



PV integration in buildings

A real-world application

“From concept to construction”

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Where
is
the PV?



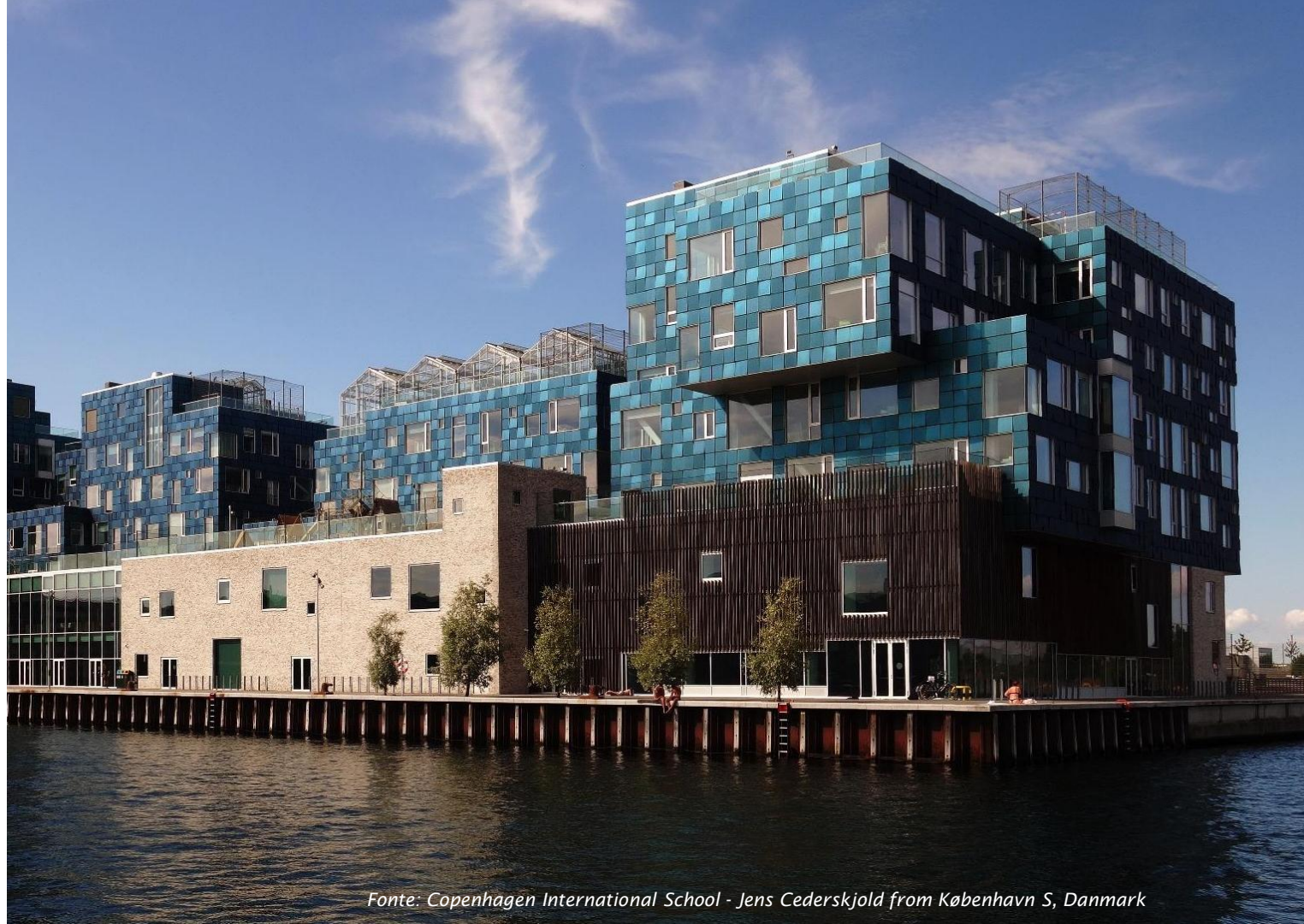
Source: SUPSI - Amsterdam Public Library. Ph: Pierluigi Bohomo

Aesthetic...
or
performance?



Source: SUPSI - Amsterdam Public Library. Ph: Pierluigi Bonomo

BIPV as
a construction
material



Fonte: Copenhagen International School - Jens Cederskjold from København S, Danmark



Vision

«I believe in an integrated solar architecture, where these energy-producing elements, are part of the solar architecture, they are part of the building..»

