Market potential of BIPV in Europe

Damien Gautier

Becquerel Institute

d.gautier@becquerelinstitute.eu

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Canton de Berne

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Becquerel Institute at a Glance

- Est. 2014 in **Belgium**
- Est. 2022 in **France**
- Est. 2023 in **Spain**
- Est. 2025 in **Italy**
- Focused on **solar PV and its related ecosystems** (storage, electro mobility, buildings)

Strategy Consulting

Applied Research

Technical Assistance

Downstream actors

TotalEnergies, EDF renouvelables, WÄRTSILÄ, innogy, BayWa r.e. renewable energy

Upstream actors

posco, SAINT-GOBAIN, ArcelorMittal, GSE Intégration

Associations

ETIP Photovoltaics, IEA PVPS, REN21 Renewable Energy Policy Network for the 21st Century, eit InnoEnergy

Research projects

VIPERLAB, BIPV boost, ProLight, Seamless-PV, IBC4 EU, NEXUS, SERENDIPV, VALHALLA, PROMISE

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The Seamless-PV project

Seamless-PV

Result summary #2

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.

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%.

- Horizon Europe project (2023–2026) to enable seamless integrated PV (IPV)
- Develop advanced, flexible, automated PV manufacturing based on high-efficiency c-Si
- Pilot and demo in real use cases (buildings, vehicles, infrastructure, agriculture)
- Deliver market-ready IPV products meeting efficiency, competitiveness and standards

Seamless-PV

Funded by the European Union

This work has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101096126

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BIPV applications

Roof applications:

Simplified BIPV

@GSE Intégration

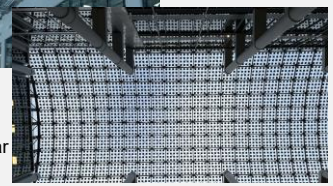
Discontinuous BIPV roofing

@Freesuns

@SunStyle

Skylights

@Onyx Solar



@Metsolar

Façade applications:

Curtain wall façade

@Onyx Solar

Rainscreen façade

@Solarnova

Insulating façade cladding

@PIZ

Balustrades, balconies and other accessories

@Ertex Solar

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BIPV applications

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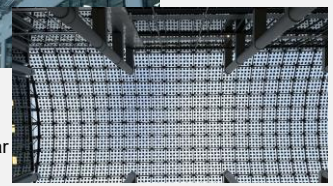

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The Seamless-PV project

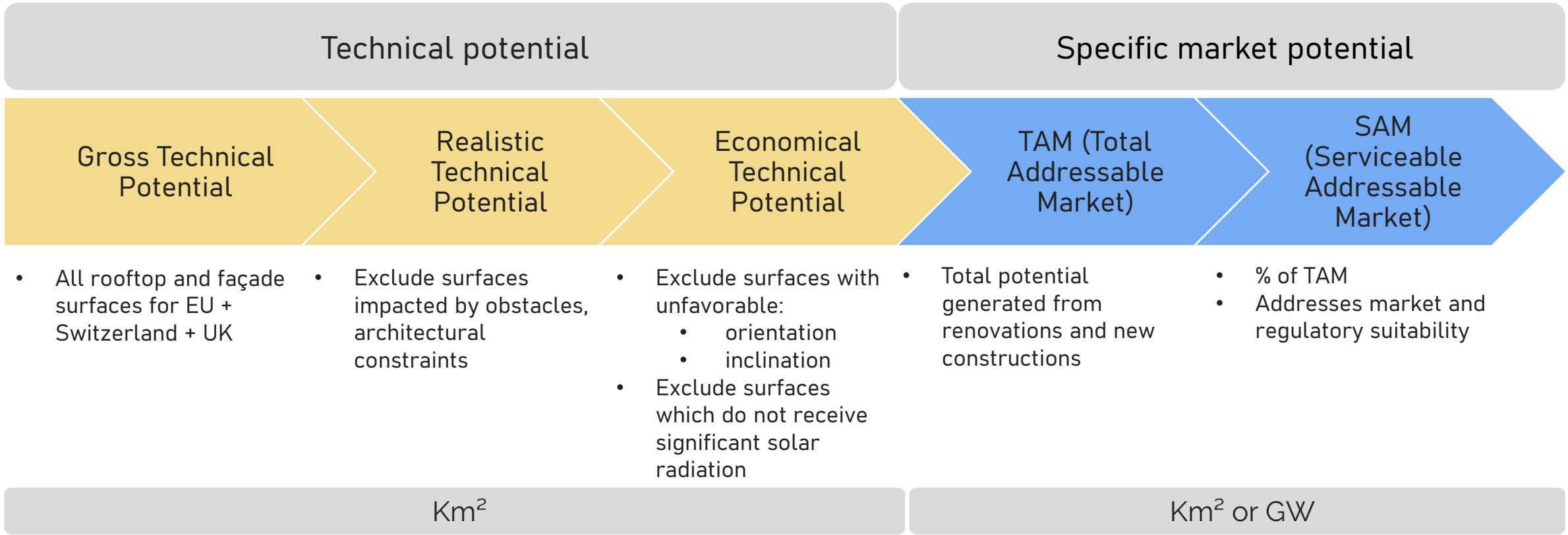
1 | **Methodology** – study design and scope

