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SPECIAL SESSION XI

New perspectives on BIPVs (Building Integrated Photovoltaic systems): numerical and experimental studies on the PV cells, power converter, control systems, and storage

ORGANIZED AND CHAIRED BY

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In the world decarbonization process renewable energy is expected to play a fundamental role. The building sector consumes a great percentage of energy, and it is responsible for a substantial proportion of the environmental pollutions with important effects on climate change. In the European Union (EU), 30–40% of energy is consumed by the building sectors, that produce 32% of carbon dioxide emissions. The most crucial end-use in the residential sector is space heating/cooling, which is responsible for 68% of the energy consumption. EU aims at a 20% reduction of energy consumption compared to baseline projections (which is an average value of 200 kWh per m2); moreover, REPower EU has the objective within 2030 to reach 45% RES share in energy consumptions.

In this scenario, building-integrated photovoltaic (BIPV) systems represent economically feasible solutions able to support the increasing demand of electricity distributed generation from renewables, since the added costs of PV cells to the overall building components are limited. BIPVs consist of solar photovoltaic (PV) cells and modules that are integrated in the envelope and are part of the building structure, replacing conventional building construction components. The control of electrical power systems quality and the monitoring of energy flows from renewables are key aspects to allow the stability of all the electricity networks.

Considering all these aspects, the present Special Technical Section aims at collecting interesting and recent research contributions in the field of BIPV systems considering not only the PV cells technologies and their integration on roofs, facades, windows, but also the power converters, control and diagnostic strategies, energy storage, and grid interface systems. Novel PV technologies such as bifacial solar cells (BSC), semi-transparent solar cells (STSC) and flexible solar cells (FSC), integration of sensors, conversion and storage systems on the BIPV devices and the designing of a building-integrated energy unit are interesting aspects to be deepened in this context. Studies on standard and innovative technologies and materials concerning the distributed generation from BIPVs are suitable for this section. Recent advances obtained by means of laboratory measurements and real-time experiments but also thanks to artificial intelligence algorithms able to develop new management strategies could be interesting to assess the improvement of these systems and their future potentials.

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Therefore, special session topics include, but are not limited to, the following:

- **Integration of energy generation from renewable sources in architecture and buildings**
- **Novel materials, technologies, and building techniques for BIPVs;**
- **Laboratory tests on PV cells, power converters, control systems, electricity storage;**
- **Machine learning and artificial intelligence applications applied for the modelling of BIPV solutions;**
- **Modelling, simulation and management of electric devices for renewable energy sources;**
- **Control techniques for power converters;**
- **Computational methods for reliability in electricity networks.**