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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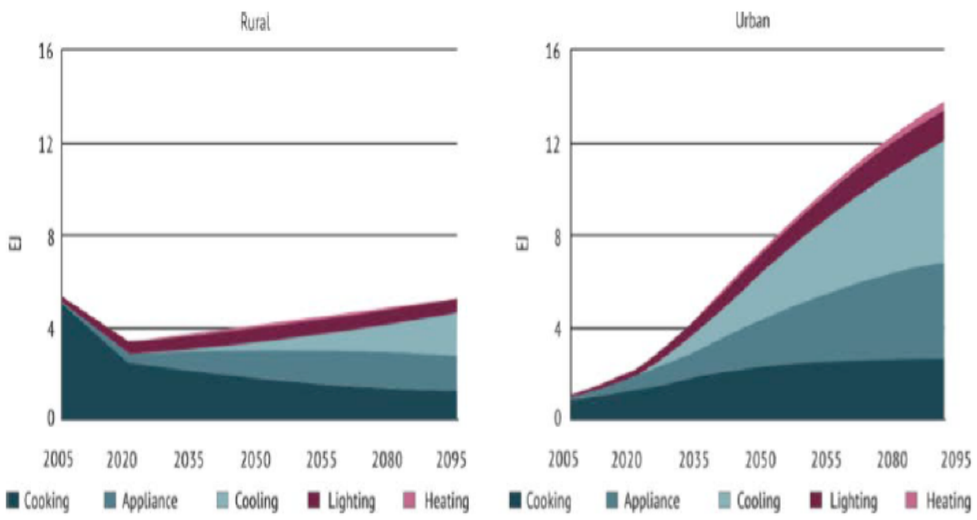
Abstract/Opportunity

- 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%**)

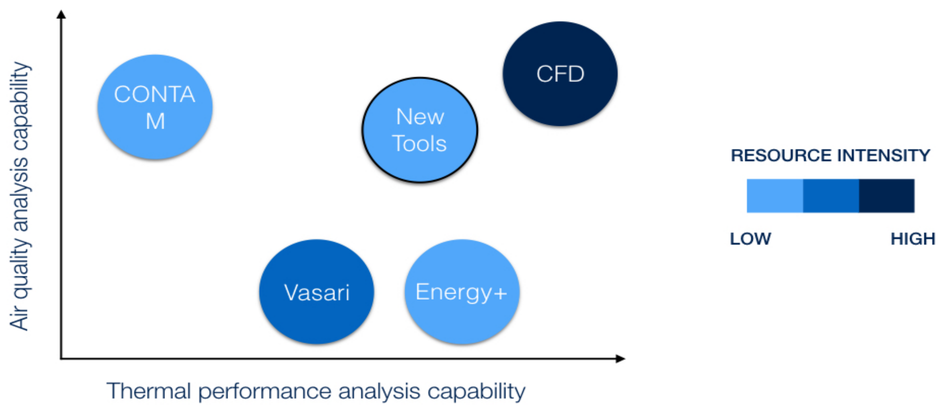


Source: Chaturvedi et al., 2014

- 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

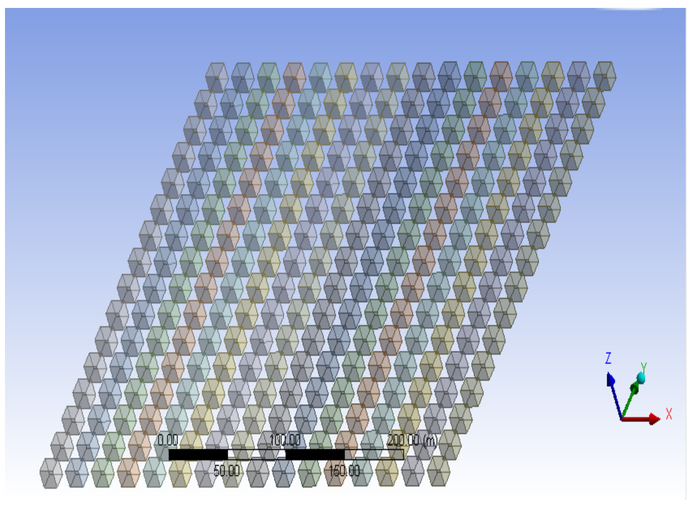
- An integrated approach to assess IAQ along with natural ventilation at the <u>building design stage</u>
- Comprehensive methods to model <u>airflows in urban agglomerations</u> (expanding prior work to account for urban densities in India)
- Expanding on <u>prior tools</u> for assessing thermal performance to include pollutant transport

