University of Applied Sciences and Arts of Southern Switzerland
Department for Environment Constructions and Design
Institute of Applied Sustainability to the Built Environment

SUPSI

The opportunity of BIPV for next generation Photovoltaics

Opportunities to achieve Carbon Neutral City

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SUPSI-ISAAC

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SUPSI-ISAAC >20 years of Photovoltaic and BIPV

- Located in **Mendrisio (Ticino)** in Switzerland, with about 55 employees organized into four main Area:
  1) Building System, 2) PV-Lab, 3) Energy system, 4) Energy-sustainability and territory
- **1982:** First grid connected PV system in Europe (TISO)
- **2004-today**: Swiss BIPV Competence center: applied-oriented multidisciplinary team, several EU founded projects
- Collaboration with industries, architects and building owners for market transfer (**TRL4 to TRL8**)
- **From 2010** we run the **www.bipv.ch** and **www.solarchitecture.ch** platforms to promote the construction of solar buildings

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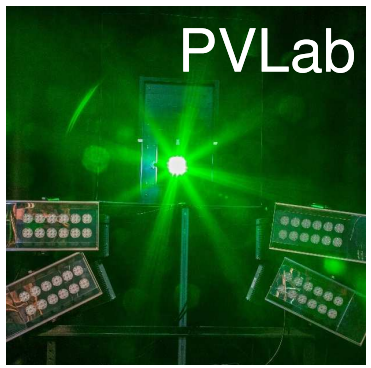
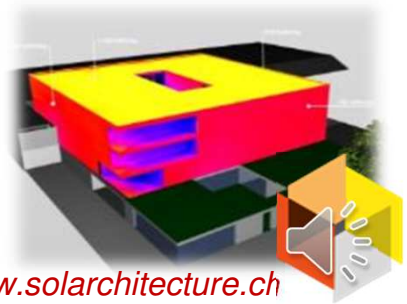
Demonstration and applied research | Test & Qualification | New Technology | Sensitization and communication



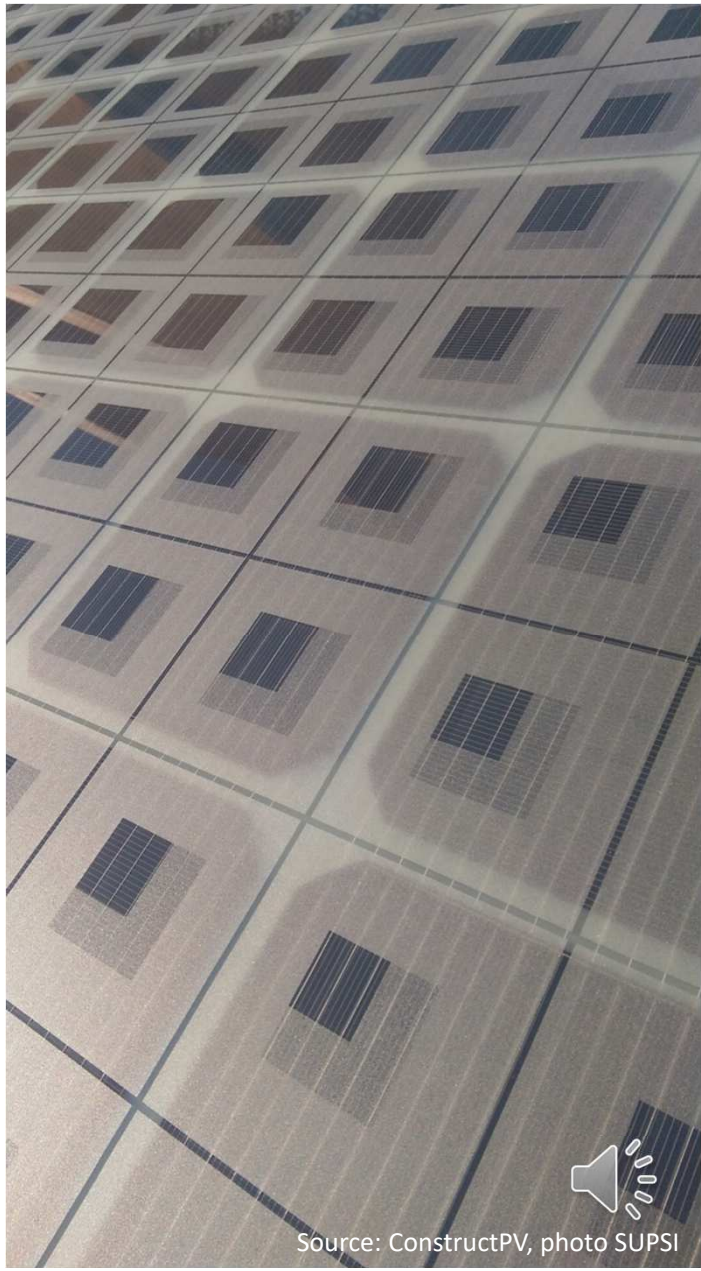


Definition of BIPV

IEC 63092-1:2020 or EN 50583 & IEA PVPS T15:

