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**Published in:**
Energies

**Published:** 01/01/2023

**Document Version:**
Final Published version, also known as Publisher's PDF, Publisher's Final version or Version of Record



**Publication record in CityU Scholars:**
Go to record

**Published version (DOI):**
10.3390/en16020836

**Publication details:**
Cao, J., Wu, W., Hu, M., & Wang, Y. (2023). Green Building Technologies Targeting Carbon Neutrality. *Energies*, *16*(2), Article 836. https://doi.org/10.3390/en16020836

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*Editorial*

# Green Building Technologies Targeting Carbon Neutrality

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The construction industry is one of the three major worldwide energy consumers, producing nearly 30% of global carbon emissions [1]. Therefore, applying green technologies in buildings to lower carbon emissions in construction [2], maintenance [3], operation [4], and even recycling [5] could considerably mitigate global warming and contribute towards the sustainable development of human society [6,7]. In this context, the development of green buildings is an important factor in promoting worldwide carbon neutrality [8]. A considerable number of studies involving technological upgrades have been devoted to reducing the carbon emissions of modern buildings in the last decade [9–12]. To further spread green technologies for zero-carbon buildings, this Special Issue "Green Buildings for Carbon Neutral" is being launched to attract cutting-edge research that addresses existing bottlenecks and future challenges. Here, after one year of collecting submissions, we summarize high-quality original research papers, including critical reviews and experimental and theoretical investigations of technology innovation and development for green building applications.

Baccega and Bottarelli [13] conducted an experimental and simulative study on granular phase change materials-enhanced plaster to improve the performance of the building envelope. Given the specific application scenarios in Italy, which has many historical buildings, the design can effectively enhance thermal inertia while avoiding alterations to the original structures and thus play a considerable role in the renovation of existing buildings. Their research proves that applying the granular paraffin phase change materials into the plaster can reduce energy consumption by 9~18%, which is of great significance for research in related fields, promoting sustainable development in building envelopes.

Gao et al. [14] focused predicting the hygrothermal properties of the indoor walls of rammed-earth folk houses. They built a numerical model of the rammed-earth folk house and conducted an experimental verification. Based on their year-round analysis, they found that the temperature fluctuation at the inner-wall surface was reduced and the humidity of the house can be maintained at about 60%. This innovative research can effectively assist in temperature and humidity management, considerably reducing the corresponding energy consumption.

Yang et al. [15] focused on the impact of split-fiber-type air conditioning on human thermal comfort. They carefully verified the rationality of the three utilized thermal comfort characterization models. Furthermore, they changed the openings of the air-distribution duct and the positions of the air outlet to explore their effects on temperature and thermal comfort. Their research proved that the thermal comfort characterization models were closely related to the comfort of the human body and thus could contribute to the development of thermal comfort in buildings.



**Citation:** Cao, J.; Wu, W.; Hu, M.; Wang, Y. Green Building Technologies Targeting Carbon Neutrality. *Energies* **2023**, *16*, 836. https://doi.org/10.3390/en16020836

Received: 8 November 2022
Accepted: 4 January 2023
Published: 11 January 2023

Moghaddasi et al. [16] proposed an adaptable net-zero model to address the challenges in promoting net-zero energy. By introducing a reorganized net-zero and further determining its baseline, projecting its optimization, and measuring/reporting its actual value, they potentially address three key problems: quantifying energy-use reduction approaches; obtaining measured data to verify net-zero achievements; and providing widely-acceptable net-zero definitions. This concept and case study could have considerable reference value in the net-zero-energy field.

Stamatellos et al. [17] analyzed the energy operation characteristics of a near-zero-energy building integrated with rooftop photovoltaic and electric vehicles. They adopted a transient simulation in the TRNSYS environment and consider heating, ventilation, cooling, vehicles, and photovoltaic elements. Their year-round analysis revealed that the photovoltaic power covered the energy consumption of the building and the 40 electric vehicles. Their results indicate the importance of the integration of electric vehicles in near-zero-energy buildings.

Lee et al. [18] designed an indoor air-quality diagnosis program and applied it to school and office spaces to monitor and predict indoor air quality, including $CO_2$ and PM2.5 concentrations. The program showed a mean absolute percentage error of 19.47% for PM2.5, which decreased by about 5% after optimization. Their work provides a simple method for indoor air-quality prediction, which could be used as the basis of indoor air-quality management and optimization.

Elshafei et al. [19] reviewed the use of the analytical hierarchy process in green building optimization, emphasizing the efficient use of natural resources. The current condition in this field is that too many criteria are too broad to be utilized, causing contradiction and loss of credibility. Thus, this review analyzed the state of the art on improving existing practices in green building through the analytical hierarchy process. This work is promising, helping find the optimal option and providing reference value in green building optimization.

Based on the aforementioned papers, the research range of the Special Issue "Green Buildings for Carbon Neutral" includes, but is not limited to:

- Low-carbon building;
- Building-integrated renewable energy technology;
- Eco-friendly building material;
- Advancing building envelope;
- Intelligent building;
- Building flexibility;
- Building energy storage;
- Healthy building;
- Energy-efficient lighting;
- Waste heat utilization in buildings.

Furthermore, the geographical distribution of authors in the Special Issue "Green Buildings for Carbon Neutral" is wide, and the details are presented as follows:

- China (12);
- USA (5);
- Greece (3);
- Korea (3);
- Italy (2);
- Egypt (2);
- Slovakia (2).

In summary, this Special Issue "Green Buildings for Carbon Neutral" contains seven high-quality articles relevant to advanced green building technologies [13–19]. It contains information on experimental and simulated research relevant to near-zero-energy or net-zero-energy buildings and the optimization of building systems. This valuable research and review work generated from all over the world is expected to help researchers and engineers with knowledge backgrounds in green building technologies to keep up to date, promote their research, and improve their practice.

**Acknowledgments:** The editorial was sponsored by the National Natural Science Foundation of China (No. 52208105); Hunan Provincial Natural Science Foundation of China (2022JJ40057); Natural Science Foundation of Chongqing, China (CSTB2022NSCQ-MSX1215); Anhui Provincial Natural Science Foundation (2008085QE234); and the Fundamental Research Funds for the Central Universities (531118010653).

**Conflicts of Interest:** The authors declare no conflict of interest.

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