2 | **Technical potential** – quantifying Europe's building surfaces

3 | **Specific market potential** – BIPV potential scenarios

4 | **Conclusions**

Becquerel Institute at a Glance



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Converting buildings to viable surface area

Gross technical potential

- **Baseline and scope:** EU + UK + CH; from 2020 building stock, estimate roof & façade surface
- **Projection to 2050:** New buildings + renovation rates, according to two scenarios (renovation wave, no renovation wave)

Realistic technical potential

- **Architectural suitability**:
  - Roofs: 40% for obstacles/access walkways.
  - Façades: 35% + **~30% (excluding windows)**
- **Note:** Same roof and façade ratios were applied across different building typologies

Economic technical potential

- **Solar suitability**: Keep surfaces with favourable orientation/inclination/shading
  - Roofs: ~ 56%
  - Façades: SVF-based ratios (~27%)

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Our two scenarios

- **Renovation wave:** Considering a major increase in renovation activity

  Average renovation rates in Europe 2020-2050:

  - Residential renovation rate: 2,51-2,67%
  - Non-residential renovation rate: 2,51—2,66%

- **No renovation wave:** Business-as-usual case

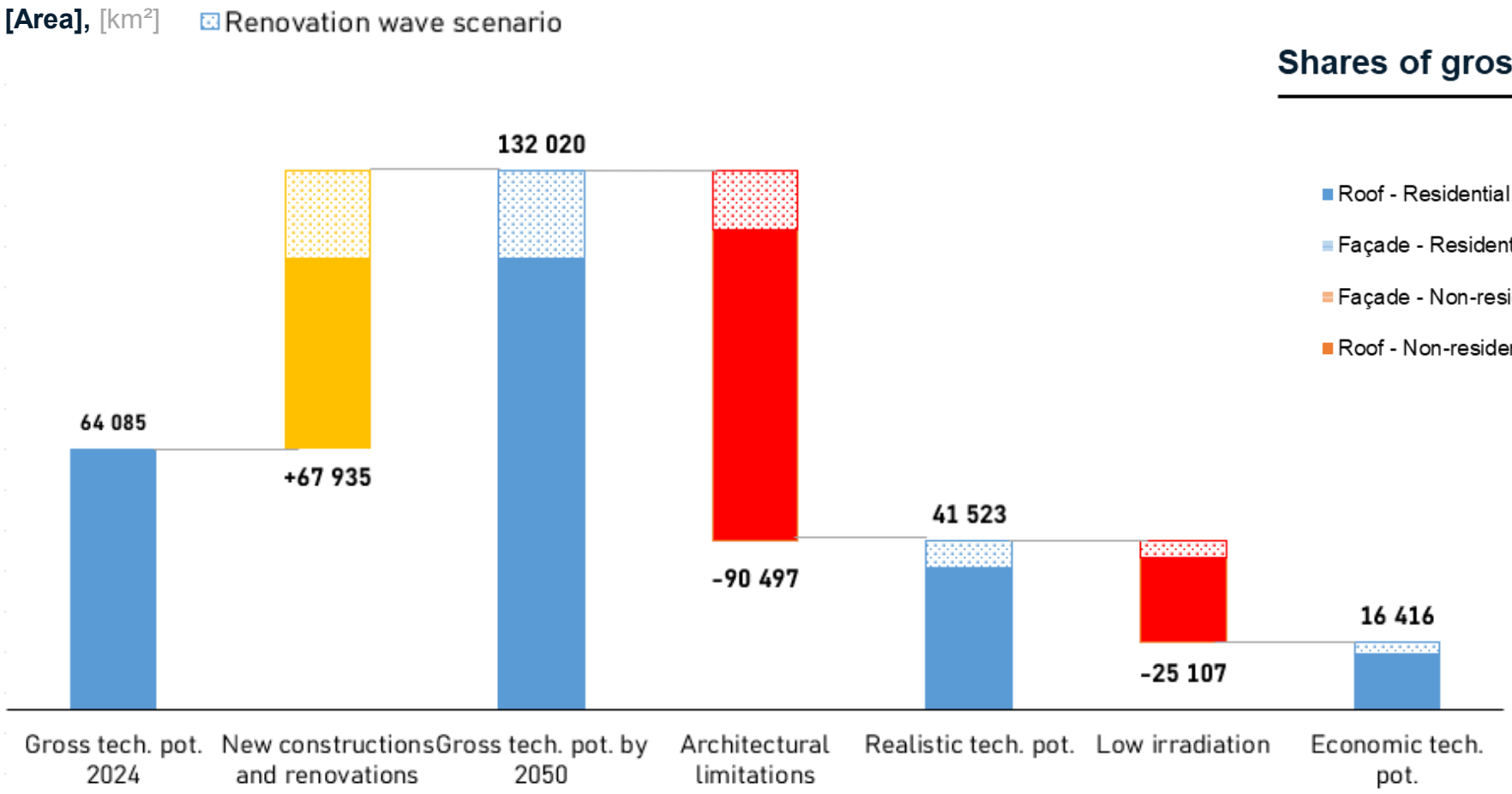
  Average renovation rates in Europe 2020-2050:

  - Residential renovation rate: 1,10-1,19%
  - Non-residential renovation rate: 1,64-1,72%

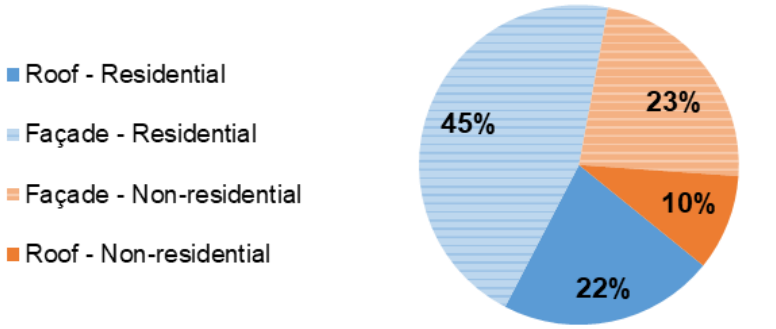
Note: *The new construction and demolition rates used were the same in both scenarios*

Technical potential for PV on buildings by 2050

Technical potential for BIPV in Europe by 2050



Shares of gross technical potential in 2024



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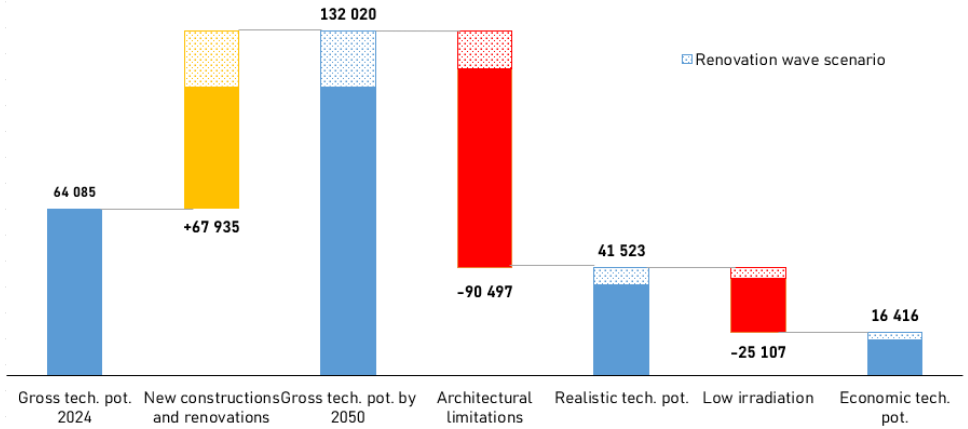
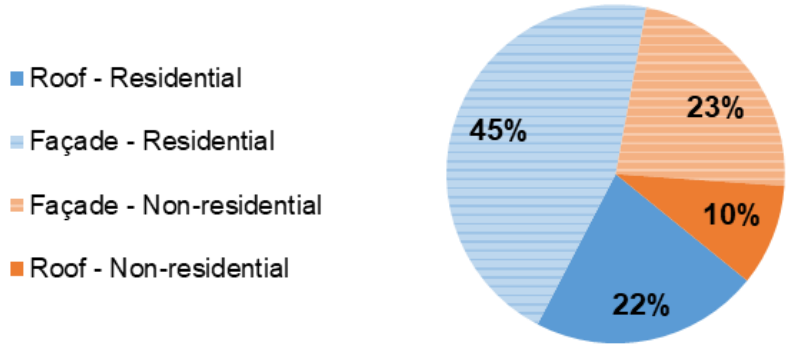
Technical potential for PV on buildings by 2050

Technical potential for BIPV in Europe by 2050



Shares of gross technical potential in 2024



- The gross technical potential for PV on buildings is over **64 000 km²** in **2024**
- **Façades** comprise **over 2/3 of the gross technical potential**
- **Renovation and new construction** activity up to 2050 increase this potential significantly
- **Architectural suitability and solar suitability ratios** reduce the potential for PV on buildings, leaving **~12% of the initial potential**

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From PV on buildings to building integrated

Total Addressable Market (TAM)

- **Definition:** Maximum potential for a product in a defined market
- BIPV-specific potential, limited to new constructions and renovations

Serviceable Addressable Market (SAM)

- **Definition**: Slice of the market that BIPV can actually serve, considering factors like geography, customer segments and regulations
  - **Regulatory suitability factor:** Share of the TAM that is realistically “solarised” by codes, mandates and permitting in each country
  - **Market suitability factor**: Likelihood that a solarised surface uses BIPV instead of BAPV