- **Photovoltaic modules are considered to be building-integrated**, if the PV modules form a construction product providing a function as defined in the European Construction Product Regulation.

- Thus, the BIPV module is a prerequisite for the integrity of the building's functionality. If the integrated PV module is dismounted (in the case of structurally bonded modules, dismounting includes the adjacent construction product), the PV module would have to be replaced by an appropriate construction product.


Source: ConstructPV, photo SUPSI

The BIPV market peaked about 10 years ago

- BIPV grew significantly from 2008 to 2011.
- This can be explained by generous support schemes for BIPHV.

Very difficult to have real market number:

In **Switzerland:**

- façade potential up to 17 TWh, 1/4 of Swiss electricity production + 50TWh for roof

Historical annual BIPV market in Europe

Source: Becquerel Institute

VARIEGATED (NEW) MARKET DEMANDS AND DESIGN COMPLEXITY

«MY PV ROOF» «AVARAGE» BUILDINGS «VALUABLE» BUILDINGS NZEB or PEB

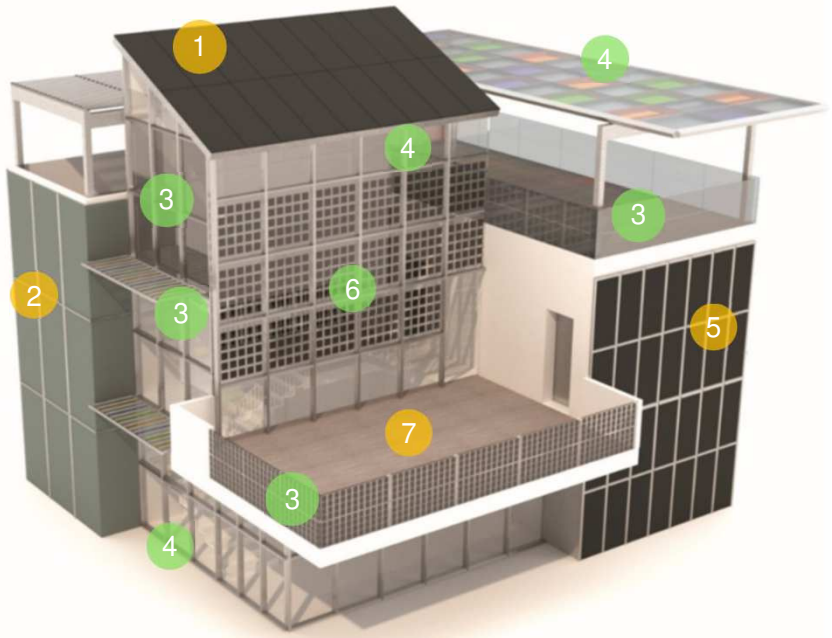
RETROFIT **NEW**

Scognamiglio A., Frontini F, "BIPV". GETTING THE TECHNOLOGY AND INTEGRATION BALANCE RIGHT, 32nd European Photovoltaic Solar Energy Conference |

High Variety of products: Mass Products vs High Value

- In the segment of **residential buildings**, cold roofs are the most common BIPV installations as also balustrades.

- In the segment of **commercial buildings**, façade BIPV systems, “external” or integrated devices are much more common, as well as BIPV skylights.
- In larger cities, where the rooftop area is a small fraction there is a major resource of solar energy falling on the **facades** → **high value solution**

