Assessing air quality for natural ventilation in India

Methods to analyze indoor air quality and energy efficiency in urban Indian buildings

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Abstract/Opportunity

• Buildings in India contribute to 35% of total energy demand and are expected to grow to 8x by 2050. (A/C and cooling uses ~ 40%)

Source: Chaturvedi et al., 2014

• Natural ventilation strategies have potential to reduce energy consumption by 10-30% even in hot climates

• Ambient air pollution greatly constrains natural ventilation due to effects on indoor environment

• No integrated methods available for primary decision makers on buildings to assess IAQ along with building thermal performance

Proposed Solution

• An integrated approach to assess IAQ along with natural ventilation at the building design stage

• Comprehensive methods to model airflows in urban agglomerations (expanding prior work to account for urban densities in India)

• Expanding on prior tools for assessing thermal performance to include pollutant transport

• Working with architecture firms and others to expand capability

• Making data available for public use

Data/Results/Prototype

• Step 1: A computational approach to wind flows in urban areas:

Source: Chaturvedi et al., 2014

• Results: wind pressure coefficients for multiple plan area densities

• Step 2: Expanding on CoolVent to include pollutant transport

• Results: Visualizations for PM2.5 concentrations, air exchange and thermal comfort in indoor zones

• Step 3 (ongoing): Assess IAQ for different building + IAQ technology intervention + urban plan scenarios

Conclusions/Value Proposition

• Expanded CoolVent for PM2.5 transport analysis in urban areas

• A first step framework for additional pollutants and wind pressure coefficient simulations for multiple urban plan densities

• Simulating effectiveness of filtration technologies to improve IAQ

Next Steps

• Expand to multiple building types and geometries + expand to other pollutants + expand CFD approach

• Future Research: Risk perceptions of IAQ; Economic benefits of good IAQ

• Possible off-takers: Building designers, architects, civil society

Select References