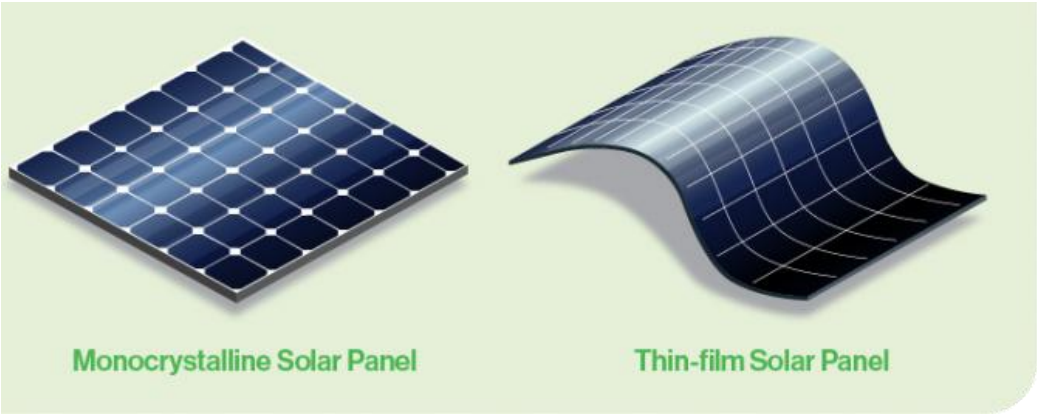
Result

- The output of the SAM feeds into the **S-curve model** to consider adoption dynamics
- Results are annual & cumulative values per scenario

Capacity conversion

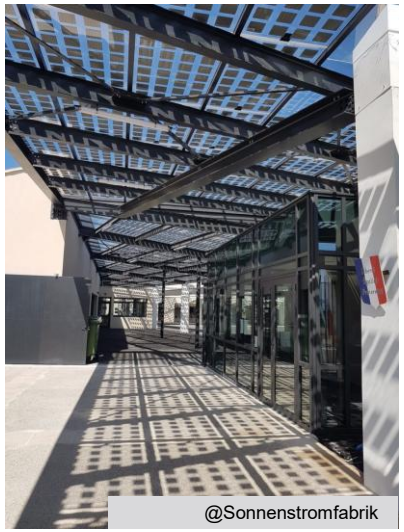
Area values were converted to capacity based on projected module efficiency, considering:

- Surface type
- Cell technology
- Semi transparency



[Power density], [Wp/m²]

	Façade	Roof
2025	141,3	202,6
2030	145,7	208,8
2040	151,6	216,6
2050	157,1	223,6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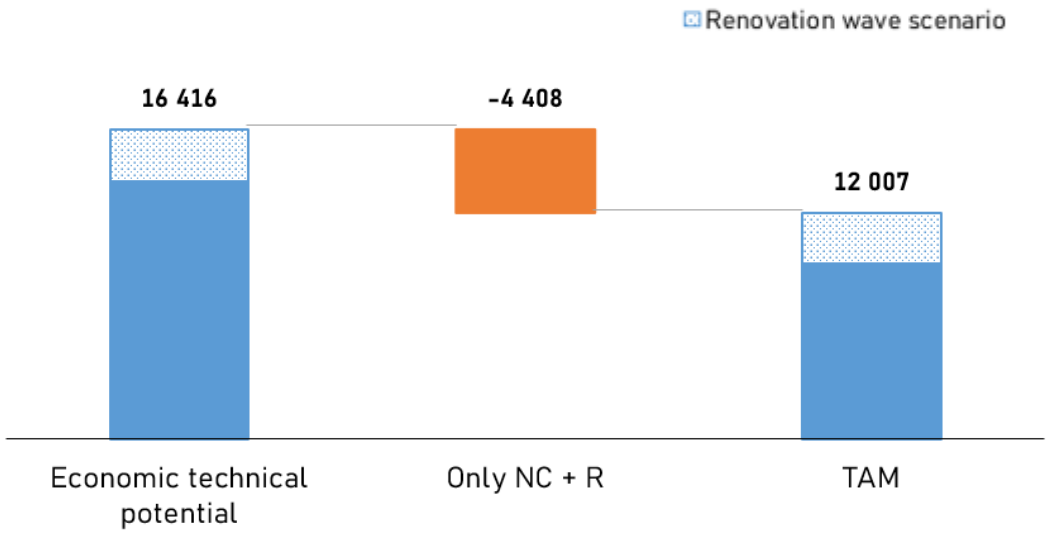
BIPV specific market potential - TAM

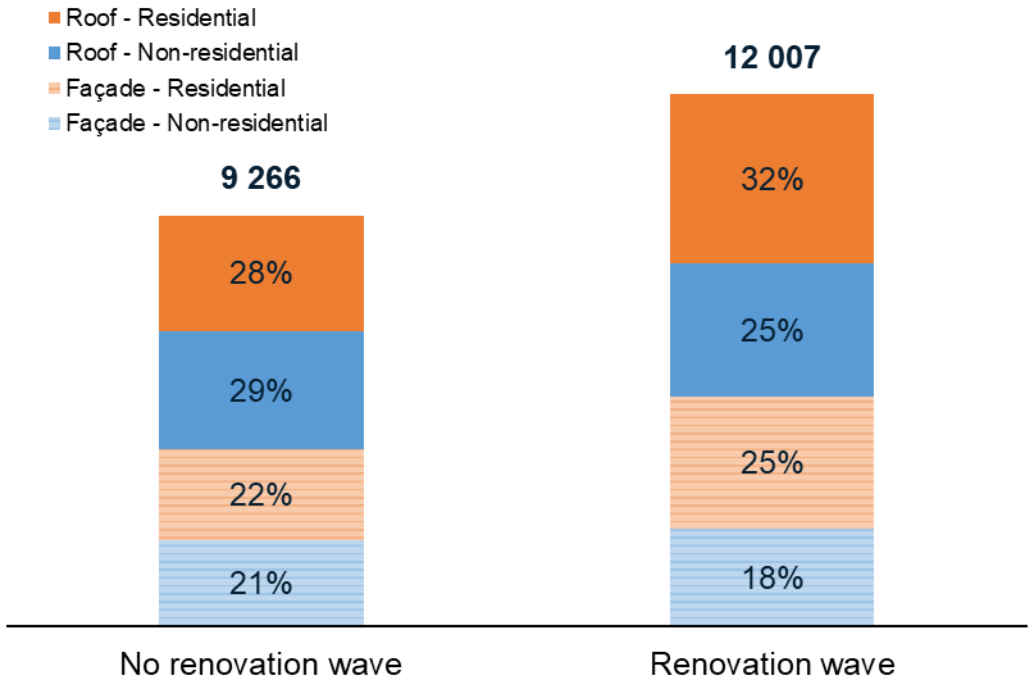
BIPV Total Addressable Market (TAM) by 2050