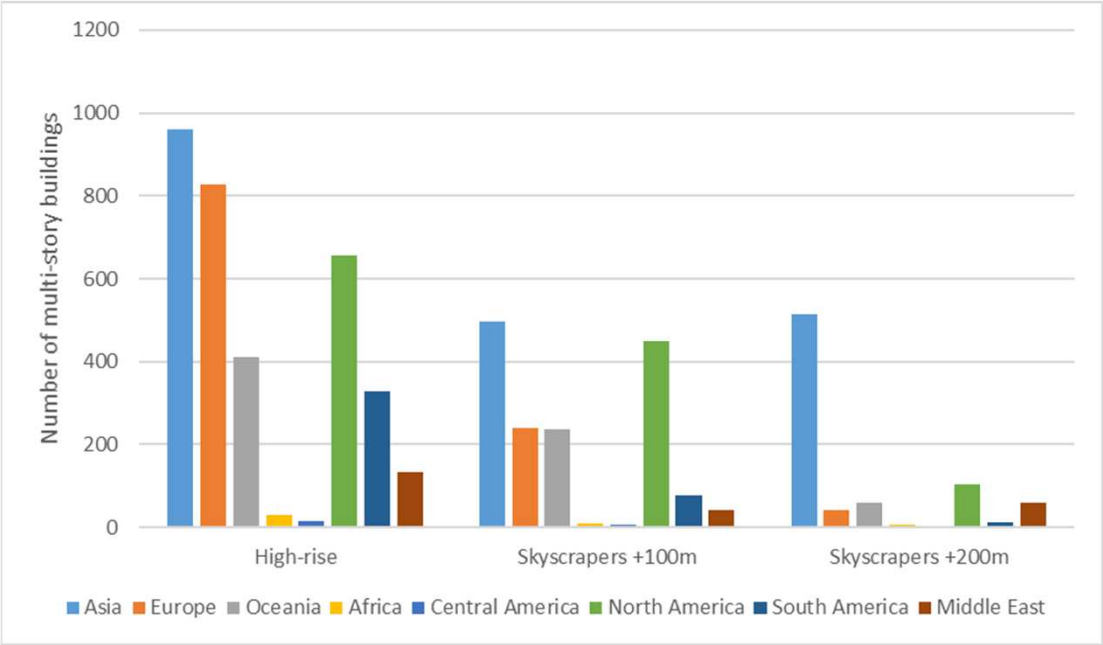


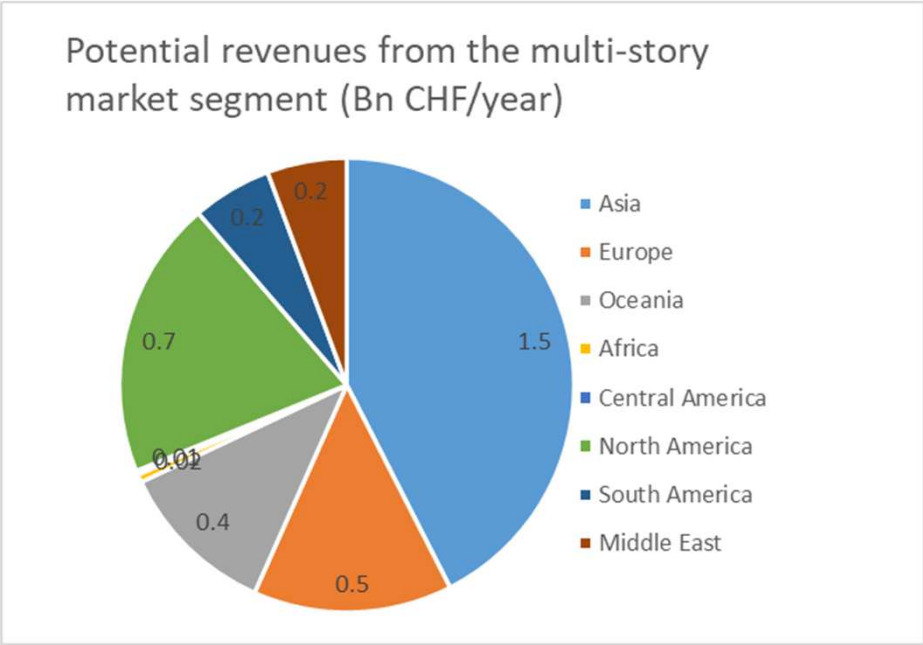
Green dots are for **high value** solutions

1. Cold roof
2. Ventilated façade
3. External integrated devices (louvers, balustrades,…)
4. Skylight or Windows
5. Prefabricated system
6. Curtain wall
7. Floors

Categorization of BIPV applications
https://iea-pvps.org/key-topics/categorization-of-bipv-applications/

Multi-story market segmentation by regions and potential revenues* for glazing facades

