Integrated Photovoltaic Conference

25 – 26 November 2025
Chamber of Commerce
Florence, Italy

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Tegola Canadese S.r.l.

BIPV for Tegola Canadese Roofing: Photovoltaic Integration without Substructures

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Background: Global Building Sector

Energy and Emissions: In 2023, buildings accounted for about 32% of global energy demand and 34% of CO_2 emissions, including 9.8 Gt from operations and 2.9 Gt from embodied carbon (Figure 1).

Target: To align with the IEA Net Zero Scenario and EU NZEB/ZEB goals, operational emissions must drop by 50% and embodied emissions by 20–25% by 2030 (Figure 2).

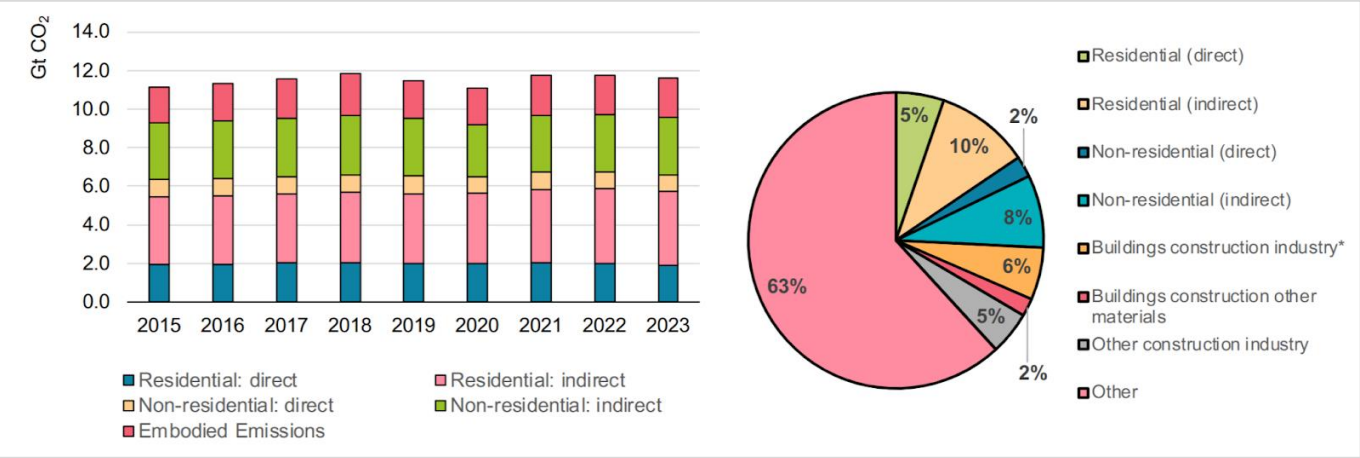

Figure 1: IEA & UNEP, Global Status Report for Buildings and Construction 2024–2025

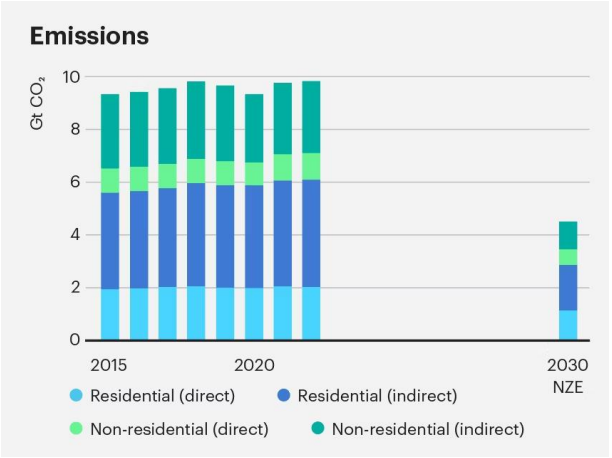

Figure 2: IEA, Tracking Clean Energy Progress 2023

Background: The Role and Limits of BIPV Systems

The European directive promotes the adoption of integrated renewable technologies, such as Building Integrated Photovoltaics (BIPV), to achieve its targets.

Roofs currently represent the primary application area for BIPV systems, accounting for ~80% of BIPV installations, with metal roofs offering high potential.

However, 79% of current products require ventilated substructures, compromising the distinctive benefits of fully adhered roof systems (Figure 3).

This reveals a research and market gap: the need for fully adhered BIPV solutions for metal roofs.

