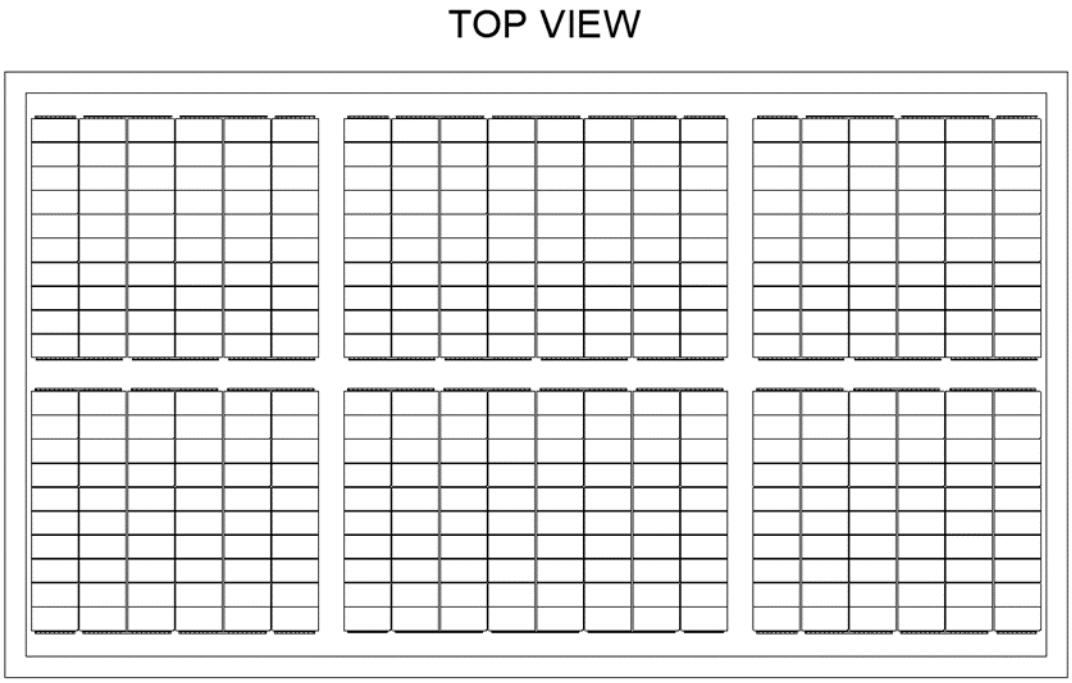

Figure 2.26: Roof FV arrangement: 6 panels

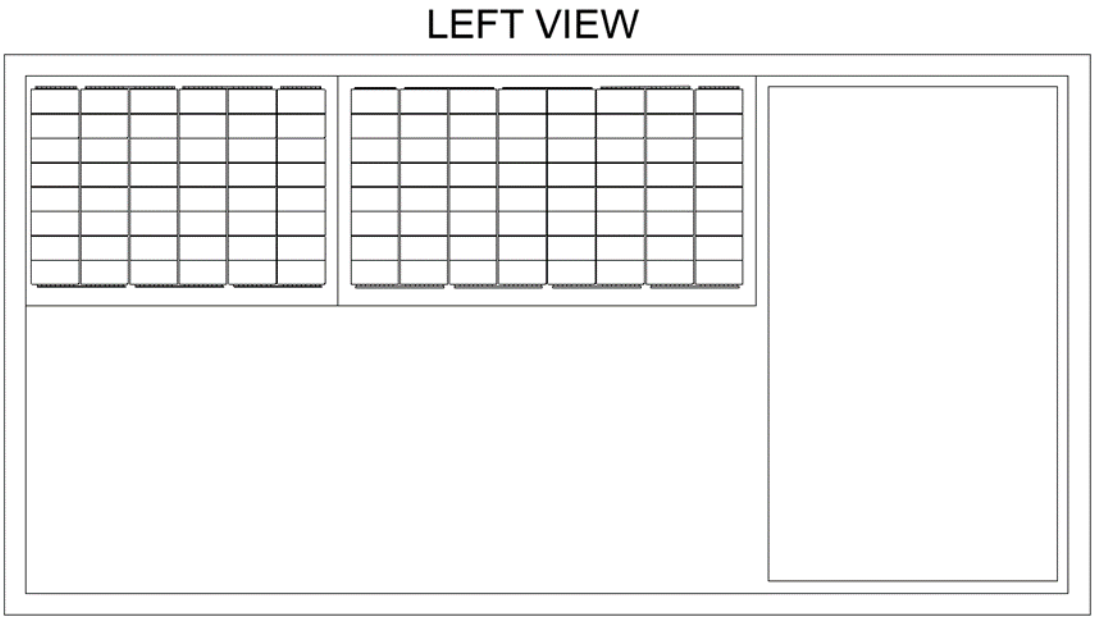

Figure 2.27: Left side FV arrangement: 2 panels

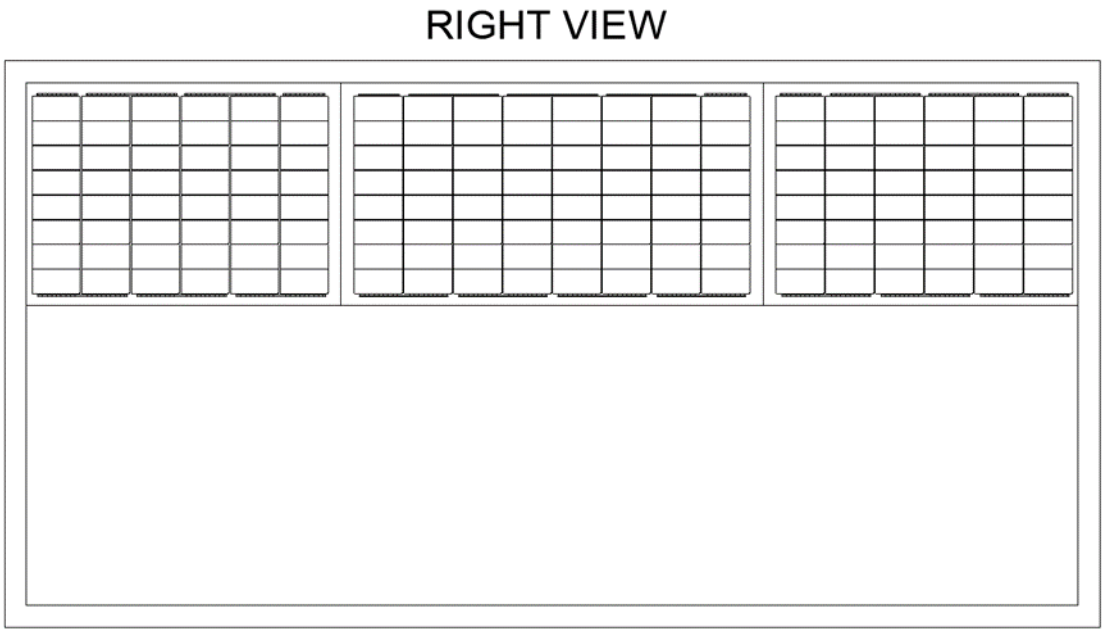

Figure 2.28: Right side FV arrangement: 3 panels

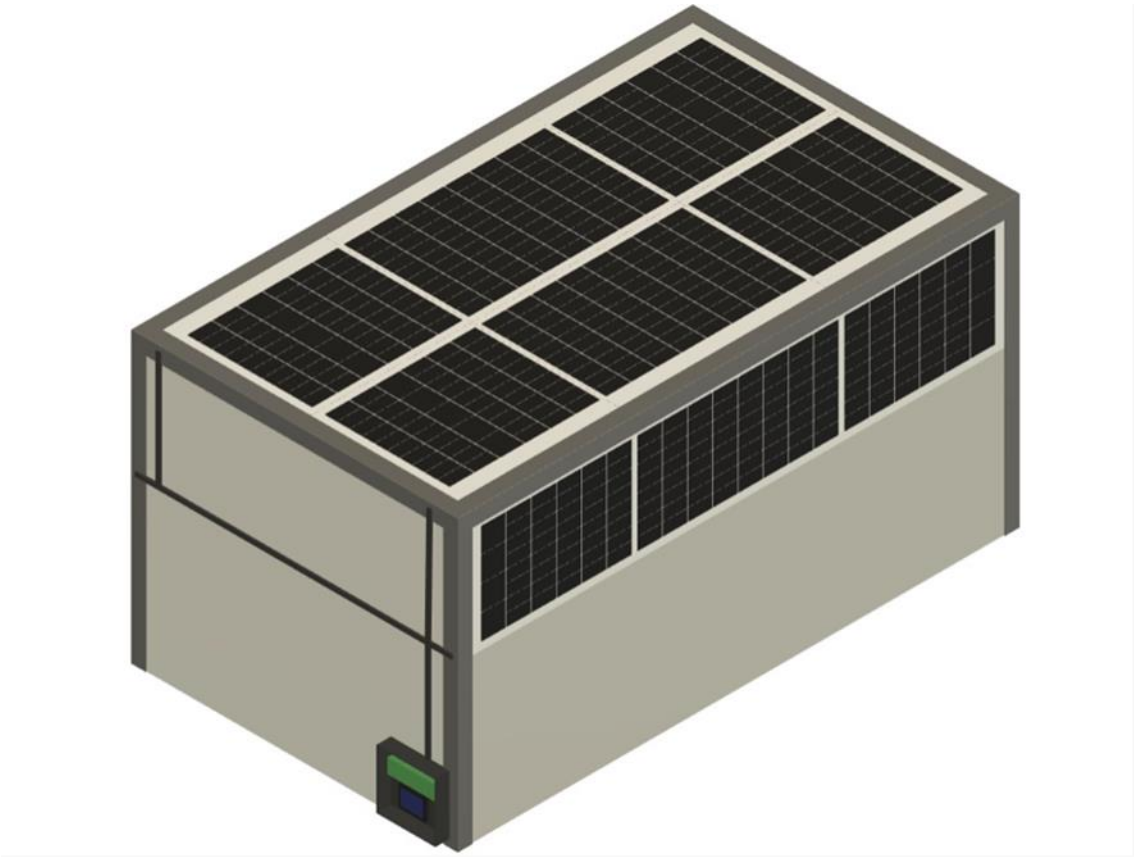

Figure 2.29: Preliminary 3D model, with the cable routs arrangement

2.4 AGRI-PV – Agriculture PV

2.4.1 Demo 8: Customised glass-glass module for open agriculture

- Demo location: France, Bizanet
- Owner: AGRITERRA GROUP
- Partners: AGRITERRA GROUP-ONYX
- Product: semi-transparent bifacial module for AgriPV applications
- Implementation: overhead PV for arable farming
- Surface: 150 m²
- Installed power: 500 kWp, including 13 kWp of semi-transparent modules
- Semi-transparency level: 54%

The objective of the demo is to contribute to understanding the impact of agriPV systems on the main types of crops growing in the South of France. Agrivoltaics systems are becoming more and more popular in France, with many models, but very little feedback on installed systems. As photovoltaics development in Europe will require to use of some agricultural lands, it is key to better understand the conditions to allow both activities to benefit from each other, instead of one being a predator to the other.