[Area], [km²]



Shares of TAM by 2050 in different scenarios

[Area], [km²]



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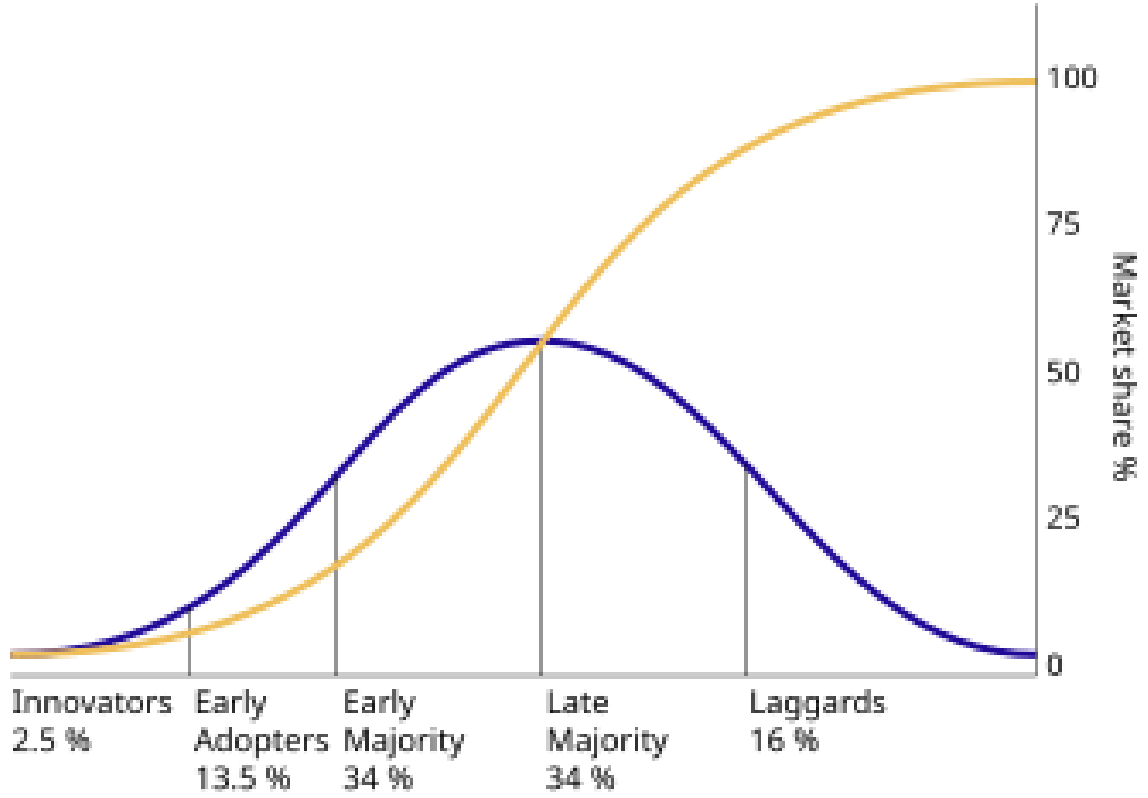
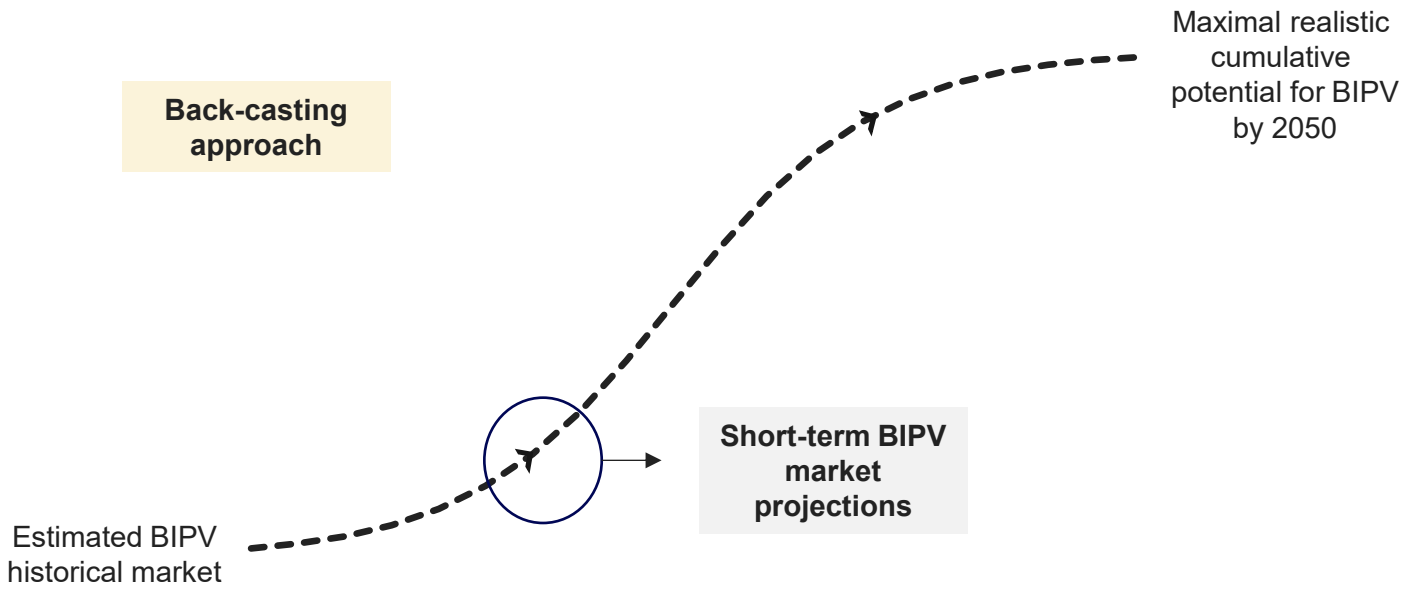
The diffusion of innovations model (S-curve)

