Guest editorial: Energy efficiency, risk, and resilience in the built environment

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The built environment faces an unprecedented convergence of pressures arising from climate change, population growth and urban intensification and rising expectations for safe, healthy and energy-efficient spaces. Globally, buildings account for a significant share of energy consumption and greenhouse gas emissions, and societies are increasingly confronted with the dual challenge of reducing environmental impacts while enhancing resilience to natural hazards, technological risks and socio-environmental disruptions. As climatic extremes intensify and urban areas continue to densify, the imperative to integrate energy efficiency, risk mitigation and resilience thinking into planning, design, construction and operation has never been stronger.

This special issue responds to these evolving demands by presenting new insights, methodological advancements and empirical evidence that collectively illuminate how energy performance, climate resilience and risk management intersect within contemporary built environments. The contributions span multiple scales, from micro-level building performance and occupant comfort to community-scale heritage protection and national energy planning and demonstrate the diversity of strategies required to achieve sustainable, safe and resilient development. Together, these studies offer an evidence base that advances the understanding of how energy transitions, risk-aware design, human decision-making and resilient infrastructure can be integrated to support both present needs and long-term societal sustainability.

The special issue brings together eight papers that address these themes from various disciplinary vantage points, each offering novel contributions that expand knowledge within the fields of energy efficiency, risk management and resilience planning. The papers were selected from those presented at the International Conference of Smart and Sustainable Built Environment (SASBE, 2024), held in Auckland, New Zealand, and each represents an extended and substantially enhanced version of the original conference submission following further development and rigorous peer review. They illustrate how operational processes, structural vulnerabilities, behavioural factors, environmental comfort and national energy systems each play a crucial role in shaping the resilience and sustainability of the built environment while also showcasing the depth and diversity of research disseminated at SASBE 2024.

Hosseinzadeh Moghaddam et.al**. (2026)** presented an integrated strategy to reduce carbon emissions associated with construction hauling operations, adopting the BASE model – eco-hauling principles, the big room collaborative approach, discrete event simulation and optimisation via Stat-Ease. Applied to a real-world scenario involving the transport of 900 tonnes of soil, the model demonstrated reductions of 12.4% in CO_2 emissions and fuel use, alongside notable decreases in idle time and operational cost. Further optimisation achieved emissions reductions exceeding 35%. This work underscores the value of data-driven, collaborative methods in enhancing operational efficiency and reducing the environmental impacts of construction logistics.

Building on the theme of resilience within existing urban environments, **Aigwi** et.al**. (2026)** developed an index-based methodology for assessing the flood vulnerability of earthquake-prone heritage buildings in Auckland. Through document analysis, site observations and mapping of ten structures, the authors identify eleven indicators spanning exposure, susceptibility and resilience. The resulting intervention priority index offers decision-makers a systematic means of prioritising mitigation actions, strengthening the protection of heritage assets under increasing climate-related flood risk.

Extending the discussion from physical vulnerabilities to human and organisational factors, **Purushothaman and Aguas (2026)** undertook a dual systematic literature review examining the behavioural influences affecting the adoption of green construction practices. Identifying 95 factors and 71 cognitive biases, the authors reveal the extent to which ingrained behavioural patterns shape both drivers and barriers to sustainability adoption. Their conceptual mapping offers practitioners and policymakers a deeper understanding of the psychological influences underpinning decision-making in the construction sector.

Complementing these behavioural insights with a focus on building performance, **Adekunle (2026)** evaluated thermal comfort and energy use in 116 mass-custom prefabricated buildings across Western Europe. Drawing on environmental monitoring, post-occupancy evaluations and statistical analysis, the study highlights substantial seasonal variation in comfort conditions and inconsistencies in energy use, with nearly half the buildings exceeding accepted gas and electricity benchmarks. The findings reinforce the importance of design factors such as orientation, occupant behaviour and renewable energy integration in improving overall energy performance.

Continuing the theme of decision-making and organisational practice, **James** et.al**. (2026)** examined the relationship between risk management strategies and project performance in New Zealand's residential construction sector. Through a systematic review and semi-structured interviews, the authors identify 19 risk mitigation strategies and highlight the critical role of proactive risk monitoring in driving successful project outcomes. Their findings provide sector-specific insights into how targeted risk management can enhance resilience and performance within residential construction.

Shifting attention back to the environmental performance of buildings, **Pourel** et.al**. (2026)** conducted a systematic literature review examining the multidirectional interactions between microclimate conditions, indoor thermal comfort and daylight performance in medium-density housing (MDH). Their thematic synthesis reveals gaps in integrated modelling and highlights the need for holistic design approaches that account for the complex interplay between indoor and outdoor environmental conditions. These insights are particularly timely as MDH intensifies internationally as a key urban development strategy.

Furthering the theme of risk and resilience in complex building environments, **Fahmi** et. al**. (2026)** investigated the factors influencing safe egress in hospitals. Drawing on 130 articles and interviews with 25 experts, the authors identify 12 critical factors, with patient mobility emerging as the most influential determinant of evacuation safety. The study offers valuable insights into how interior layout, fire dynamics, occupant behaviour, detection systems and evacuation modelling interact, supporting improvements in the design and resilience of critical healthcare infrastructure.

Finally, at a broader systems level, **Poorisat** et.al**. (2026)** applied the HOMER modelling platform to optimise a hybrid renewable energy system for Nakhon Ratchasima, Thailand. The analysis identifies solar energy as the most cost-effective renewable option, supported by hydropower resources, while wind and battery storage showed limited feasibility under current conditions. The study provides a replicable framework for regional energy planning and contributes to national strategies for clean, reliable and resilient energy systems.

The papers presented in this special issue offer timely insights into the evolving challenges and opportunities at the nexus of energy efficiency, risk and resilience in the built environment. Collectively, they demonstrate the value of interdisciplinary approaches, robust empirical analysis and context-sensitive frameworks in advancing sustainable development. Whether through innovative simulation tools, behavioural insights, climate adaptation strategies or integrated design considerations, each contribution advances understanding of how built environments can better respond to the demands of a rapidly changing world. It is our hope that the findings presented here will inform future research, guide practitioners and inspire continued innovation in the pursuit of a resilient, low-carbon and sustainable built environment.

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