Lord Norman Foster

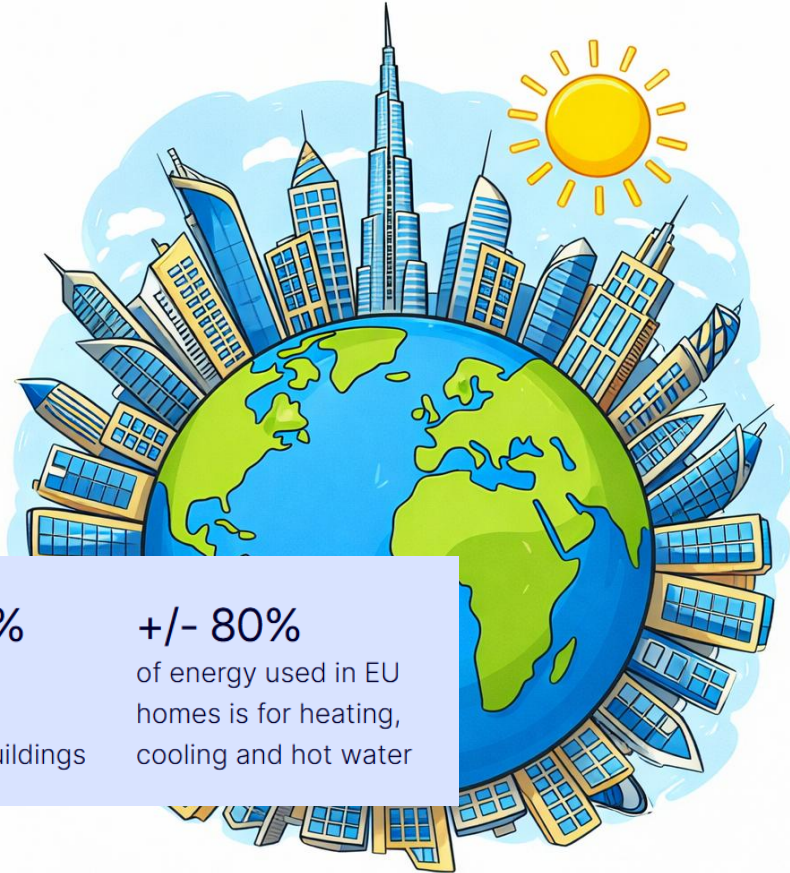
Swiss Solar Prize 2010

Why the solar architecture?

