Seamless-PV

Result summary #4

July 2025

Seamless-PV drives the implementation of new integrated photovoltaic (IPV) solutions in different market sectors. The objective is to develop advanced manufacturing equipment, processes and digitalisation strategies focusing on glass-glass lamination as well as lightweight composite and polymer-based technologies.

Facing at real industrial environments and different market demands and opportunities, Seamless-PV sets up six pilot line levels and 11 different IPV demo cases across Europe, divided between integration in noise barriers, buildings, electric vehicles, and agriculture.

Photovoltaics in Infrastructures: Unlocking new potential

In the report "*IPV market potential and comparative long-term impact scenarios*", the Becquerel Institute has analyzed the potential of Infrastructure-Integrated-Photovoltaics (IIPV) across Europe. This segment is further divided into two relevant subcategories: PV carports and PV noise barriers (PVNB). The assessment was conducted using a "top-down" approach, considering the characteristics of IPV market segments and basing evaluations on costs, competitiveness levels, and ambitious project performance goals. This analysis looks at both short- and long-term visions (up to 2050) under various scenarios that illustrate market and regulatory conditions.

▲ *Examples of IIPV applications*

The methodology is divided into two main sections:

Technical Potential

This identifies all surfaces that could be utilized by photovoltaics.

Gross Technical Potential considers all exploitable surfaces for an IPV application.
Realistic Technical Potential excludes surfaces that are not permitted or are subject to technical constraints.

Economic Technical Potential excludes surfaces that are not economically attractive, such as those with low photovoltaic yield.

Specific Market Potential (SAM)

This takes into account the specific characteristics and limitations of IPV technology. It uses the innovation diffusion model (S-curve) to describe the pattern and speed of innovation adoption in the market. The Total Addressable Market (TAM) represents the maximum potential, while the SAM is the accessible and relevant portion of the TAM, considering limitations such as regulation and geographical area.

Market Potential Analysis for PV Carports

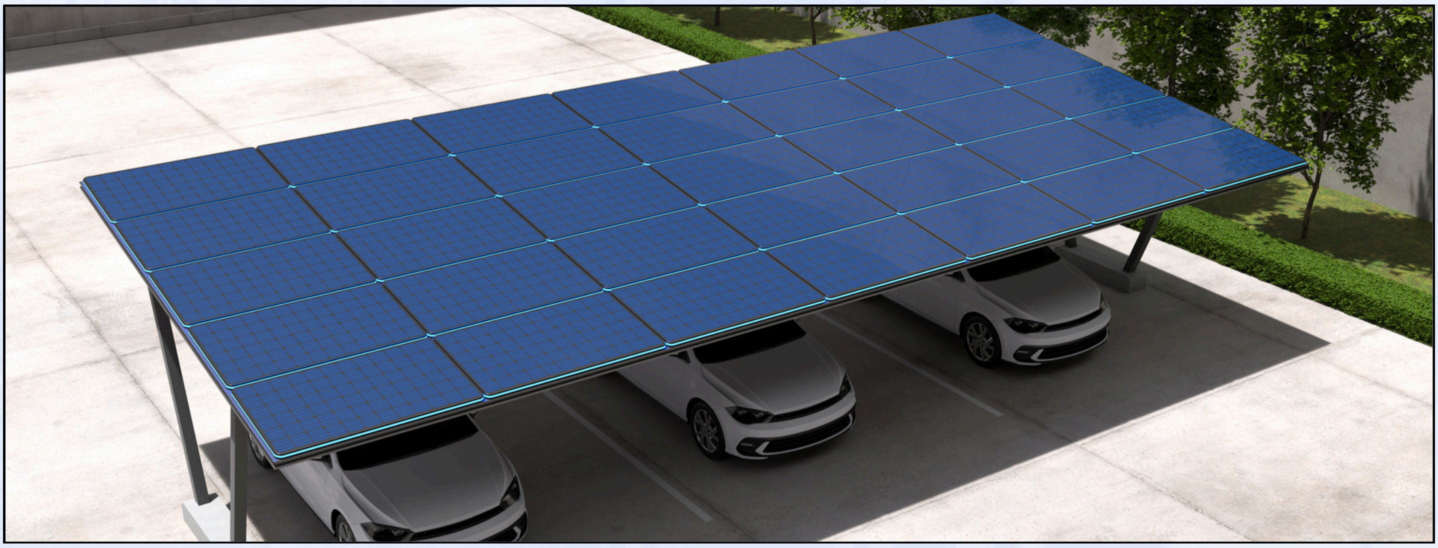
PV carports are considered a promising application that is gaining momentum in Europe. Their evaluation is based on two sub-segments: commercial and residential.

