HOUSES TOO HOT TO HANDLE

New research shows that modern houses are warmer year-round, meaning they can actually be too hot in summer.

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A modern house in the foreground which, like many new houses, has large windows and limited eaves. The older houses down the road have comparatively wider eaves and less windows.

The Household Energy End-use Project (HEEP) monitored temperatures in living rooms and bedrooms in 397 houses throughout New Zealand. The results showed that newer houses are warmer in both summer and winter. This is great during the colder months, when our houses are too often at a lower temperature than considered comfortable or healthy. In summer, however, newer houses are starting to become uncomfortably warm.

Some new houses are too warm

HEEP used the temperature range of 20–25°C to represent New Zealand comfort temperatures. Over all the HEEP houses, only the post-1978 houses had mean daytime temperatures above 25°C. BRANZ is using thermal simulation models to try to identify the reasons why modern houses are so much warmer. Possible drivers include:

- increased glazing areas
- higher thermal insulation
- reduced or no eaves
- better orientation of windows for passive solar heating
- increased airtightness of the houses
- different occupant behaviour.

Since 1978 houses have needed higher levels of insulation in the roof, walls and floor. HEEP found that houses with thermal insulation were slightly warmer than those without thermal insulation during the summer. However, the presence of insulation explains only a little of the increase in temperatures due to house age.

The trends to no eaves and larger glazing areas both give solar heat gains. Eaves and shading prevent direct sun from entering the house and increasing temperatures. In HEEP houses the random orientation of glazing resulted in glazing areas only having a marginal influence on living room temperatures. However, simulations suggest that the peak temperatures do increase in living rooms when glazing is increased.

It is also possible that occupants behave differently in response to different house designs. Things like the pulling of blinds, and the opening and closing of windows and internal doors, all affect the solar gains and the airflow through the house.

Design to prevent overheating

To prevent overheating it is much easier to make the appropriate decisions at the design stage of building. Once a house is built and found to be overheating it is difficult to make significant improvements. Although we do not yet know all the reasons for the increasing temperatures in New Zealand houses, there are some clear guidelines that can help prevent houses from overheating.

VENTILATION AND SHADE

Ventilation and shading need to be considered at the design stage. Each room should have good ventilation, such as windows that can be opened without causing a security issue or letting in too much noise, and passive vents that are easy to operate. This is in addition to extractor fans to remove heat and steam out from cooking and bathing.

Shade, such as eaves and movable shading, is needed from the sun in the middle of the day and afternoon. External shading is much more effective at keeping heat out than internal shading. No amount of ventilation or air conditioning will make the occupant feel cooler if they are sitting in direct sun.

Take care placing large windows facing east (morning sun), west (afternoon sun) or north (daytime sun).

SPACE HEATING

Areas such as garages can become very hot from both the sun and heat from vehicles. If the garage is attached to the house, heat from the garage can enter the house. Therefore, internal garages must be well ventilated.

THERMAL MASS

Concrete, water or earth store heat during the warm part of the day and release it when the surrounding air is cooler than the mass. During summer, heat from the day is stored in the thermal mass and released in the evening. Therefore, houses with high thermal mass need to have good night time ventilation so the house is able to be cooled in the evening.

INTERNAL GAINS

Although the 'free heat' from appliances and people can be very useful in the winter, in summer it can be a problem. In well insulated houses, think carefully about how to make the most from these internal gains. For example, take care in positioning appliances and appliance choice, and consider that some lights release more heat than others and should be on separate switches from the general room lighting.

The role of climate

Climate also has an effect on house temperatures – warmer local climates mean warmer houses. For example, in Northland the median living room day temperature is 22.5°C, but in Otago/Southland, it is just 19.5°C. A long-term concern is that a potential 2–3°C temperature rise due to climate change could make many newer houses uncomfortably warm, making occupants reliant on air-conditioning.

Cooling increases electricity use

Mechanical ventilation (forced air) and air conditioning are currently uncommon in New Zealand houses, which are traditionally naturally ventilated by opening doors and windows. Just 4% of the HEEP households had air conditioners or reverse cycle heat pumps, but import figures suggest there is a sizeable growth in their use.

The impact of this increase in summer cooling on the electricity grid is unknown, but if it is large enough it has the potential to change our traditional winter peak in electricity use to a summer one. The problem will be far worse if the houses are not designed to be able to maintain comfortable temperatures.

HEEP research and data collection has financial support from the Foundation for Research, Science and Technology and Building Research.