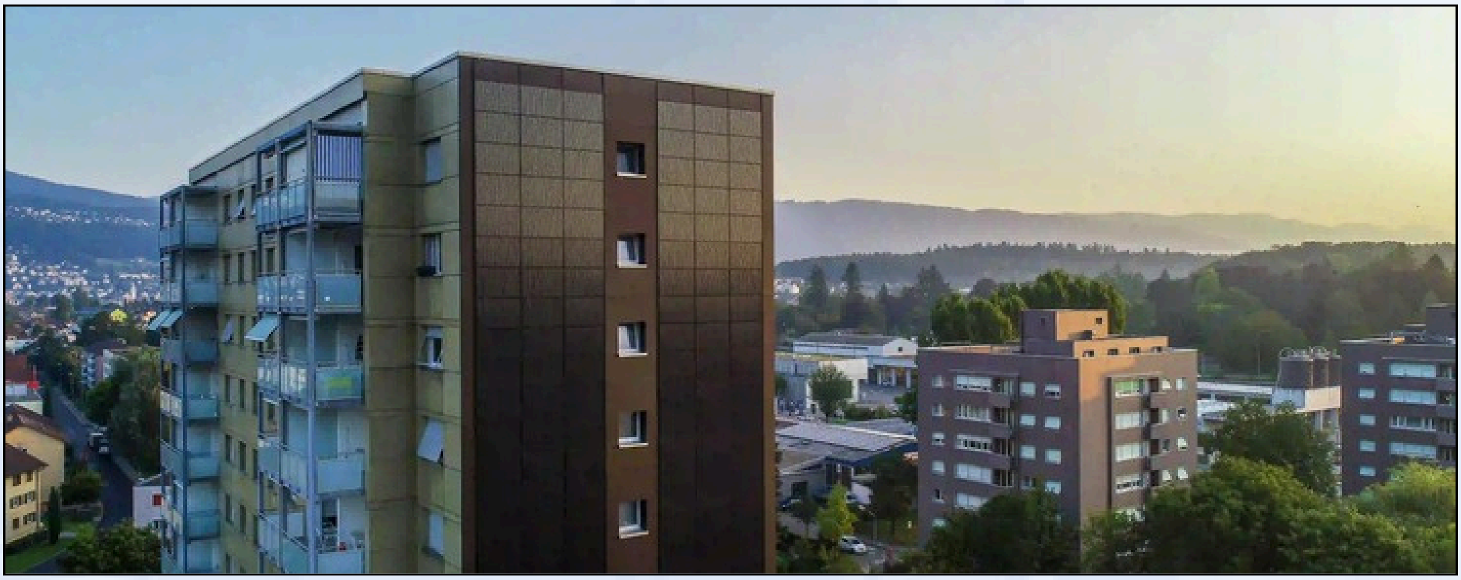
Seamless-PV drives the implementation of new integrated photovoltaic (IPV) solutions in different market sectors. The objective is to develop advanced manufacturing equipment, processes and digitalisation strategies focusing on glass-glass lamination as well as lightweight composite and polymer-based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

Market potential of Building-Integrated PV

Becquerel Institute, a key partner of the Seamless-PV project, has conducted an assessment of BIPV market potential in Europe inside the report "*IPV market potential and comparative long-term impact scenarios using a supply-side approach*". The report analyzes the available surface area in the building stock that can be integrated with photovoltaics. It's crucial to note that BIPV installations are limited to periods of new construction or building renovation.



▲ *Example of BIPV application*

The methodology is divided into two main sections:

Technical Potential

This initial phase evaluates all surfaces on buildings that could be exploited by photovoltaics, without initially distinguishing between BIPV and Building Applied Photovoltaics (BAPV) systems.

- Gross Technical Potential: Includes roof and facade surfaces for every building type in the EU, (puls Switzerland, and the UK), based on building stock data and including potential generated from new construction and renovations up to 2050. Two renovation rate scenarios were developed: "No renovation wave" (business-as-usual scenario) and "Renovation wave" (with a significant increase in renovations).

- Realistic Technical Potential: Reduces the gross potential by considering architectural limitations and obstacles. For roofs, a 40% reduction is applied (for chimneys, passages, etc.). For facades, the reduction is approximately 35%, also excluding window areas.