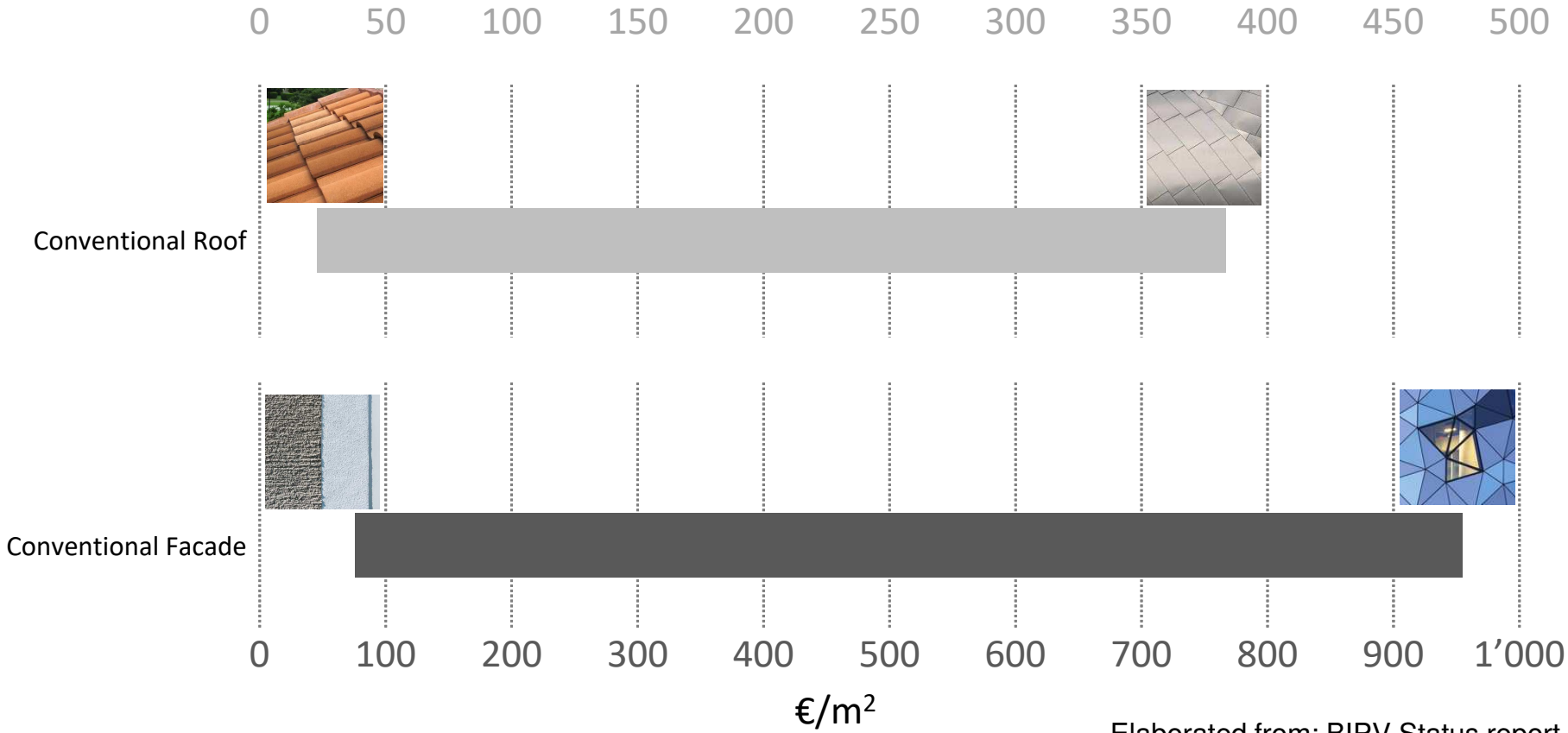




Source: SUPSI, number extrapolated by several market anaylsis and interviews with industry players

*average price 450€/sqm

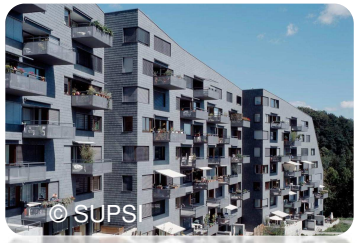
Price range of building products/systems (no PV)

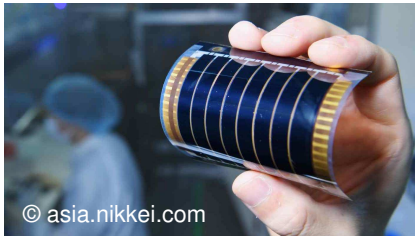


Elaborated from: BIPV Status report available at: https://solarchitecture.ch/wp-content/uploads/2021/02/BIPV_Status_Report.pdf

Challenges and opportunities for new BIPV implementation

- Articulation of the building → **geometry and shapes** + shadow resilience
- Urban area (density) → **shadow resilience**
- Vegetation in urban environment → shadows resilience + **environment protection**
- Building material compatibility → bendability, **weight**, **colour**, adhesion
- Durability & reparability/maintenance → 15-40 years depending on application, **circularity**
- Cost-effectiveness → depends on application & market





Concludions: how to win this game?

