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A Design Decision Framework for Net-Zero Carbon Buildings in Hot Climates: A Modeled Approach and Expert's Feedback

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Abstract : The rising building energy consumption and related carbon emissions make it necessary to construct net-zero carbon buildings (NZCBs). The objective of net-zero buildings has raised the benchmark for building performance and will alter how buildings are designed and constructed. However, there have been growing concerns about uncertainty in net-zero building design and cost implications in decision-making. Lessons from practice have shown that a robust net-zero building design is complex, expensive, and time-consuming. Moreover, climate conditions have an enormous implication for choosing the best-optimal passive and active solutions to ensure building energy performance while ensuring the indoor comfort performance of occupants. It is observed that 20% of the design decisions made in the initial design phase influence 80% of all design decisions. To design and construct NZCBs, it is crucial to ensure adequate decision-making during the early design phases. Therefore, this study aims to explore practical strategies to design NZCBs and to offer a design framework that could help decision-making during the design stage of net-zero buildings. A parametric simulation approach was employed, and experts (i.e., architects, building designers) perspectives on the decision framework were solicited. The study could be helpful to building designers and architects to guide their decision-making during the design stage of NZCBs.

Keywords : net-zero, net-zero carbon building, energy efficiency, parametric simulation, hot climate
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