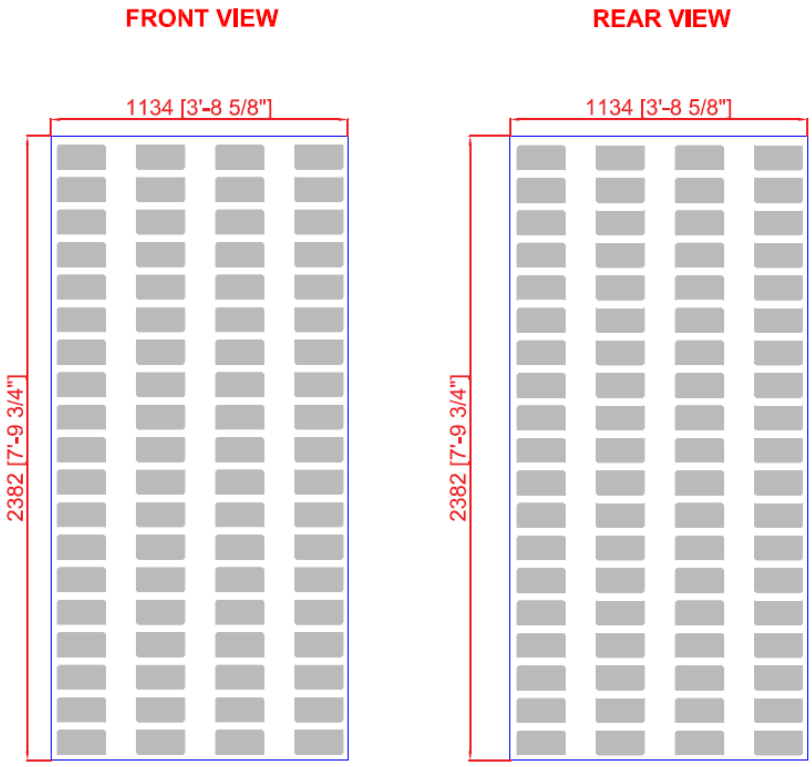

Figure 2.30: Demo 8 - Plan of the module

These modules will be placed on tracking systems as represented in Figure 2.31, and regular PV modules will also be part of the demo.

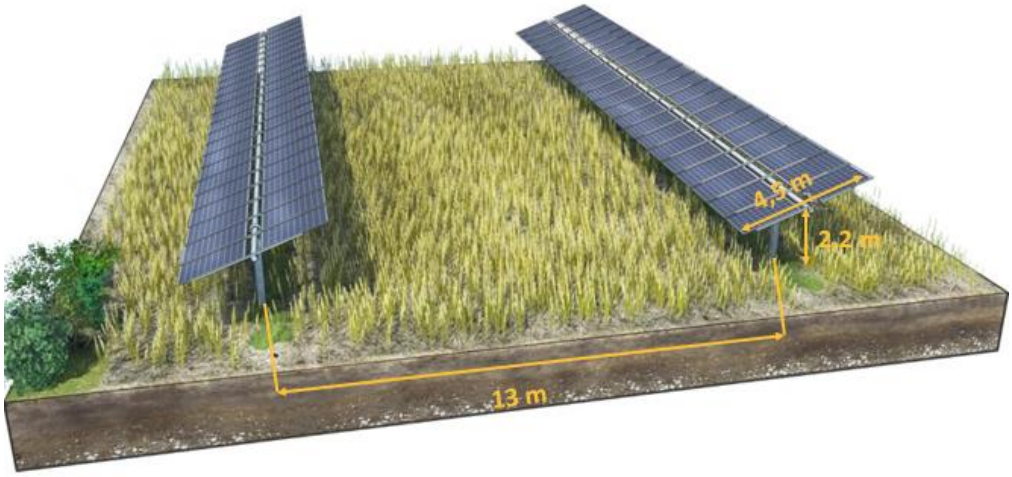

Figure 2.31: Demo 8 – Implementation simulation

Four agriculture systems will be tested in the Gaussan's Abbey garden, based on existing components in the market, allowing for large-scale deployment afterwards:

- Cereals with a tracking system.
- Vineyards with a tracking system.
- Market garden with tracking system.
- Arboriculture (pistachio, olive) with a fix or tracking system.

