HORIZON EUROPE PROGRAMME
TOPIC HORIZON-CL5-2023-D3-01-02

GA No. **101136094**

Sustainable Photovoltaics Integration in buildings and Infrastructure for multiple applications

SPHINX - Deliverable report

D5.5 – PV technology for carport application

Funded by
the European Union

Deliverable No.	5.5	
Related WP	5	
Deliverable Title	PV technology for carport application	
Deliverable Date	31/10/2026	
Deliverable Type	Demonstrator	
Dissemination level	PU - Public	
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Status	Final	

Document History

Version	Date	Editing done by	Remarks
1	27/10/2026	VOLTEC	First version
	30/10/2026	UNR	Review
	30/10/2026	VOL	Approval

Public Summary

Two PV technology for carport application were installed at Voltec Solar car park (Dinsheim sur Bruche, France) :

- 600 m² carport, 300 modules
- 8 m² bike port, 4 modules

The carport is made of RG5 bifacial panels developed by Voltec Solar. Sphinx products developed in this project were used in the Built of Materials in order to check their possible improvement of the Voltec's 2 m² full size module. These panels consisted of 4 types of modules:

- Bare RG5 modules
- Coated RG5 modules
- RG5 modules equipped with UV-downshifter encapsulant
- Coated RG5 modules equipped with UV-downshifter encapsulant

The bike port was installed on the bicycle shelter, also located on Voltec's car park. The panel were built using shingle matrices, with or without UV-downshifter encapsulant.

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Abbreviations & Definitions

Abbreviation	*Explanation*
UV-DS	Ultraviolet Downshifter
RG5	Hail Resistance Class 5
CSEM	CENTRE SUISSE D'ELECTRONIQUE ET DE MICROTECHNIQUE
BOM	Bill of Material

1 Introduction

During the final year of the project, Voltec Solar installed two photovoltaic demonstrators on its premises: a carport and a bike port, both equipped with TARKA DIAMANT T110 modules developed by Voltec Solar.

- Carport: 600 m², equipped with 300 photovoltaic modules.
- Bike shelter: 8 m², equipped with 4 photovoltaic modules.

The installation work was completed in June 2026, with commissioning and the start of monitoring activities scheduled for November 2026.

2 Carport demonstrator

Tarka 110 DIAMANT bifacial modules were manufactured at Voltec Solar for installation on the carport located in Voltec Solar's car park.

The carport consists of two sections:

- 264 standard Tarka 110 DIAMANT bifacial modules.
- 36 Tarka 110 DIAMANT bifacial modules incorporating components developed as part of the SPHINX project, including anti-soiling, anti-reflective and anti-glare coatings, as well as UV-downshifting (UV-DS) encapsulants.

2.1 Tarka 110 DIAMANT production

The production of the Tarka 110 DIAMANT modules took place in March 2026.

These modules are RG5-rated, hail-resistant photovoltaic modules featuring glass without any anti-reflective, anti-glare or anti-soiling coating.

Some of these modules were stored pending installation on the carport, while others were sent to CSEM for the application of the coatings developed within the project.



Figure 1 : Tarka 110 DIAMANT production. Pannel assembling on the left, full panel on the right

2.2 Tarka 110 SPHINX production

A batch of Tarka 110 DIAMANT modules was manufactured immediately after the previous production run. During this production, a UV-downshifter (UV-DS) encapsulant developed by CSEM was integrated into the Bill of Materials (BOM), replacing the standard front encapsulant used in Tarka 110 DIAMANT modules.

