Future proofing residential development to climate change

COUNCIL NAME
Waverley Council

WEB ADDRESS
waverley.nsw.gov.au

SIZE
9.25 square kilometres

POPULATION
74,276

Overview

This project sought to identify threats to the resilience of residential housing in Sydney's eastern beaches by modelling the effect of projected climate change on houses approved under current NSW building controls and to identify implementable climate change adaption measures. All compliant dwellings that were assessed failed the regulated thermal comfort requirements for cooling by 2030, and by 2070 cooling loads increased on average 308% above the baseline year. This project demonstrated the need to incorporate building fabric improvements now to deliver cooler, safer homes over the lifetime of the dwelling, otherwise dwellings approved today will be unsuitable for occupation by 2070 without extremely high levels of mechanical cooling.

Background

Nationally, it is estimated that 500,000 dwellings will be built over the next three years. At the same time, Australia's climate is changing with average and extreme temperatures increasing and rainfall in the southeast declining; most notably in winter. These regional climate changes impact our health and wellbeing, our energy and water infrastructure and supply, and should impact how we manage our built environment.

In 2014, it was observed that planning for demographic and population changes had failed to account for climate change related risks and hazards in Metropolitan Sydney. Despite numerous heat events and resulting research, building controls still do not account for projected warming caused by climate change. In fact, the climate data used in the current Nationwide House Energy Rating Scheme (NatHERS) software which is used to model the heating and cooling loads and energy consumption of dwellings in the Building Sustainability Index (BASIX) is predominantly from last century (1970 – 2004). Similarly, BASIX uses climate data from pre-2004 to model estimated outdoor water consumption and the productivity of rainwater tanks.

Given the historical data used in current planning tools, Waverley Council designed this project to see if the residential buildings we approve today, will be safe in the hotter, drier climate of the future. And if not, how can they be adapted to be more resilient to climate change.

Implementation

Council officers selected five recently approved residential buildings (detached, attached, low-rise, mid-rise and high-rise) common to the Eastern Beaches (217 dwellings in total) that met BASIX requirements, and sought to review the performance of each building type against

- Thermal comfort i.e. estimated heating and cooling loads (MJ per m^2 per year)
- Energy consumption and greenhouse emissions (kg CO_2 per person per year)
- Water consumption (litres of water per person per year).

Each building type was then assessed for the above criteria under three different climate scenarios: present day 2020 (to serve as a baseline year); near future change 2030 (average 2020 – 2039); and far future change 2070 (average 2060 – 2079). Historical data files in NatHERS and BASIX were replaced with projected climate data for Eastern Suburbs Climate Zone 56, using high emissions scenarios. For NatHERS the RCP8.5 data for 2030 and 2070 provided by CSIRO's Energy Division was used. For the BASIX tool the NSW and ACT Regional Climate Model (NARCliM) A2 data for 2030 and 2070 was used, provided by NSW Department of Planning, Infrastructure and Environment.

The follow up study identified what compliance design treatments would enable the five BASIX buildings to reach thermal comfort compliance under 2030 and 2070 climate scenarios. Design treatments included building fabric improvements (e.g. glazing performance, insulation, cross ventilation), shading improvements (e.g. eaves, awnings, venetian blinds, lighter coloured walls and roofs, reducing, removing or shading skylights), glazing area reductions, modelling of ceiling fans, and combined treatments (i.e. two or more treatments listed above).

The project was funded by the NSW Government's Increasing Resilience to Climate Change program. It has provided evidence to inform advocacy, education and development controls within Council and for the built environment industry more broadly. Planning and regulatory bodies at State and Federal Government have been briefed as have councils and engaged community members over the last 18 months. The overall grant funding for Stage 1 modelling reports and Stage 2 implementation actions were $135,000.

Outcomes

The modelling shows that, despite a relatively mild coastal climate, all compliant dwellings in the Eastern Beaches failed regulated thermal comfort requirements by 2030, because cooling loads increased by 70% on average above the baseline year. By 2070, cooling loads increased by 308% on average above the baseline year. Therefore, dwellings approved under existing NSW regulatory controls will be unsuitable for occupation by 2070 without extremely high levels of mechanical cooling.

This raises questions about affordability and equitable access to cooling for Sydney's vulnerable communities, not to mention looming peak electricity demand challenges as the climate warms and the frequency of extreme heat events increase. It also calls into question the feasibility of governments' net zero and resilience aspirations.

The project has also identified the design adaptations that enable the modelled buildings to meet thermal comfort compliance requirements in both 2030 and 2070 and deliver thermally comfortable and safe dwellings. To reach compliance in 2030, the modelled detached house required high performance single glazing, an increase in wall and roof insulation and the installation of a high-performance ventilated skylight. By 2070, the house also required high performance double glazing, a reduction in skylight area, light-coloured walls and roofs, openable windows in all rooms and ceiling fans in bedrooms and living areas to stay cool.

Key Learnings

To ensure our communities are not forced to live in dwellings that are maladapted for the near future, this project advocates for the use of future climate data to inform current planning tools. This will ensure that the houses built today are thermally comfortable and safe for occupants to live in well into the future. The BASIX tool is a State-wide policy while the NatHERS software is used nationally in the National Construction Code, and both are currently undergoing updates. As demonstrated by this project, adopting future climate data in both tools is a simple and available measure that can be implemented today, which would deliver safe and comfortable housing nationally.

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This project was the 2021 winner of the Climate Change Adaptation Award at the LGNSW Excellence in the Environment Awards