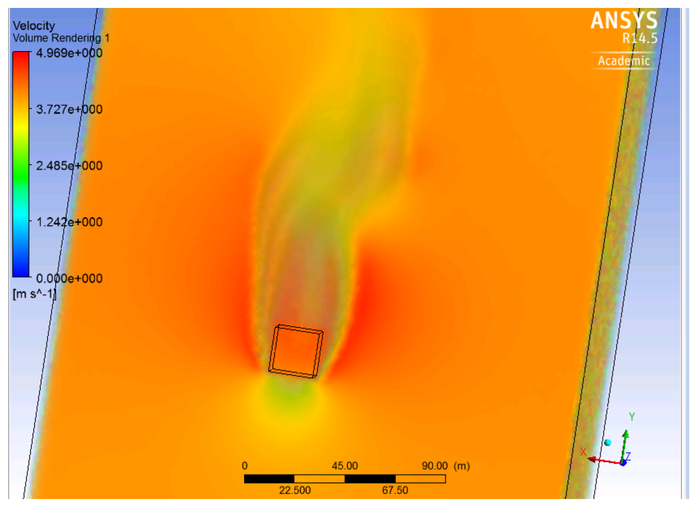


- Working with architecture firms and others to expand capability
- Making data available for public use

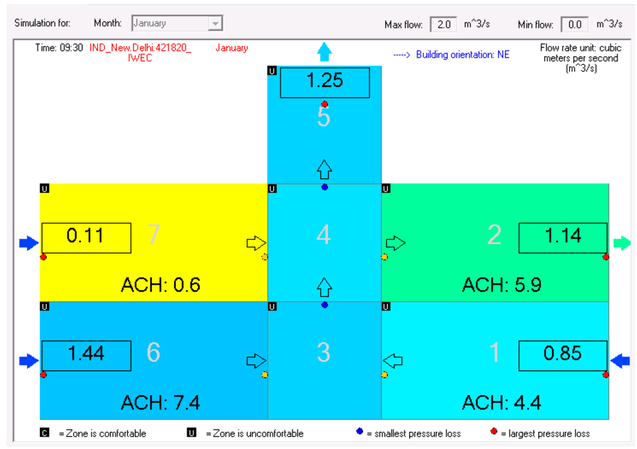
Data/Results/Prototype

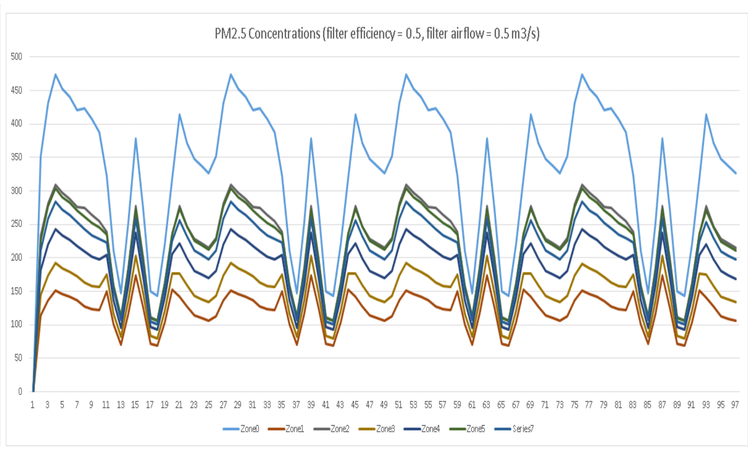
- <u>Step1:</u> A computational approach to wind flows in urban areas:





- <u>Results:</u> wind pressure coefficients for multiple plan area densities
- <u>Step 2:</u> Expanding on CoolVent to include pollutant transport
- <u>Results:</u> Visualizations for PM2.5 concentrations, air exchange and thermal comfort in indoor zones





- <u>Step 3 (ongoing):</u> Assess IAQ for different building + IAQ technology intervention + urban plan scenarios
- Assessing efficacy of HEPA, ULPA and air purifiers to control IAQ

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 <u>building types and geometries</u> + expand to <u>other pollutants</u> + expand CFD approach
- Future Research: Risk perceptions of IAQ; Economic benefits of good IAQ
- Possible off-takers: Building designers, architects, civil society

Acknowledgments

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