- An **S-curve model** explains how innovations spread overtime.
- Adoption starts slow, accelerates after take-off as awareness builds, and plateaus as it approaches the market ceiling
- It captures social spread: uptake grows as people see others adopt and results become visible
- Fits finite markets where adoption eventually saturates the pool of potential adopters



The diffusion of innovations model (S-curve)

The S-curve model

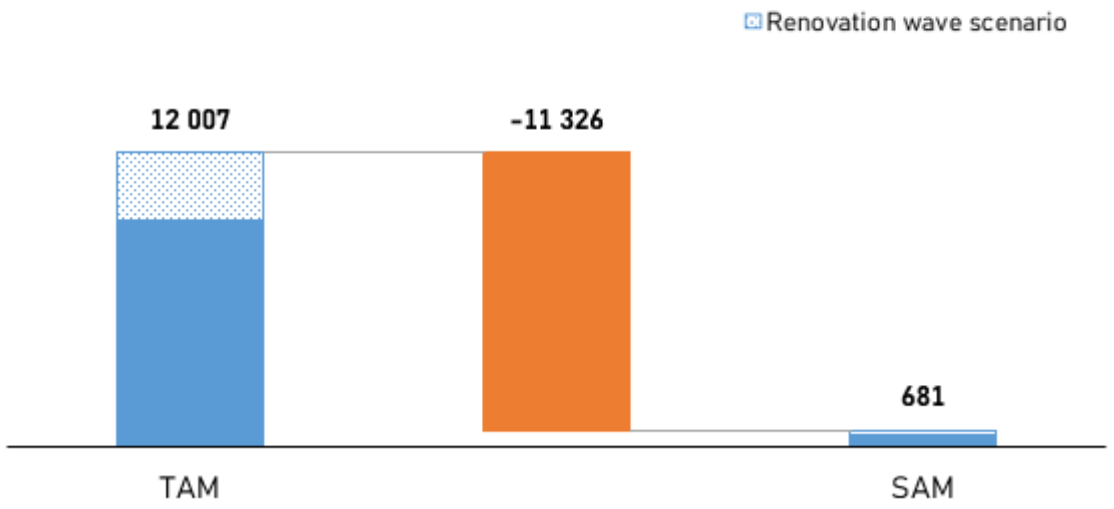


- **Inputs:**
  - Ceiling: SAM output
  - Adoption rate: Calculated based on BIPV historical capacity + Becquerel Institute's short-term forecast
- **Scenario impact:**
  - Renovation wave: larger SAM ceiling and faster adoption rate
  - No renovation wave: Smaller SAM ceiling with moderate adoption rate
- **Output:** Annual & cumulative BIPV potential area by 2050