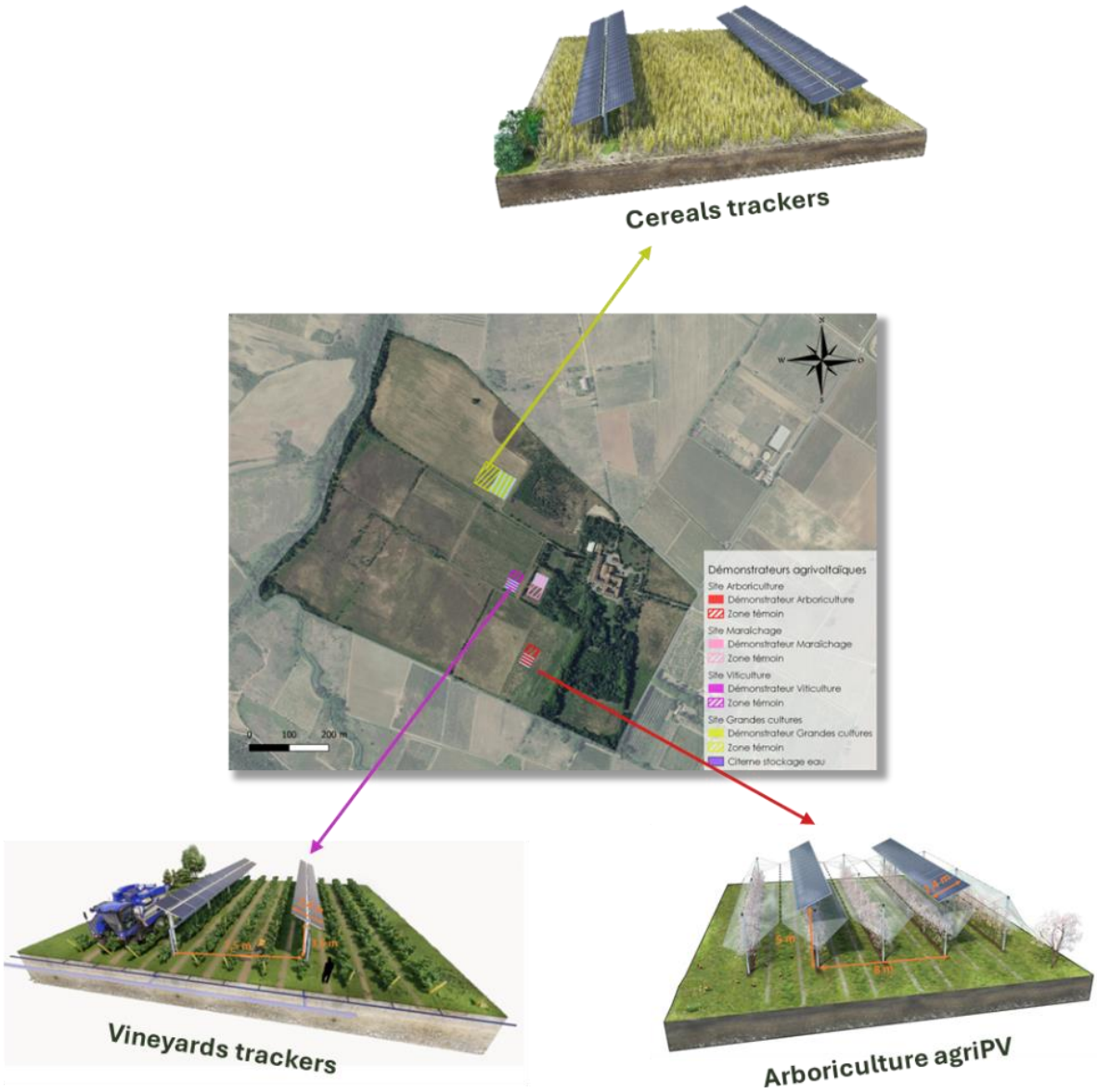

Figure 2.32: Demo 8 – Location of four demo units

Figure 2.33: Demo 8 - Gaussan's Abbey site

Several parameters, such as temperature, light, humidity, etc., will be monitored at strategic points of the demonstrator, and the agronomist engineers will also monitor plant development.

2.4.2 Demo 9: Lightweight PV over tunnel multi-span greenhouse

- Demo location: Spain
- Owner: Neiker (Instituto vasco de investigación y desarrollo agrario).
- Partner: TECNALIA
- Product: lightweight, semi-flexible, semi-transparent bifacial composite
- Implementation: replacement of multi-span plastic cover
- Surface: 150 m²
- Installed power: 12-15 kWp (depending on transparency degree)

Figure 2.34: Demo 9 – Picture of the greenhouse

The Agri-PV modules that will be installed over the multi-span plastic cover greenhouse consist of narrow, stripe-like modules, containing bifacial half-cut M10 solar cells. The modules are 1020 mm long by 400 mm wide, with two strings of 10 half-cut M10 cells, achieving a nominal peak power of 67.5 Wp per module.

The modules are made of a composite with glass fibre reinforcements, which, at 0.7 mm thick, makes them both resistant and flexible at the same time, to be able to adapt to the curvature of the greenhouse cover. Figure 2.35 shows a detailed drawing of the AgriPV module design.