Buildings represent the largest untapped surface for on-site renewable energy

The built environment already covers about 145 billion m² worldwide

By 2030, an additional ~73 billion m² of new buildings are expected



around 40%

of energy consumed in the EU is used in buildings

around 50%

of EU's gas consumption is attributable to buildings

+/- 80%

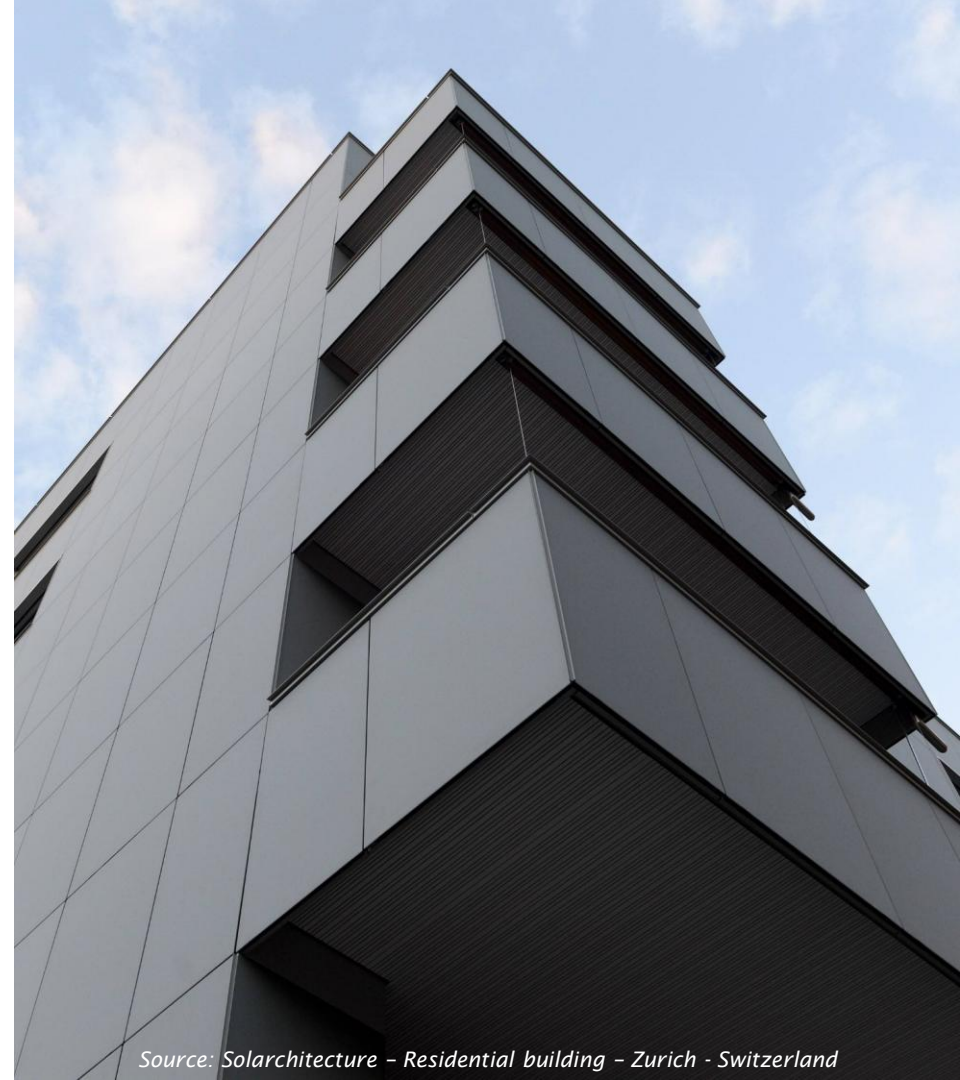
of energy used in EU homes is for heating, cooling and hot water

Energy targets...

- **EPBD** – Energy Performance of Buildings Directive
- **Directive 2010/31/EU** - Introduced minimum energy performance requirements and the NZEB concept
- **Directive (EU) 2018/844 (revision)** - Strengthened energy efficiency targets and integration of renewables
- **Directive (EU) 2024/1275 (recast EPBD)** - Introduces Zero-Emission Buildings (ZEB):
 - Tightens requirements for new and existing buildings
 - Promotes on-site renewable energy generation
 - Addresses whole-life performance and decarbonization

And technical requirements

- **Construction products** (CPR – Reg. (EU) 2024/3110)
- Essential requirements for construction works, including BIPV
- Electrical safety - **Low Voltage Directive** (LVD 2014/35/EU) / IEC
- Fire safety classification (EN/ISO)
- **CE marking**



Source: Solarchitecture – Residential building – Zurich – Switzerland

Buildings evolution...

From massive buildings ...

- Rectangular and massive, regular, symmetrical shapes
- Stone, brick, solid wood (mineral materials)
- High mass and high thermal inertia
- The building envelope encloses





Source: Zaha Hadid Architects - Cultural Center - Baku, Azerbaijan - Photographs: Iwan Baan, Hufton+Crow, and Helene Binet

... to performance, complexity, and integration

- Fluid, lightweight, and complex forms (free forms)
- Polymers, glass, composites, lightweight metals (engineered materials)
- Structure and envelope are separated; polymers act as functional skins



Source: La Seine Musicale, by Shigeru Ban Architects, Paris

... and to multifunctional active façades

Building-Integrated Photovoltaics is a building element capable of:

- Providing a building function
- Enable architectural and design flexibility
- Generate renewable energy on-site