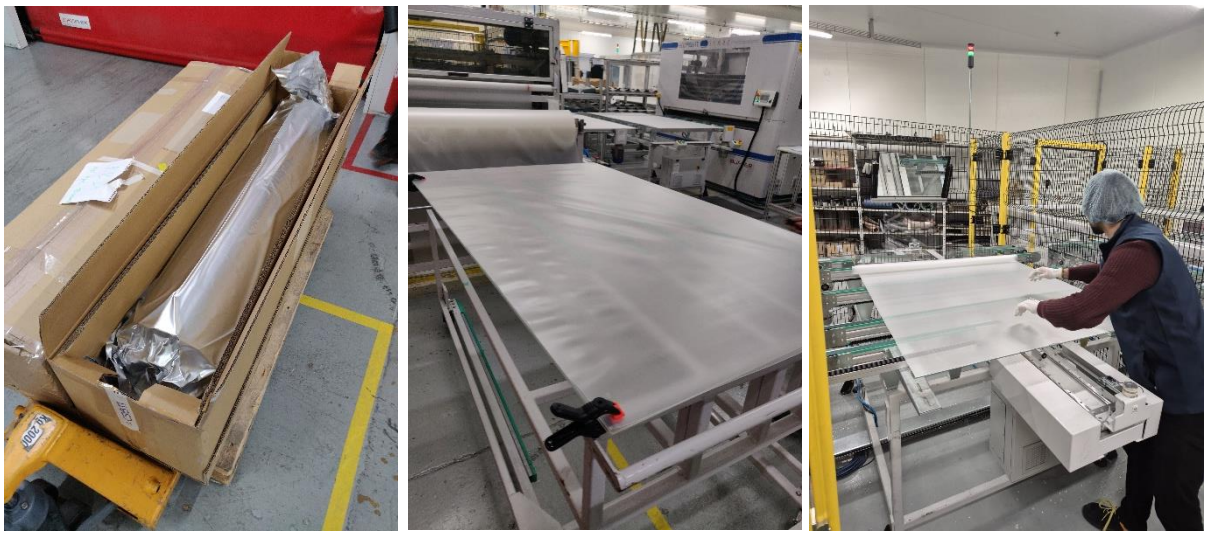


Figure 2: Implementation of CSEM UV-DS in Voltec Solar production line

The UV-DS encapsulant was manually unrolled, cut to size and placed onto the glass before the lamination process. These modules will subsequently be referred to as Tarka SPHINX modules throughout this report.

A total of 13 Tarka SPHINX modules were then sent to CSEM for the application of the coatings developed within the project.

2.3 Reception of coated modules

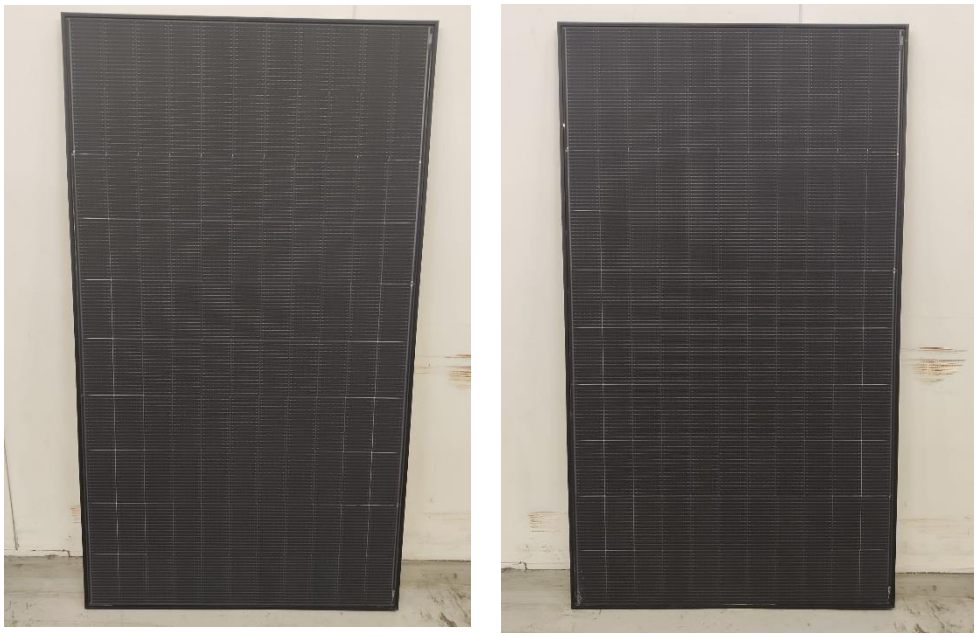


Figure 3: Coated panels; Tarka 110 SPHINX with M coating (left), Tarka 110 DIAMANT with M coating (right)

Following the application of the different coatings developed by CSEM, the modules were returned to Voltec Solar.

Upon reception, the modules were selected according to their electrical power output and visual appearance to determine which ones would be installed on the carport demonstrator.

The distribution of the modules to be installed, according to their type and coating configuration, is presented below:

Table 1: Summary of the different panels installed on the carport

Module Type	Coating	Number of modules
Tarka DIAMANT	No coating	264
Tarka DIAMANT	D	4
Tarka DIAMANT	M	6
Tarka DIAMANT	C	2
Tarka SPHINX	D	2
Tarka SPHINX	M	6
Tarka SPHINX	No coating	16