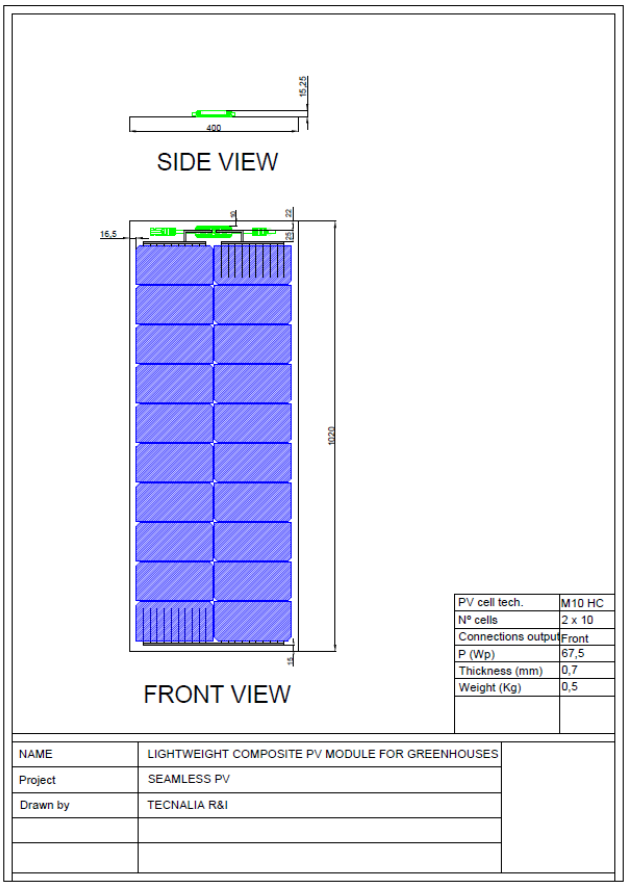

Figure 2.35: Demo 9 - AgriPV module design details

The aim of having narrow modules is to space them along the greenhouse tunnel to allow enough light to reach the inside. It has been defined that a 60% transparency degree is adequate for the plants that are going to be grown, so, in order to achieve this, the PV modules will be installed with a 600mm gap between them.

One of the objectives of the design is to install de modules using the existing fixing points of the greenhouse cover, to avoid drilling extra holes that could compromise the watertightness of the structure. After measurements taken at the demo site, it was seen that these fixing points were not spaced evenly; therefore, the fixing system of the modules needed to be designed to be adaptable to the available fixing points at the time of the installation.

Two thin metal sheets will be attached to both the top and bottom of the module, around 30mm x 500mm x 2mm. The thickness and width of the sheets could vary, since the important part is the length, which should be 50mm wider than the module on each side. Figure 2.36 shows an overall view of the described metal sheets, and Figure 2.37 shows a more detailed view.

The metal sheets will be attached to the module on site, using double-sided tape, so that their position can be adjusted to fall exactly on top of the metallic profiles of the structure.

Once the metal sheets are stuck to the modules, they will be placed on top of the plastic envelope of the greenhouse, trying to match the existing fixing points, as well as the specified distance between modules. Finally, the metal sheets will be drilled on site, and the modules will be fixed to the structure with adequate screws and washers.

In cases where it is not possible to use the existing fixing points, additional holes will need to be drilled in the plastic cover and the metallic profiles of the structure, but the goal is to minimise the extra holes.

Figure 2.36: Demo 9 – Fixing method of the AgriPV module

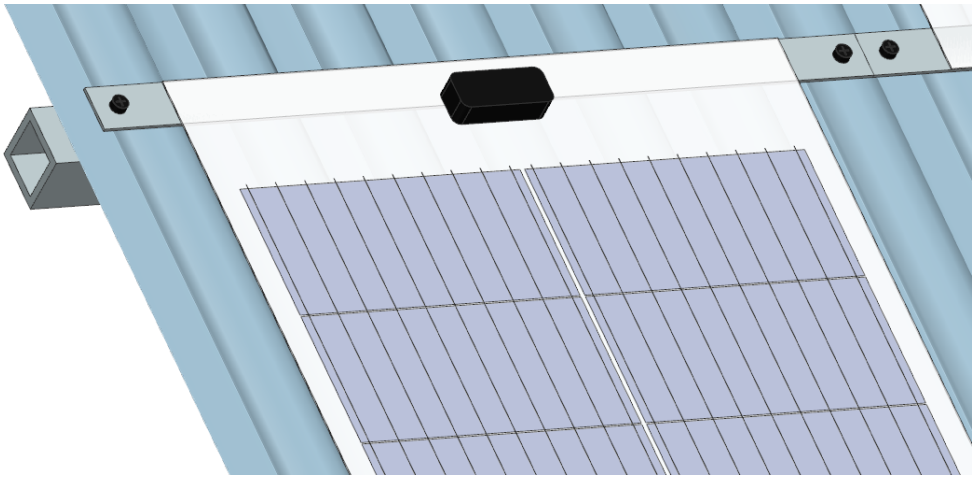

Figure 2.37: Demo 9 – Fixing method of the AgriPV module (detailed view)