BIPV as an Enabler for Sustainable Architecture



**Buildings as active
energy generators, not
passive envelopes.**



**BIPV merges energy
production +
architectural function.**



**Integrate innovation into
safety and regulation
driven sectors.**

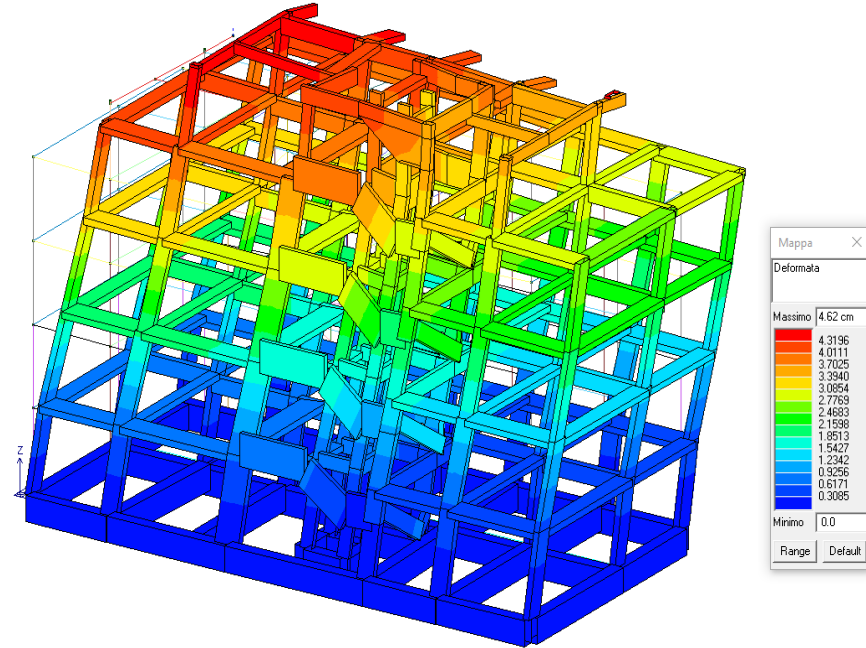
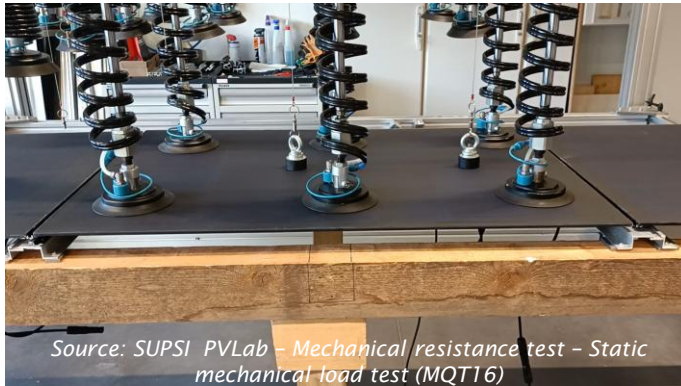


New materials in the envelope: New challenges

- Fulfil building functions, complying with structural, thermal, and fire safety requirements
- Enable architectural and design flexibility, supporting innovative building solutions
- Provide a multifunctional solution, combining envelope performance with on-site renewable energy production

A BIPV system integrated in a building must address:

- **Structural loads** - (wind, seismic)
- **Mechanical stability**
- **Durability**



Source: SUPSI and Università degli Studi della Basilicata (UNIBAS) -COMPYDIN 2025 – 10th International Conference on Computational Methods in Structural Dynamics and Earthquake Engineering. Integrating Seismic Strengthening and Energy Efficiency for Building Renovation: Bio-Based Insulation, BIPV, and Structural Retrofits for Minimal Disruption

A BIPV system integrated in a building must address:



Source: The National – The Torch Tower in Dubai Marina - UAE

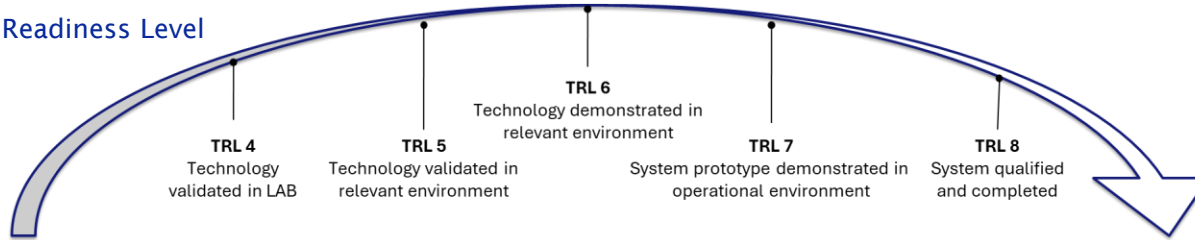
- Electrical safety
- Thermal behavior
- Fire performance
- Acoustic performance



Source: GUIDELINE – TÜV Rheinland Energie und Umwelt GmbH - Fraunhofer - Institut für Solare Energiesysteme (ISE)