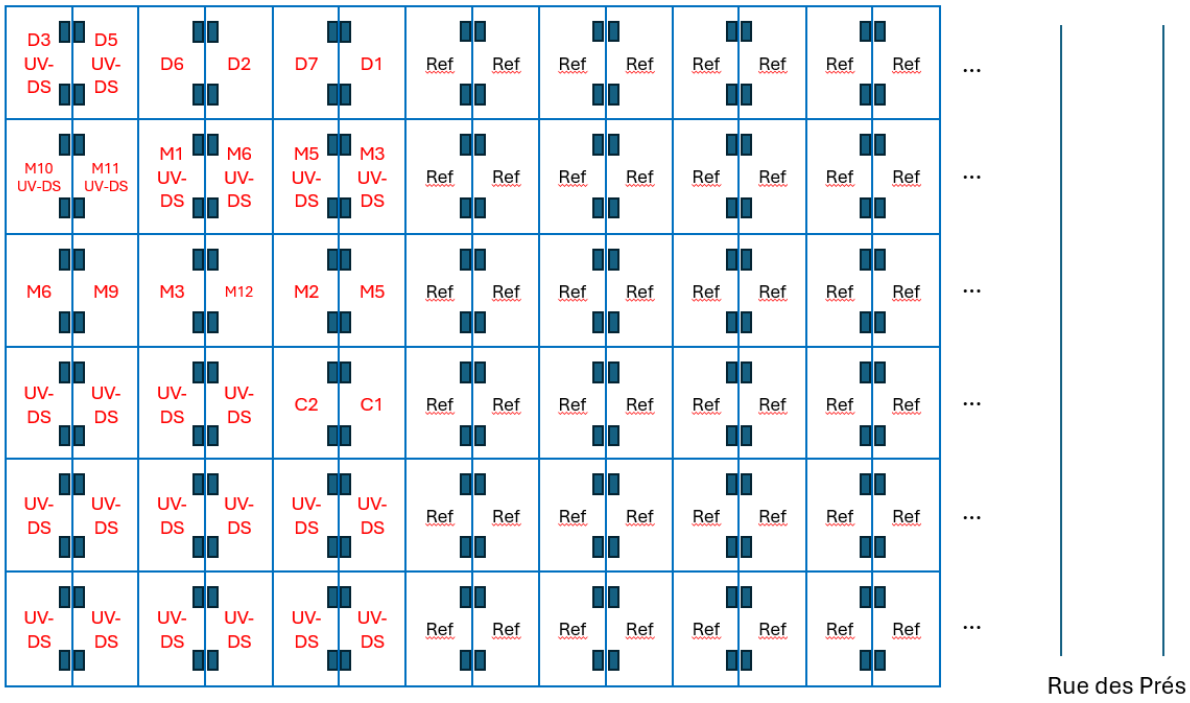


Figure 4: Schematic of the panel layout installed on the carport

2.4 Carport installation

The installation of the carport began in June 2026, with the delivery of the structural components and the preparation of the ground.



Figure 5: Installation of the carport structure

The installation of the photovoltaic modules took place in July 2026. The standard Tarka DIAMANT modules were installed first, followed by the Tarka SPHINX modules and the coated modules.

Voltec Solar's team assisted the installation contractors during this final stage to ensure that the designated installation layout was correctly followed, particularly regarding the positioning of the coated Tarka DIAMANT modules and the coated and uncoated Tarka SPHINX modules.



Figure 6: Panels placement on the carport

The monitoring of the modules' electrical power output will be carried out through the company responsible for the carport installation. Once the modules are electrically connected, the installer will provide Voltec Solar with the necessary monitoring equipment and access to the corresponding data.

Weather monitoring will be conducted in collaboration with Fraunhofer ISE. A weather station has been installed close to the Tarka SPHINX modules to measure solar irradiance, wind speed and temperature. The station has been connected to the electrical terminal mounted on one of the carport's structural pillars.



Figure 7: Location of the weather station

As of September 2026, all carport installation work has been completed. The demonstrator was also presented during the most recent General Assembly.



Figure 8: Carport installation at Voltec Solar car park

3 Bike port demonstrator

3.1 Tarka 110 DIAMANT production

The production of the four modules intended for installation on Voltec Solar's bicycle shelter took place at Fraunhofer ISE (Freiburg, Germany) in October 2025.

The BOM was based on the materials and components used in the bifacial Tarka 110 DIAMANT modules, with the addition of either a CSEM-developed UV-downshifting (UV-DS) front encapsulant or a standard front encapsulant. All modules also incorporated a TOPCon shingled cell matrix developed by Fraunhofer ISE.
A specific spacing between the shingled cells was required to ensure the bifacial functionality of the modules.

