Advanced Solar Technologies in Buildings


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The global growth of energy demand is putting pressure on establishing regulatory frameworks aimed at reducing the carbon footprint of our societies, thus mitigating the climate change. For instance, one of the main targets of the European Union’s energy policies is the reduction of greenhouse emissions by 80-95% by 2050 [1]. Such decarbonisation process, as envisioned by most researchers and policy makers, requires policies promoting investments to support new low-carbon solutions, efficiency measures, and people behavioural changes.

Renewable energies are recognised as one of the most important pillars for achieving a more sustainable society. A recent report by the International Renewable Energy Agency (IRENA) indicates that the share of renewable energy in the power sector would increase from 25% in 2017 to 85% by 2050, mostly through growth in wind and solar power generation [2]. Therefore, greater efforts should be made to achieve a higher and widespread penetration of renewables in all economic sectors.

In this context, solar energy has been the subject of intense research and development efforts thanks to its promising and unmatched resource potential, which led to a large diffusion as residential, commercial, and industrial solar appliances over the last few decades. Among others, buildings represent an important sector for solar energy technologies, since they are responsible for about 39% of the total primary energy consumption [3]. Therefore, the integration of solar technologies in buildings, such as advanced solar thermal collectors, photovoltaic (PV) and hybrid PV systems, the use of photoactive materials, solar cooling and passive solar systems, and energy storage, may lead to significant primary energy savings and carbon emission reduction.

Further research opportunities are still growing, looking at novel building applications where advanced material devices, integrated system configurations, design and management strategies, novel modelling, and assessment techniques are adopted. On the other hand, making solar energy cost-effective and market ready technologies requires the adoption of innovative modelling approaches and quantitative assessment procedures capable of (i) reducing the environmental and cost impacts of appliance production, installation, and disposal processes (i.e., life-cycle analysis-LCA), (ii) allowing the integration with existing facilities and infrastructures, and (iii) providing technical and economic optimisation of design and management, including control algorithms and smart grid integration.

This special issue is an attempt to collect articles on advanced solar technologies for building applications. It includes numerical and experimental works on photovoltaic systems and their integration at building level, novel solar concentrators, hybrid thermal-power systems, and energy storage coupled with thermal solar systems.
Conflicts of Interest

The editors declare that they have no conflicts of interest regarding the publication of this special issue.

Mattia De Rosa
Paolo Conti
Yasser Mahmoudi
Vincenzo Bianco

References