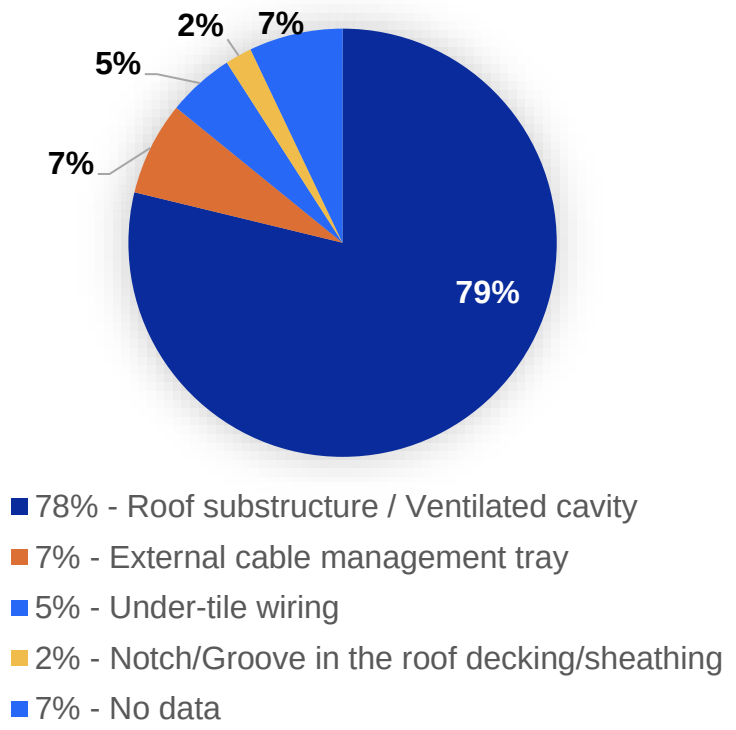

Figure 3:
Internal market analysis, 2025 – sample:
55 products from 32 EU manufacturers

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Research Objective: Fully Adhered BIPV System

Goal: Develop a new BIPV system integrating flexible photovoltaic panels into metal asphalt shingles by *Tegola Canadese S.r.l.*, overcoming current limitations.

Specific objectives:
- Achieve full-adhesion installation without dedicated substructures;
- Ensure simplified installation and easy maintenance;
- Enhance architectural and aesthetic integration.

Impact: Contributes to EU decarbonization goals and the wider deployment of BIPV technologies.

Collaboration: *Università IUAV di Venezia* & *Tegola Canadese S.r.l.*

TEGOLA CANADESE
ITALIAN ROOFING DESIGN

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Base Roof System by Tegola Canadese

System characteristics

- Full-adhesion installation (no substructures required)
- Lightweight configuration
- Inherent waterproof performance
- High resistance to extreme weather conditions

Layer composition

- OSB board (18 mm) fixed to the supporting structure
- Self-adhesive waterproof membrane (Safety R-evolution T, 3 mm)
- Ultimetal HD Slate metal–asphalt shingles (1000 x 340 x 4.7 mm):
    - Bonding via bituminous mastic strip at the upper overlap
    - Final fixation by nailing or flame-bonding to the membrane

Figure 4: Design Ultimetal HD Slate

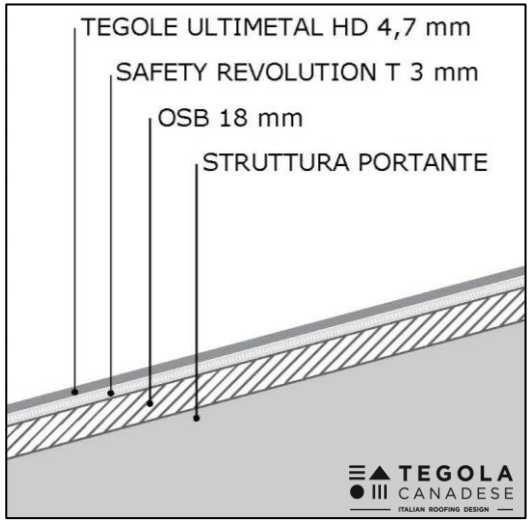

Figure 5: BIPV system components

Methodology: Three-Phase Development Process

The research followed a three-step sequential process:

Developed BIPV System: Components

The system integrates flexible CIGS thin-film photovoltaic modules directly onto Ultimetal HD Slate metal–asphalt shingles by *Tegola Canadese*.

Key technical specifications:

- **Custom CIGS modules:** 17% efficiency, 150 Wp/m², thickness <2 mm, adhesive backsheet film.

- **Ultimetal HD Slate metal–asphalt shingles** (4.7 mm): bituminous base layer with 300 µm pre-coated aluminum layer.