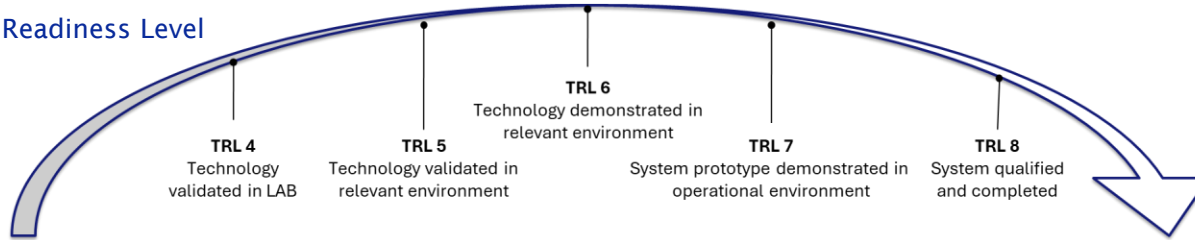
How can we overcome these challenges?

Technology Readiness Level



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Technology Readiness Level



Research and industry collaboration

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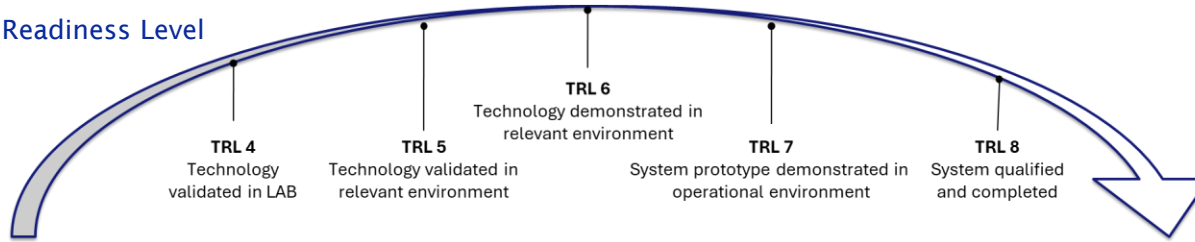
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PIZ
cladding systems

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BIPV
boost

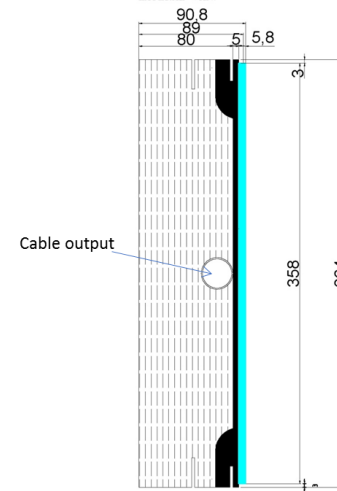
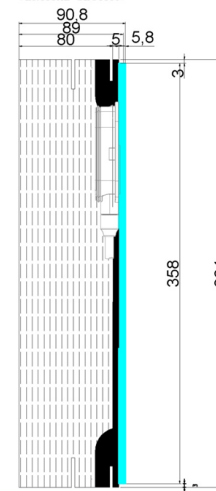
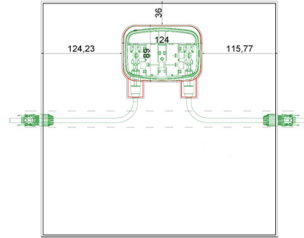
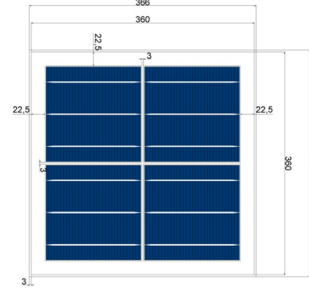
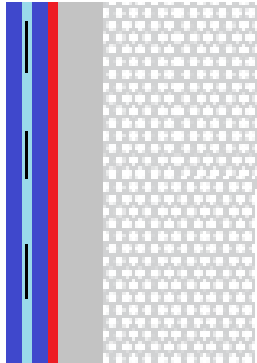


 **Seamless-PV**



**Further
Projects**

Project-driven development



PV prototype TRL4



Source: PIZ S.r.l.

Product validation and testing TRL4/5



Source: PIZ S.r.l. - SUPSI

Tested and demonstrated in relevant environment TRL6/7



Source: SUPSI - PIZ S.r.l.



Conclusions

We need systems that are:

- Integrated
- Prefabricated
- Reliable
- Ready for construction





Thank you!



seamless-pv.eu



SEAMLESS-PV Project



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