Commercial Carports

The **gross technical potential** was extrapolated from results obtained in Germany to the rest of the EU, UK, and Switzerland, based on car ownership rates. An area coverage factor (42.2%) was used to account for the share of parking lots with carports. A shading factor further reduced the surface area. For the **SAM**, a country-level regulatory suitability factor was applied, defining two scenarios: a "High" (optimistic, with strong regulatory support like in France) and a "Low" (conservative, "business-as-usual") scenario.

Residential Carports

Potential was estimated using the number of single-family homes and an average area of 15 m^2 per carport. A realistic suitability factor (35% of single-family homes with carports) was applied.
A solar suitability ratio (56.5%) excluded areas with low irradiation. The SAM applied a country-level market suitability factor to determine the share of TAM likely to adopt PV carports versus standard ones.



Key Results for PV Carports

The PV carport segment is set to grow significantly, even in the "Low" scenario. This growth is supported by a favorable regulatory environment for renewables, policies mandating solar integration in large parking lots (e.g., France), and the rapid growth of electric vehicles (EVs), which creates a strong synergy with PV systems for charging stations.

Annual commercial carport installations are projected to peak around 2045 in the "High" scenario.
Residential carports will remain a smaller part of the market, driven mainly by personal preferences rather than regulatory conditions.

Estimated Cumulative Capacity (SAM):

- By 2030: between 10.7 GW (Low scenario) and 13.1 GW (High scenario).
- By 2050: between 56.8 GW (Low scenario) and 102.2 GW (High scenario).

The significant difference between scenarios highlights the importance of regulatory support for the expansion of PV carports.

Market Potential Analysis for PV Noise Barriers (PVNB)

PV noise barriers offer a dual benefit, combining noise reduction with renewable energy generation. Currently, PVNB installations are limited to a few countries (mainly Germany, Switzerland, Netherlands, Austria, Italy, France) with a **total capacity of 13.7 MW** as of 2022. Despite successes (e.g., the Solar Highways project in the Netherlands), adoption has been limited by organizational barriers, technical regulations, and design considerations.

Methodology

The technical potential was based on a Joint Research Centre (JRC) study that identified a potential of **403 GWp of vertical PV** along highways and railways in the EU, excluding protected or unsuitable areas like tunnels and bridges. For PVNB, an effective height of 3 meters was used.

The Total Addressable Market (TAM) is defined as the cumulative potential if PV were installed in all existing and future noise barriers up to 2050, based on limited data on their extent in Europe.
The Specific Market Addressable (SAM) applied a country-level regulatory suitability ratio to assess the realistic share of TAM that could be implemented with PV. Two scenarios were defined: a "High" (with strong regulatory impetus) and a "Low" (business-as-usual) scenario.

Key Results for PV Noise Barriers

The estimated surface area of noise barriers for 2024 and 2050 represents a very small fraction of the overall technical potential for vertical PV along transport infrastructure. Roadside noise barriers constitute the majority of current installations. Significant growth is expected compared to the current installed capacity in both scenarios. The Cumulative Capacity (SAM) is estimated as follows:

- By 2030: between 29.1 MW (Low scenario) and 34 MW (High scenario).
- By 2050: between 212.5 MW (Low scenario) and 371.8 MW (High scenario).

Despite the potential, the impact of PVNB remains relatively smaller compared to other IIPV applications like carports, although it aligns with EU environmental and health objectives.

LEARN MORE

If you want to learn more, check out all the **materials** and **results** available on **seamlesspv.eu**

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