

Innovative Integrated Photovoltaic Systems and Components for Resilient and Energy-Efficient Industrial Facilities And Buildings

ORGANIZED BY

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SPECIAL SESSION OVERVIEW

Photovoltaic (PV) technologies are increasingly deployed across the built environment—from industrial facilities such as factories, warehouses, logistics hubs, and data centers to residential and commercial buildings—on roofs, façades, carports, and as multifunctional envelope components, supporting decarbonization while enabling on-site energy production. In parallel, both productive sites and buildings are exposed to more frequent extreme events (heat waves, storms, grid disturbances) and energy price volatility, making resilience, energy efficiency, and operational continuity strategic priorities. Innovative integrated PV solutions (e.g., BIPV/BIPV-T, PV shading elements, PV glazing, advanced PV cooling technologies (e.g., phase change materials), hybrid renewable systems with storage and advanced control) can improve self-sufficiency, mitigate peak loads, enhance comfort and power quality, maintain critical services and processes during disruptions. Furthermore, when combined with other innovative envelope components, e.g. cool roofs or green roofs, BIPV systems can contribute to mitigating the urban heat island (UHI) effect, thereby supporting broader urban sustainability goals.

This Special Session aims to bring together researchers, designers, practitioners, and industry experts to discuss recent advances in the design, integration, control, and assessment of innovative building components especially integrated photovoltaic systems that enhance resilience and energy efficiency in industrial sites and buildings, from materials and components to whole-facility, microgrid, and district/energy-community applications.

TOPICS OF INTEREST

We invite original contributions, including but not limited to the following topics:

- **Building-integrated photovoltaics (BIPV): roofs, façades, glazing, shading systems, and multifunctional envelope components**
- **Hybrid PV solutions (e.g., PV-thermal/BIPV-T), solar-assisted heat pumps, and coupling with HVAC systems and low-temperature industrial processes**
- **Advanced PV cooling technologies (e.g., phase change materials) to enhance efficiency and reliability in industrial facilities and buildings**
- **Integration of advanced building envelope solutions to promote climate-resilient, energy-efficient buildings and contribute to urban heat island (UHI) mitigation.**
- **Integration of PV with electrical and thermal energy storage, electric vehicles, and demand response**
- **PV integration and retrofit in industrial and commercial facilities (e.g., factories, warehouses, logistics hubs), including power quality and reliability constraints**
- **PV-enabled industrial decarbonization: electrification, flexibility services, and integration with site microgrids and energy communities**
- **Resilience-oriented design: critical-load supply, islanding operation, microgrids, and black-start strategies at the facility and building scale**
- **Industrial and building energy management systems, digital twins, AI/ML-based forecasting and predictive control for PV-rich industrial sites and buildings**
- **Performance assessment: monitoring, diagnostics, fault detection, degradation, and reliability of integrated PV solutions**
- **Techno-economic analysis, life-cycle assessment (LCA), embodied carbon, circularity, and climate-resilience and sustainability metrics**
- **Safety, codes and standards, fire behavior, and regulatory aspects for BIPV and integrated PV**
- **Experimental validations, living labs, field demonstrations, and case studies in different climates, industrial sectors, and building typologies**

We invite original contributions addressing theory, methods, and real-world applications that can accelerate the adoption of integrated PV systems and innovative building components to deliver more resilient and energy-efficient industrial facilities and buildings.