- Economic Technical Potential: Excludes areas with insufficient photovoltaic yield due to unfavorable orientation, inclination, or shading. For roofs, a solar suitability ratio of 56.5% was considered, while for facades, it ranges from 14% to 33%, with an average of 27%.

Specific Market Potential

This section considers the specific characteristics and limitations of the IPV application (BIPV only). The innovation diffusion model (S-curve) is applied to estimate the adoption rate.

- Total Addressable Market (TAM): Represents the maximum achievable potential for BIPV, limited by new construction and renovations between 2024 and 2050.

- Serviceable Addressable Market (SAM): Refines the TAM by considering regulatory and market suitability factors. The regulatory suitability factor, based on expert analysis, ranges from 60% to 90% for roofs and 3% to 17% for facades. The market suitability factor, which assesses BIPV's competitiveness compared to BAPV, ranges from 4% to 50% for roofs and approximately 85-96% for facades.

▲ *A pilot BIPV facility in Florence (IT)*

BIPV Market Potential Results

Technical Potential:

- The gross European technical potential for BIPV was approximately 64,000 km^2 in 2024.
- In the gross technical potential for PV on buildings, 69% comes from the residential sector and 43% from facades.
- After reductions from realistic and economic technical potentials, the estimate of the cumulative potential until 2050 is equivalent to 16,416 km^2.

Specific Market Potential (TAM and SAM):

- In the TAM, the potential for facades is significantly reduced compared to the gross technical potential due to architectural limitations and low irradiation.
- The SAM for BIPV is significantly lower than the TAM due to regulatory and market factors.
- The document indicates that annual peaks in BIPV installations will not be reached before 2050 in any scenario, suggesting continuous growth beyond that date.

- Over 80% of the BIPV potential in the SAM comes from roofs.
- The conversion of areas into capacity (GW) uses estimated power density values: for facades, an increase from 141.3 W/m^2 in 2025 to 157.1 W/m^2 in 2050 is expected; for roofs, from 202.6 W/m^2 in 2025 to 223.6 W/m^2 in 2050.

SAM Results in GW (Cumulative Potential):

- By 2030, BIPV could reach a total cumulative capacity of 15.1 GW in the "No renovation wave" scenario and 17.1 GW in the "Renovation wave" scenario.
- By 2050, the total cumulative potential rises to 91.7 GW in the "No renovation wave" scenario and 137 GW in the "Renovation wave" scenario.

Comparison with Other Studies

The potential estimated in this work aligns with recent trends:

- Compared to the study *Technical potential for photovoltaics on buildings in the EU-27 (2012)*, which estimated a suitable area of 4,979 km^2 for existing buildings only, our work includes new constructions and renovations, leading to a cumulative potential value in the SAM of approximately 100 GWp by 2050, offering a more realistic view of expected market dynamics.
- In contrast to the BIPVBOOST report (*BIPV market and stakeholder analysis, 2019*) which projected an annual market of over 1 GWp for France and Germany, it assessed a potential annual market of between 1.5 and 2 GWp for all of Europe. This discrepancy is attributable to a more realistic assessment of the slow evolution of the BIPV market, based on more recent data.

Role of BIPV in European Climate Goals

BIPV is a fundamental piece for achieving EU climate goals:

- It will contribute modestly but significantly (about 2.5-2.8%) to the indicative target of 600 GW of photovoltaics by 2030 under REPowerEU.
- It can represent an 81-86% reduction in carbon emissions (gCO_2/kWh) compared to electricity drawn from the grid.
- It is positioned as a key material for building renovation and construction to achieve Nearly Zero-Energy Buildings (NZEB) targets and aligns with the "Renovation Wave" initiative. Its dual functionality offers an aesthetically pleasing alternative to conventional materials, optimizing available surface area for electricity generation.

Wrapping up the conclusions of Becquerel's study, BIPV shows significant potential and expected exponential growth up to 2050, supported by the growing need for renewable energy and its ability to integrate seamlessly into the built environment. Its development will depend on continued policy support and technological improvements, which will ensure its crucial role in Europe's renewable energy strategy.

LEARN MORE

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

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