The Tiny Tropical Healthy House

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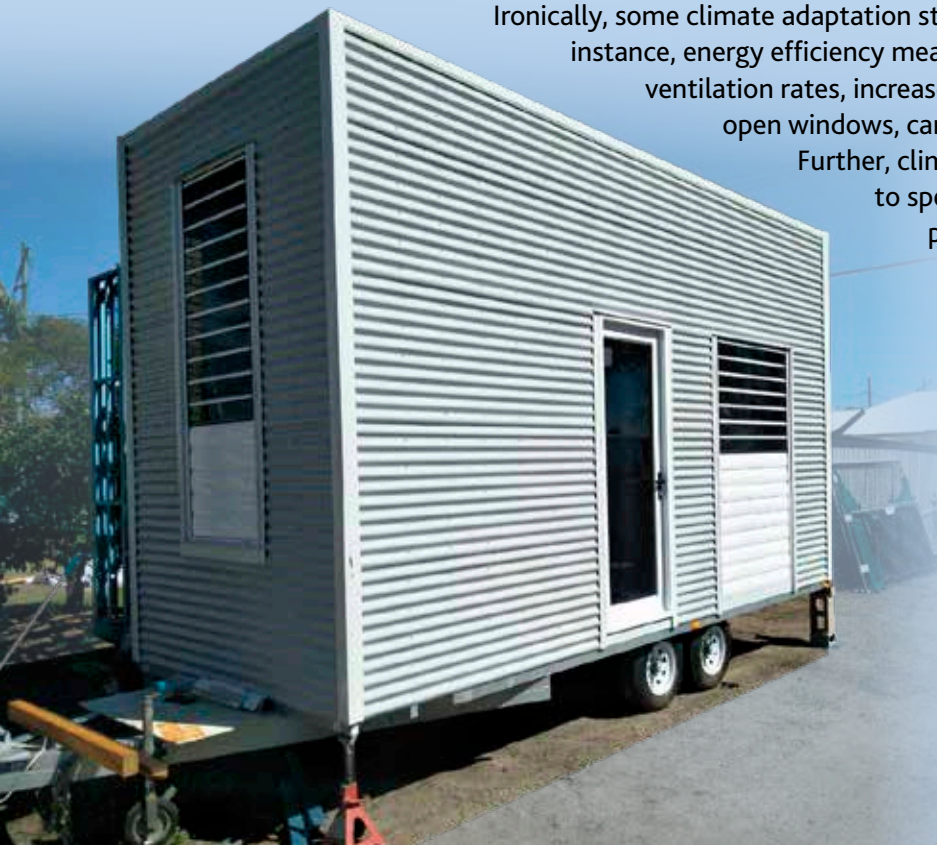
Thinking globally, sustainable cities depend on sustainable tropical cities, and on housing within those cities. Nearly half of the world's population lives in the tropics. More of the world is likely to become tropical and sub-tropical, given climate trends. Climate-related hazards (e.g., cyclones, bushfires, sea-level rise, floods and droughts) are becoming more frequent, widespread, and severe, emphasizing the need for resilient housing.

In Australia, as in many other countries, we spend most of our time indoors, such as in homes. However, levels of pollutants are typically several times higher indoors than outdoors. Even so-called green, eco, and sustainable buildings can have high levels of indoor pollutants. Consequently, most of our exposure to pollutants that can harm our health occurs in places that we consider safe, such as our homes.



Ironically, some climate adaptation strategies can impair indoor air quality. For instance, energy efficiency measures that involve tighter buildings, lower ventilation rates, increased reliance on air conditioning, and less use of open windows, can increase pollutant concentrations indoors. Further, climate and weather extremes often drive people to spend more time indoors, which can increase pollutant concentrations and exposures.

To meet the needs for resilient and safe housing, we have developed a "tiny tropical healthy house" (TTHH). The TTHH seeks to meet the key criteria of being (1) healthy (good indoor air quality, low/no offgassing materials, mould resistant, pest resistant) and (2) tropical (resilient to climate-related hazards and suitable to tropical environments). In addition, the TTHH is designed to be energy efficient, cyclone rated, affordable, adaptable, self-sustaining, and transportable. Turning to the key criteria:

For healthy, the TTHH is constructed with stainless steel, known for its low-offgassing and inert properties and its resistance to microbial growth and infestation. Avoided are petrochemical-containing building materials (such as manufactured wood, recycled products, treated lumber, or composites) within the TTHH. In addition, the structure is built using metal flashing, mechanical fixings, and wall frames assembled with screws and rivets. This avoids the use of petrochemical-containing glues within the TTHH. Each component, even the smallest item, is tested before being introduced into the TTHH.

For tropical, the TTHH emphasises climate sensitive design, working with nature, adjusting to environmental conditions, and taking advantage of favourable winds, ambient air quality, and solar direction. It employs passive ventilation, with open windows to encourage cross-ventilation, along with a shade or tarp over the house. In this way, the TTHH eliminates the need for air conditioning and mechanical ventilation. In addition, as a principle of biomimicry, the TTHH can be rotated according to the direction of the winds or the sun, just as animals move throughout the day to adapt to their environment.

Target applications include the following:

- disaster preparedness
- disaster relief
- affordable housing
- social housing
- temporary worker accommodation
- student housing
- teenager housing
- ageing in place
- health recovery
- eco-retreat
- indigenous housing
- ageing in place
- rental housing
- second home

Project Lead: Professor Anne Steinemann, James Cook University
Project Manager and Builder: Darren Finlay, Innovation House
Project Funder: CSIRO, Land and Water
Collaborators: Townsville City Council, Sustainability Team in Environmental Services
Project Timeline: 2015-2019
Dimensions: 6.1 metres (length) x 4.3 metres (height) x 2.4 metres (width).
Weight: 2.5-3.0 metric tons.