The influence of the urban climate on building energy use

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ABSTRACT

In cities, rising global temperatures, increased frequency of extreme heat events, and the urban heat island effect (UHI), collectively amplify heat-related risks. To counteract this climate impact and the resulting uplift in energy consumption, building construction methods have evolved over recent decades. This study investigates the influence of the heat island phenomenon on space-conditioning loads in urban office buildings. Additionally, it examines how the trend of replacing traditional heavyweight stone facades with lightweight, highly glazed, and insulated alternatives impacts both the intensity and timing of the heat island effect, as well as overall building energy usage. The investigation considered this via the simulation of a commercial district street canyon, modelled after London's Moorgate area.

Key findings include:

→ ***Heat island load:*** *Integrating this load into dynamic thermal simulations adversely affected annual space-conditioning demands. Buildings with stone façades experienced a 4% increase in demand, while those with glazed construction exhibited a 10% increase.*

→ ***Urban glazing trend:*** *Urban centres increasingly favour highly glazed buildings with lightweight insulated facades. However, this choice increases space-conditioning loads and exacerbates the heat island effect, which then contributes to a positive feedback loop that intensifies urban warming and the impacts of climate change.*

The study underscored the importance of accounting for heat island loads when estimating urban energy use, with the combined simulation approach applied highlighted as a practical assessment pathway for addressing this demand.

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