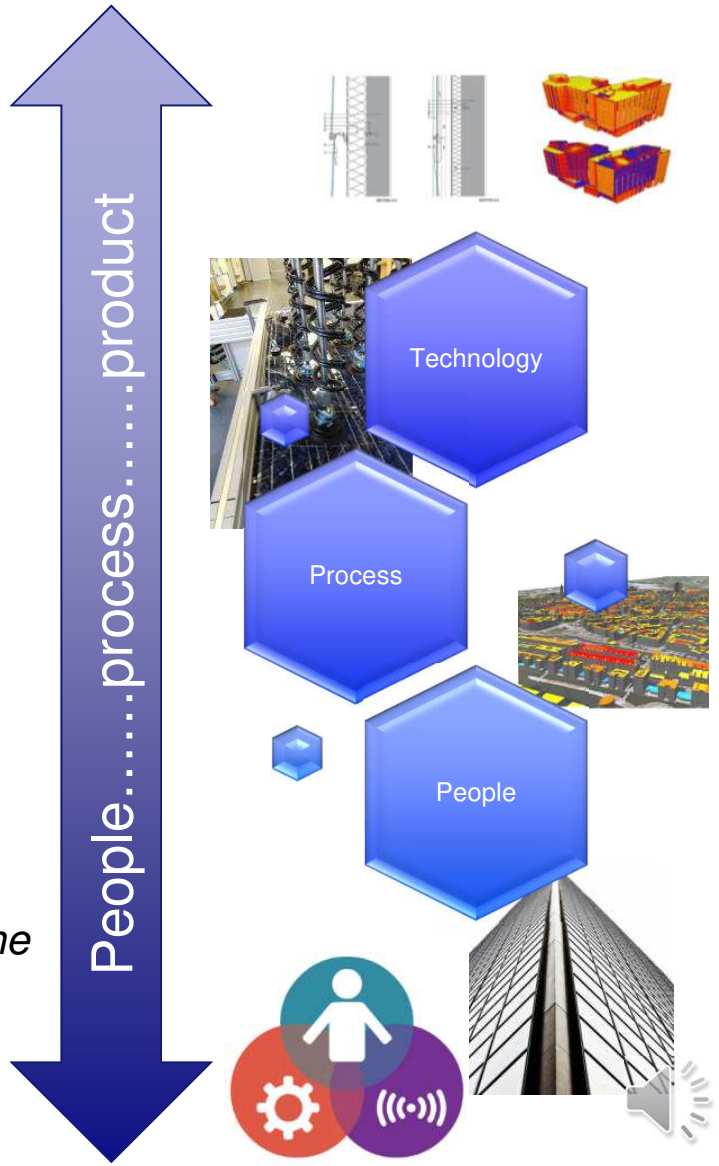
*(1) implementing a large degree of **flexibility and automation** in the manufacturing of BIPV*

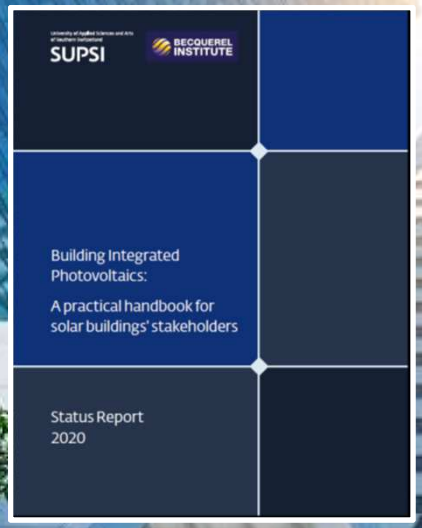
*(2) developing a range of **multifunctional** and **cost-competitive solutions** for building skins*

- *Aesthetics, dimensions, static vs dynamic solution*

*(3) defining a **qualification (measurement) process** that simplifies the standardization framework*

***(4) Digital process (BIM-based)** to enhance the collaboration throughout the value chain*





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THANK YOU FOR YOUR ATTENTION

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