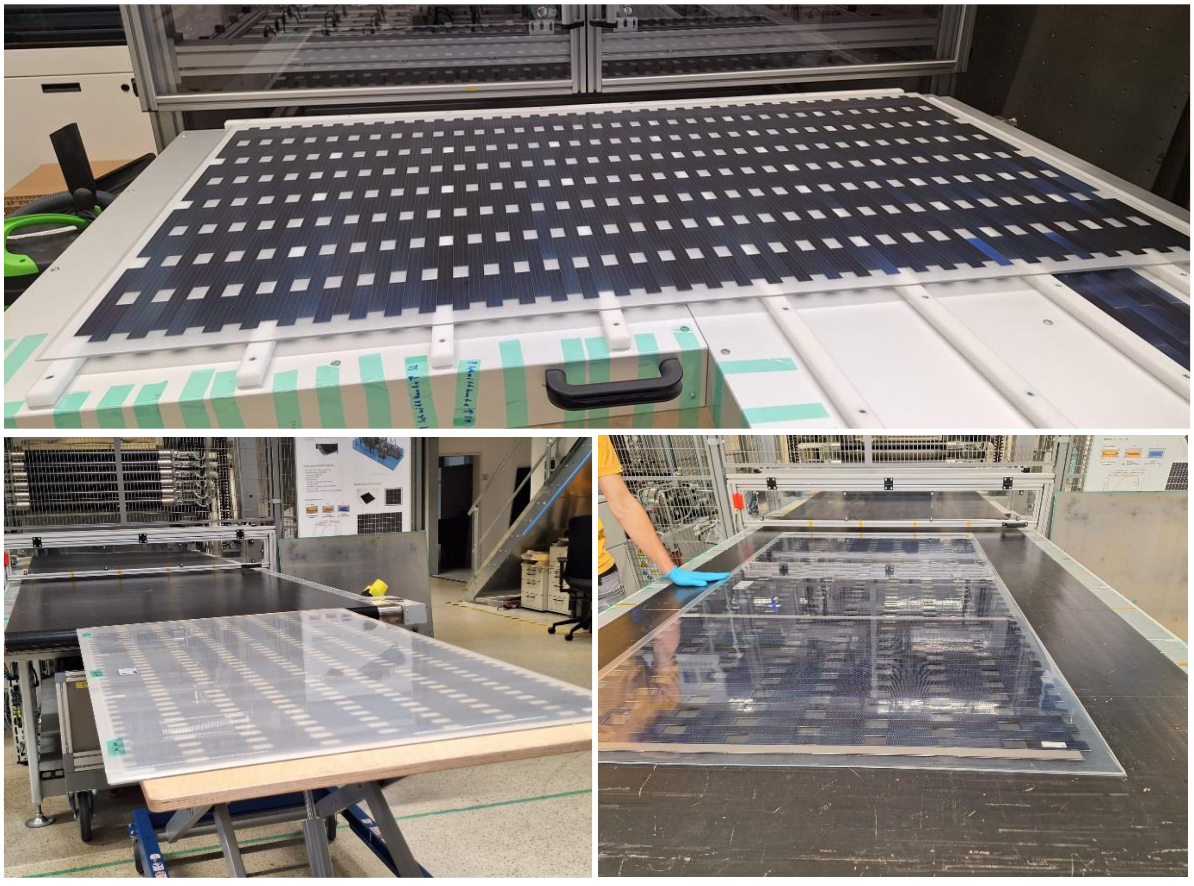


Figure 9: Panel assembling at Fraunhofer-ISE, using matrix shingle and UV-DS encapsulant

Of the four modules produced, two incorporated the UV-DS encapsulant, while the other two were manufactured without it.

3.2 Module production

The four photovoltaic modules were intended to replace the existing sheet-metal roof of Voltec Solar's bicycle shelter. Once the original metal roofing had been removed, the modules were installed to cover the entire shelter structure.



Figure 10: Bike port installed at Voltec Solar car park

As with the carport demonstrator, monitoring of the modules' electrical power output will be handled by the company responsible for the carport installation. The necessary monitoring equipment and access to the corresponding data will be provided to Voltec Solar once the photovoltaic modules have been electrically connected.

4 Acknowledgement

The author(s) would like to thank the partners in the project for their valuable comments on previous drafts and for performing the review.

Project partners:

#	Partner short name	Partner Full Name
1	VOL	VOLTEC SOLAR
2	ETW	ETWAY S.R.L.
3	HLP	HELIUP
4	M10	M10 INDUSTRIES AG
5	UNR	UNIRESEARCH BV
6	Fraunhofer	FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG EV
7	ICARES	ICARES CONSULTING
7.1	BI	BECQUEREL INSTITUTE FRANCE
7.2	BIE	BECQUEREL INSTITUTE SPAIN
8	CEA	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
9	FSUNS	Freesuns SA
10	CSEM	CSEM CENTRE SUISSE D'ELECTRONIQUE ET DE MICROTECHNIQUE SA - RECHERCHE ET DEVELOPPEMENT
11	EPFL	ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE
12	SOP	SOPREMA

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This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101136094. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.