BIPV specific market potential - SAM

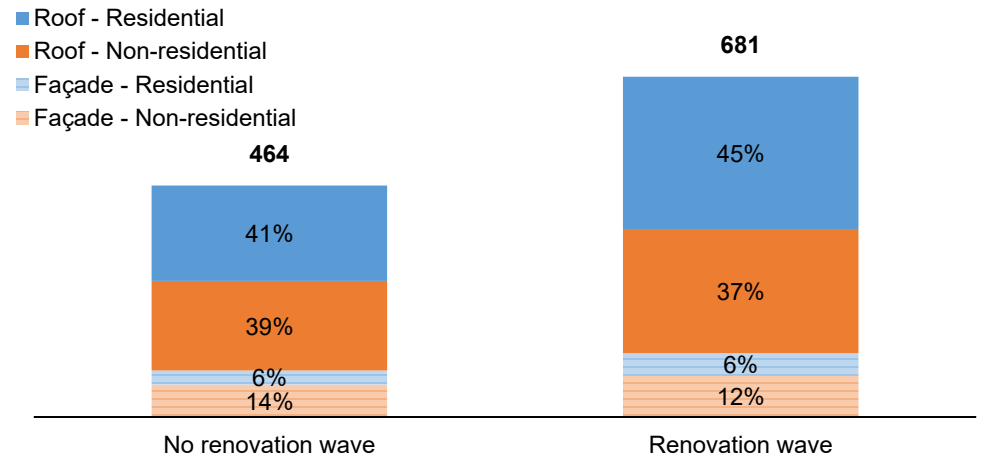
BIPV Serviceable Addressable Market (SAM) by 2050

[Area], [km²]

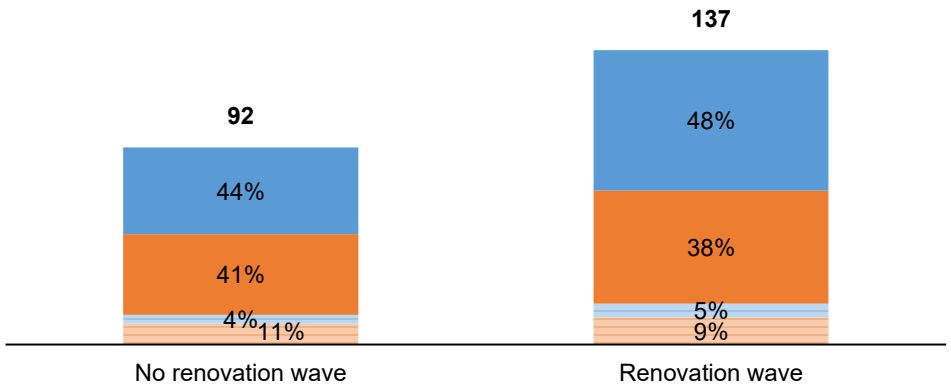


Shares of SAM cumulative potential by 2050

[Area], [km²]



[Cumulative capacity], [GW]



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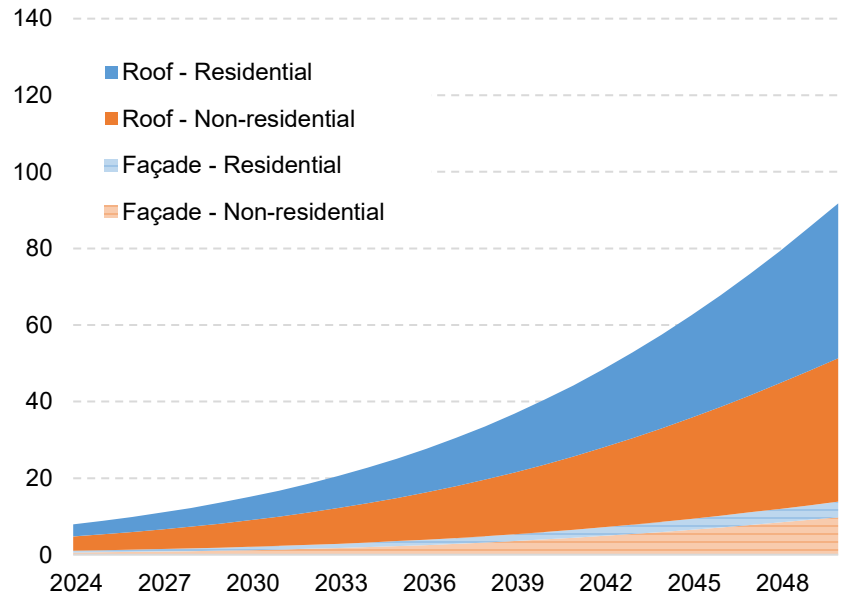
BIPV specific market potential - SAM

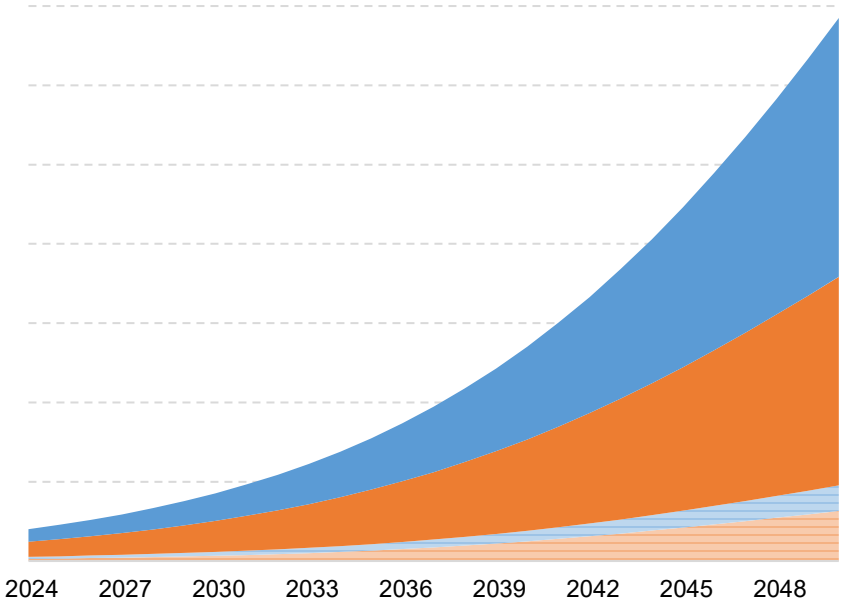
Cumulative Serviceable Addressable Market by 2050
No renovation wave scenario

