

## Building for Cool in Informal Settlements

Climate Ready City

Built Environment



### Climate Issue: Heat in the Global South

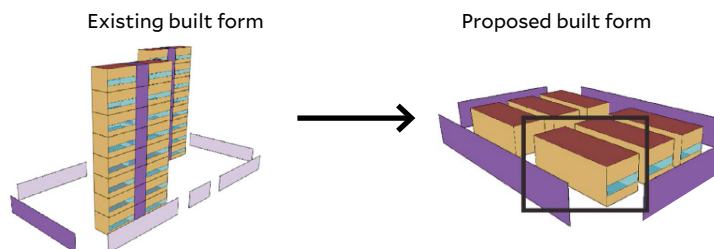
- Climate change and urbanization is leading to dangerously high temperatures in informal settlements, also known as slums
- More than 1.1 billion people live in informal settlements - expected to triple in next 30 years
- Geographic location, building materials, lack of electricity and poverty make residents of informal settlements extremely vulnerable to heat
- Some cities are proposing to replace existing settlements with apartment buildings
- But the science shows that the proposed buildings can result in hotter conditions for residents - putting lives at risk.

### Temperature: A Critical Consideration

- Redevelopment schemes aim to improve the quality of life for residents, by replacing informal settlements with mid- to high-rise buildings
- However, temperature and energy requirements are often not considered in the design phase
- Building design and materials are incredibly influential on indoor temperatures
- In some cases, redevelopment can lead to hotter indoor temperatures than existing conditions.

### Redevelopment: Not Always Cooler

This redevelopment model, proposed in both India and Kenya, was found to have **hotter** conditions than retrofitting existing homes. Lack of shade from surrounding buildings and high temperatures in upper floor apartments contributed to hotter conditions.



Source: Nutkiewicz et al. (2022)

### What About Air-Conditioning?

- Air-conditioning (AC) is energy intensive, and too expensive for the majority of residents of informal settlements
- Widespread installation of AC would strain energy infrastructure and resources in developing countries
- AC's use refrigerant gases, which are powerful greenhouse gases (GHG)
- Unless electricity is from a renewable source, it would also lead to increased GHG emissions, further accelerating climate change.

### Retrofit Cooling Options

Redevelopment schemes are important, as residents deserve safe, secure and sanitary housing. However, new housing must provide cooler conditions than current options without reliance on AC. In the meantime, existing homes can be retrofitted to provide better cooling outcomes.

**COOL ROOFS:** Painting roof with white, reflective paint to reflect sunlight

**RESULT:** Can reduce annual heat stress incidents by 91% in informal settlements

**INSULATION:** Replacing metal roofs with insulated concrete roofs

**RESULT:** Can reduce number of heat stress incidents by 98%

**VENTILATION:** Increasing air flow in and out of homes, with windows and/or fans

**RESULT:** Can decrease heat exposure by 39%

**SHADE:** Shading homes via other building structures, awnings or trees.

**RESULT:** Reduces solar radiation on home.

To find out more information about this fact sheet, contact **Professor Narasimha D. Rao** at [narasimha.rao@yale.edu](mailto:narasimha.rao@yale.edu). Fact sheet based off Nutkiewicz et al. (2022). Cool roofs can mitigate cooling energy demand for informal settlement dwellers. *Renewable and Sustainable Energy Reviews*. 159, 112183. <https://doi.org/10.1016/j.rser.2022.112183>. Informal settlement population data from United Nations Statistics Division (2024), SDG Report #11.