Urban Micro Climates: Retrofitting Australian precincts for heatwave resilience

PROJECT FACTSHEET

LOW CARBON LIVING CRC

THE OPPORTUNITY / CHALLENGE

Heatwaves are the deadliest natural hazard which also drives peak electricity demand caused by air-conditioning, contributing to soaring electricity prices and energy poverty. Air-conditioning also increases carbon emission, contributes to urban heat island effects and can increase dependence on it. Keeping Australian homes cool while reducing the demand for air conditioning is a key challenge. A further concern is that during heatwaves, indoor conditions can be worse than the outdoor environment because of inadequate building design, increasing electricity demand and creating a vicious feedback loop.

OUR RESEARCH

In the first phase of the research, the connections between the intensity and the impacts of heatwaves, such as heatwave-related, excess ambulance call-outs, electricity demand and water consumption have been analysed. In the second phase, the level of population's vulnerability and adaptation, the heat stress resistance of the built environment were surveyed, and their interplay was analysed. In the third phase, the heat stress resistance of a typical dwelling type with different star ratings and design was compared using AccuRate energy simulation software. The findings were translated into policy recommendations.

CRC for Low Carbon Living

We are a national research and innovation hub supported by the Commonwealth Government's Cooperative Research Centres programme that seeks to enable a globally competitive low carbon built environment sector.

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THE OPPORTUNITY / CHALLENGE

- The excess heat factor was found to be a superior predictor of heat-related morbidity in Adelaide but not in Sydney.
- The excess water use in Adelaide and Sydney on heatwave days reach 20 per cent, nearly as much as excess peak demand in electricity.
- One-fifth of the population reported negative heat-related health issues during heatwaves in Adelaide.
- The real-world benefits of heat stress resistant design features, such as roof insulation and double-glazing, on health during heatwaves were confirmed.
- Pre-existing health conditions and tenancy predict higher than average heat-related health issues due to lack of awareness and poor housing conditions, respectively.
- The availability and the level of air-conditioning diminish other forms of adaptation and increase reliance on mechanical cooling.
- Heat health messages about recommended adaptation techniques should be tailored for different social groups to increase their efficiency.
- High star rating does not necessarily indicate a building with high heat stress resistance. The integration of overheating risk in the Australian Nationwide House Energy Rating Scheme would be warranted.
- The framework devised integrates heat stress resistance, public health, energy and water resources to help resource management in preparation for and during heatwaves.

USERS OF THE RESEARCH RESULTST

The report prepared for the Australian Building Codes Board as part of our research recommended the introduction of separate heating and cooling thresholds to eliminate inadequate design causing overheating during summer. The evidence presented in the report assisted with the development of heating and cooling load limits as well as the regulatory impact analysis for National Construction Code 2019. As a result, to improve the year-round performance of Australian homes, the 2019 National Construction Code (NCC) requires NatHERS assessments to meet separate heating and cooling load limits in many climate zones.

The project further contributed to the architectural practice with an Environmental Design Note published by the Australian Institute of Architects. The note outlines strategies for heat stress resistant residential building design and construction, discusses measures in current building standards and provides recommendations on the assessment of buildings' heat stress resistance.

LESSONS

The research project demonstrated the importance of multidisciplinary research of urban microclimate to address the negative impacts of heatwaves on society.

NEXT STEPS

The research was followed up by a policy recommendation, combining the policy instruments from public health, urban and infrastructure planning and building design to address many aspects of heat stress risk and resilience. These policy proposals could collectively increase the population's heat stress resilience through improved adaptation and heat stress resistance of the built environment, including infrastructure, as well as provide increased care for the most vulnerable population groups. The measures targeting the peak demands in electricity, water and public health would minimise the risk of the collapse of the urban services during heatwaves.

PROJECT TEAM

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PROJECTREPORT(S)

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FURTHER INFORMATION

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