Each side of the greenhouse tunnel will hold four modules per lineal meter but, instead of placing them directly on top of each other, they will be arranged in a staggered pattern, so that they do not interfere with one another, as shown in figure below.

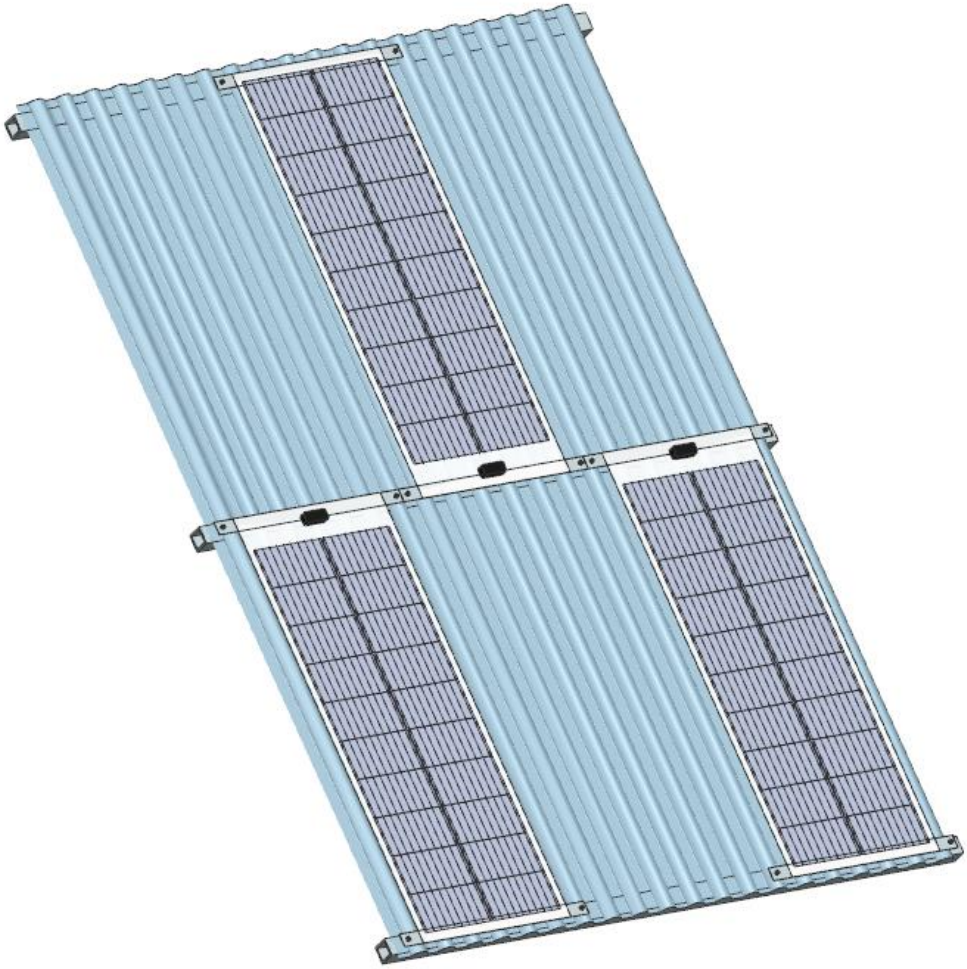

Figure 2.38: Demo 9 - Staggered arrangement of the AgriPV modules

3 CONCLUSIONS

The present report details the design of the different IPV solutions (IPV modules) and the location that will be developed within the SEAMLESS-PV project.

Seamless-PV

Co-funded by
the European Union

Project funded by

Schweizerische Eidgenossenschaft
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