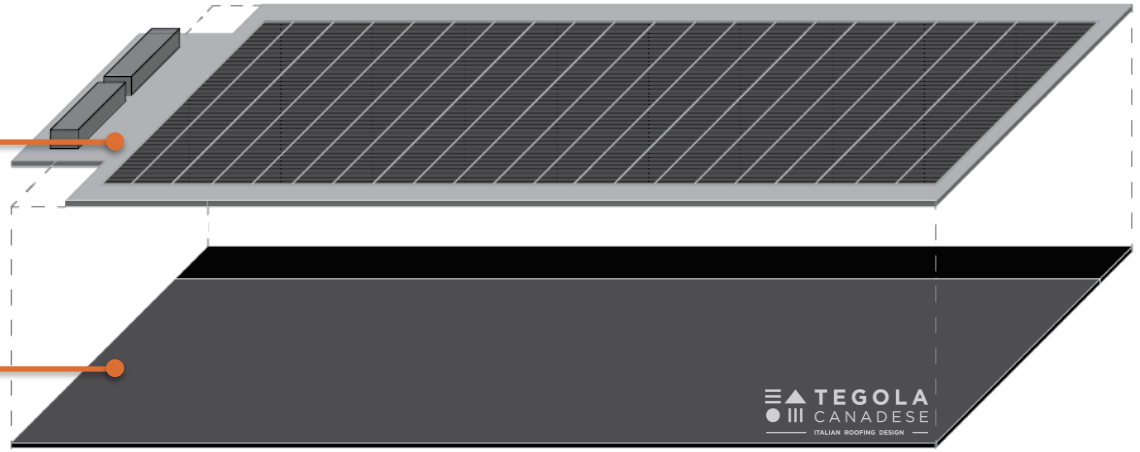

Figure 6: BIPV system components

Developed BIPV System: Integrated Configuration

The system ensures full architectural integration through two coordinated shielding elements designed with matching materials and surface finishes:

- **Arched vertical caps (1):** provide physical protection for the junction boxes and inter-tile transitions, while ensuring cable accessibility and maintainability.
- **Ridge caps (2):** conceal horizontal cabling and connect all vertical elements, thereby establishing a continuous, integrated wiring management system.

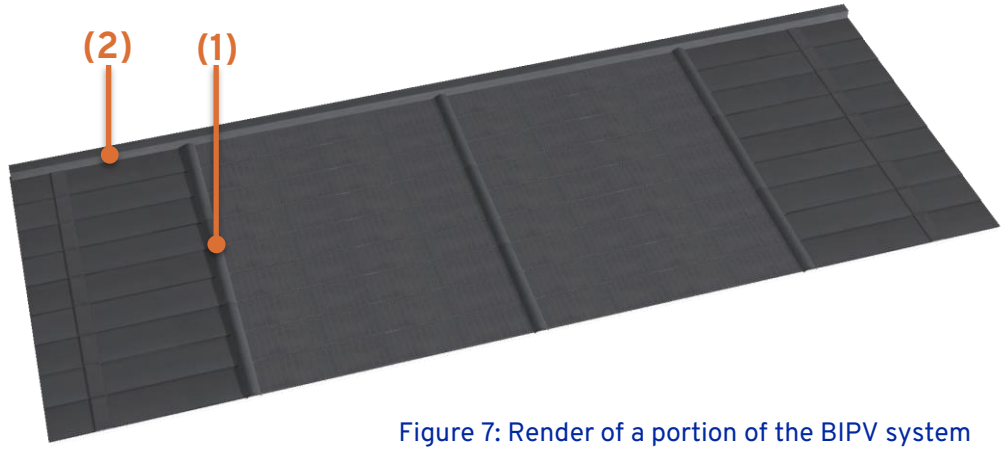

Figure 7: Render of a portion of the BIPV system

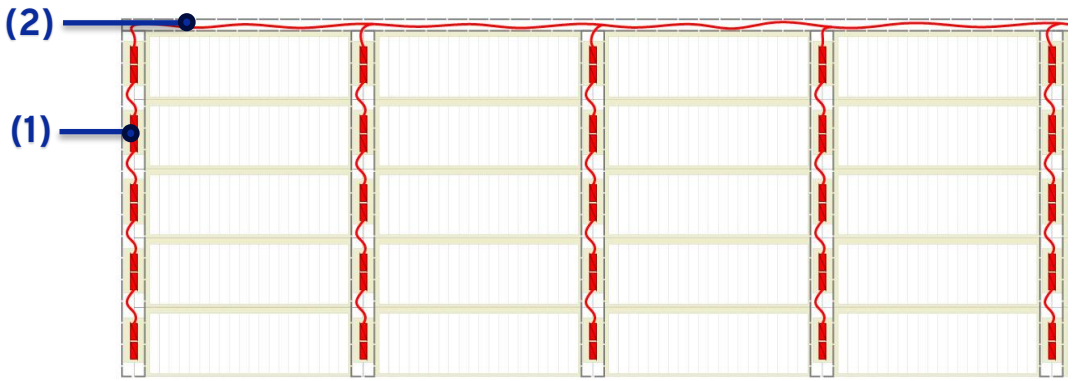

Figure 8: Electrical configuration diagram

Results and Competitive Advantages

Validation confirmed the technical feasibility and architectural integration of the system. Curved components successfully transformed functional requirements into coherent design elements.

Key advantages:

- No substructure required
- Reduced system weight
- Full compatibility with existing *Tegola Canadese* systems (retrofit-ready)
- Faster installation compared to conventional BIPV
- Ensured maintainability

Figure 9: Installation of the BIPV system in the test room

Conclusions and Outlook

Key Takeaways

- The project demonstrates a fully adhered BIPV roofing system with validated technical feasibility and architectural quality.
- The solution preserves the identity of *Tegola Canadese* metal shingles while integrating PV functionality seamlessly.
- The final configuration enables simplified installation, easy maintenance.

Future Directions

- LCA & cost optimization
- Certification & market deployment

Figure 10: BIPV system installation rendering

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Thank you!

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