[Capacity], [GW]



Cumulative Serviceable Addressable Market by 2050
Renovation wave scenario

[Capacity], [GW]



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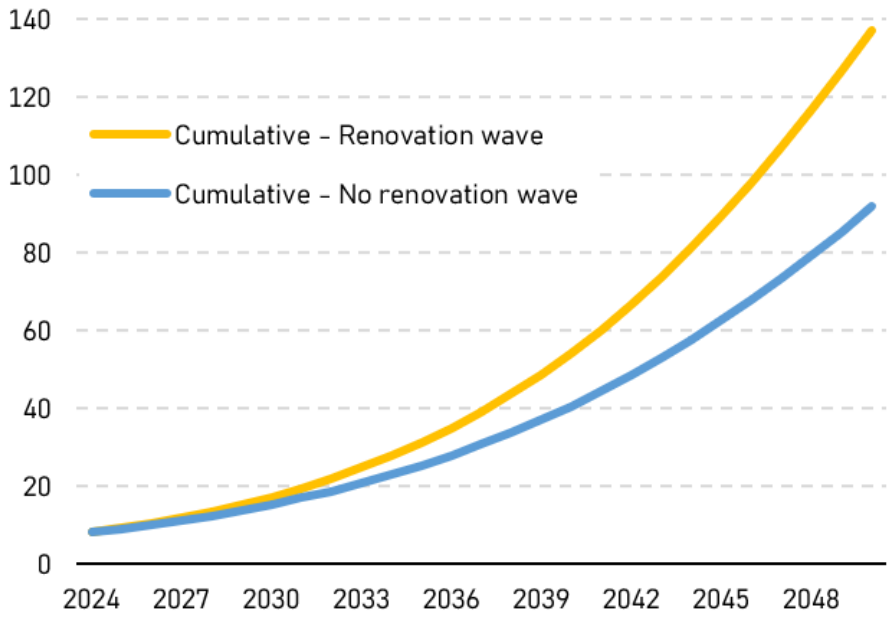
BIPV specific market potential - SAM

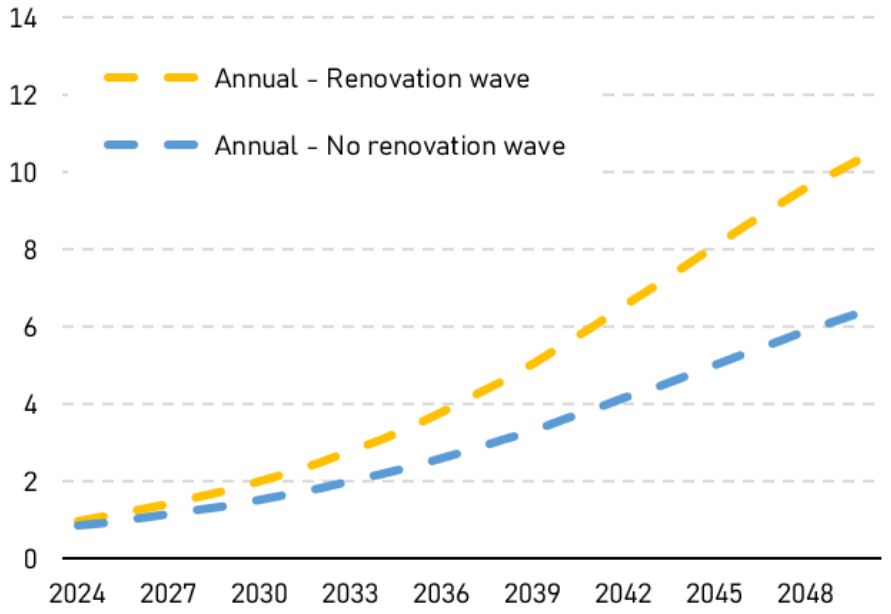
Cumulative Serviceable Addressable Market by 2050

[Capacity], [GW]



Annual Serviceable Addressable Market by 2050

[Capacity], [GW]



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Key takeaways

- The **technical potential for PV on buildings is massive**, particularly for façades
- Even with all the **reductions and constraints**, the BIPV **potential is significant**, with a Serviceable Addressable Market of over **100 GW**
- **Roofs dominate SAM potential by 2050** – Façades will remain as a focused, design-orientated niche
- An increase in **renovation activity is key** in unlocking a large part of the BIPV potential
- **BIPV** installations will not plateau by 2050 – the market size will keep **increasing year-over-year beyond 2050**