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Editorial

Editorial Special Issue: Building Energy Consumption and Urban Energy Planning

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As of 2021, the global urbanization rate was still increasing, especially in China, whose permanent urban population reached 64.72% [1]. This intense urban population growth has led to urban sprawl, while human activities have produced profound changes in the urban physical environment. Beyond promoting urban development and improved quality of life, urbanization causes a series of negative effects, such as the deterioration of the environment and gradual ecological fragility. These effects not only lead to human health issues and climate change, but also impact energy use and carbon emissions. Specifically, rapid urbanization poses urban thermal challenges with a range of environmental consequences, including an increased difficulty for people to participate in outdoor activities, increased storms and precipitation events, and increased heat-related mortality.

Buildings, where people spend 90% of their time, are the major energy consumer in cities [2,3]. Therefore, many researchers are looking to find more efficient, environmentally friendly, energy-saving and low-carbon building methods, and are approaching the problem from different perspectives. In this Special Issue, seven papers from different fields and different institutes have been published, and all of those papers have made clear and obvious contributions to better building operations in urban contexts.

Xiang et al. [4] pointed out that an analysis of carbon emission reduction in buildings is a timely and effective global response to the climate change crisis, making the efficient computation process of a building's carbon emissions a necessary prerequisite. They proposed a new open-source Python tool (PyLMDI) to quickly compute the results of LMDI decomposition analysis, which can provide calculation guidance for carbon emission reduction in the building sector.

Zhang et al. [5] also have concerns about carbon emissions from residential blocks and how to reduce them, through improvements in the built environment of resettlement housing. Based on a questionnaire collected in 12 resettlement housing neighborhoods in Nanjing in 2022, their study used a three-group structure equation model (SEM) to measure the impact of the built environment on travel-related CO_2 emissions, such as those from commutes, the running of errands, and recreational trips.

Furthermore, to assess a building's carbon footprint, Torres et al. [6] took nine two- to four-star Mexican hotels as an example and tracked their energy-use index and carbon footprint, assessing their performance with an expert model based on artificial neural networks. The model can simultaneously generate the energy-consumption indicators, environmental impact, and economic savings of hotels based on their category, location, number of rooms, number of existing electrical or thermal devices, and the percentage of these devices that are replaced with devices using more energy-efficient technologies.

Furthermore, in ref. [7], one detailed study focused on household room air conditioners (RACs) and pointed out that the aggregate utilization of RACs in a region has a great impact on regional building energy demand in both warmer and cooler seasons; therefore, a data-driven method has been proposed to classify the different types of RACs and further analyze the differences in monthly and hourly usage periods and the flexibility potential of RACs.

The final three works consider the design stage of buildings. Li et al. [8] tried to solve the problem of balancing improved residential capacity and solar shade constraints for multi-story residential buildings using a multi-objective optimization method to add new volume to existing buildings. Three building-addition modes were considered, in the horizontal, vertical, and mixed directions, respectively. Among them, the mixed style can offer the best results with a 70% increase in the floor area ratio. The vertical style has the least impact on the solar shade of existing buildings, while the horizontal style could further improve the floor area ratio in areas where the building height was strictly limited.

Wu et al. [9] and Deng et al. [10] both focused on the micro-climate surrounding buildings in the urban context. The former proposed the application of neural network algorithms to predict the microclimate around buildings, with a three-year-long monitoring dataset. The variables include temperature, cooling and heating degree day, relative humidity, and solar radiation. The latter proposed applying the ENVI-met simulation technique to reveal the impacts of trees on the microclimate around buildings and their further impact on the heat gain on a building's surface. The two studies provide an interesting and necessary insight into more environmentally friendly and more energy-efficient building design strategies.

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

References

1. National Statistical Bureau of the People's Republic of China. *Statistical Bulletin of the People's Republic of China on National Economic and Social Development in 2021*; People's Dly.; China National Bureau of Statistics: Beijing, China, 2022.
2. Zhang, X.; Wang, F. Hybrid input-output analysis for life-cycle energy consumption and carbon emissions of China's building sector. *Build. Environ.* **2016**, *104*, 188–197. [CrossRef]
3. Gruber, J.K.; Prodanovic, M.; Alonso, R. Estimation and analysis of building energy demand and supply costs. *Energy Procedia* **2015**, *83*, 216–225. [CrossRef]
4. Xiang, X.; Ma, X.; Ma, Z.; Ma, M.; Cai, W. Python-LMDI: A Tool for Index Decomposition Analysis of Building Carbon Emissions. *Buildings* **2022**, *12*, 83. [CrossRef]
5. Zhang, Y.; Zhou, W.; Ding, J. Effects of the Built Environment on Travel-Related CO_2 Emissions Considering Travel Purpose: A Case Study of Resettlement Neighborhoods in Nanjing. *Buildings* **2022**, *12*, 1718. [CrossRef]
6. Mengual Torres, S.G.; May Tzuc, O.; Aguilar-Castro, K.M.; Castillo Téllez, M.; Ovando Sierra, J.; Cruz-y Cruz, A.d.R.; Barrera-Lao, F.J. Analysis of Energy and Environmental Indicators for Sustainable Operation of Mexican Hotels in Tropical Climate Aided by Artificial Intelligence. *Buildings* **2022**, *12*, 1155. [CrossRef]
7. Gu, X.; Liu, M.; Li, Z. Classification of Household Room Air Conditioner User Groups by Running Time in the Hot Summer and Cold Winter Zone of China. *Buildings* **2022**, *12*, 1415. [CrossRef]
8. Li, J.; Wang, Y.; Xia, Y.; Song, Y.; Xie, H. Optimization of Urban Block Form by Adding New Volumes for Capacity Improvement and Solar Performance Using A Multi-Objective Genetic Algorithm: A Case Study of Nanjing. *Buildings* **2022**, *12*, 1710. [CrossRef]
9. Wu, X.; Hou, J.; Hui, J.; Tang, Z.; Wang, W. Revealing Microclimate around Buildings with Long-Term Monitoring through the Neural Network Algorithms. *Buildings* **2022**, *12*, 395. [CrossRef]
10. Deng, L.; Jia, X.; Wang, W.; Hussain, S.A. Revealing Impacts of Trees on Modeling Microclimate Behavior in Spaces between Buildings through Simulation Monitoring. *Buildings* **2022**, *12*, 1168. [CrossRef]