Thermally Autonomous Housing

Tata Fellow Emma Nelson
Professors Leon Glicksman and John Ochsendorf

Massachusetts Institute of Technology
Hunnarshala Foundation, Bhuj

Motivation
- Inadequate protection from extreme heat was cited as one of the six major concerns for healthy housing environments by the WHO.
- An estimated 1 billion people, nearly 10%, of the world’s population inhabit arid desert regions (National Geographic).
- Extreme heat can lead to cardiovascular and respiratory disease.
- May 2015, 2,500 lives taken as a result of heat waves in India (EM-DAT).
- Most of the world’s population growth over the next 20 years will occur in low and middle income cities” (WHO 2010, p. 17).
- About 21.9% of India’s urban population still subsists on incomes that are below the poverty line (World Bank 2011).
- Housing needs to be affordable and provide adequate protection in order to meet the demands of rapid urbanization.

Background
Thermal Autonomy: Achieving thermal comfort though passive means
- Night Flush Ventilation
- Heat Avoidance and radiant barriers
- Combination of thermal mass and proper insulation

Design for Development
- Local partner, Hunnarshala, for co-design and dissemination of results
- Housing for all by 2022, India Ministry of Housing and Urban Poverty
- Alleviation Program to reduce slum growth and encourage incorporation of innovative technology in building design.

Research Progress
Define current slum archetypes
- Walls: Sandstone, rocks, concrete, earth
- Roof: Corrugate concrete asbestos sheets, plastic covering, cloth, thin thatch, tin sheets

Look to existing housing for successful passive cooling technique
- Conduct field tests to study
- Effects of insulation
- Ventilation schedules
- Various roof types

Next Steps
The researchers will now examine how other factors (apart from roofs) affect indoor thermal comfort. Investigation will primarily focus on
- Fan operation scheduling.
- Optimization of roof design. The design will incorporate local resources and artisan skills.
- Wall design to further improve thermal autonomy.

Research Methodology
- Identify market, audience, and cost points
- Run simulations and calculations to predict thermal performances
- Conduct field tests to verify proposed solutions
- Survey existing materials

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References