

Use of modern tools and technologies for effective natural ventilation and dynamic shading in modern buildings

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- Context
 - Traditional practice for natural ventilation and shading
 - Key challenges in adopting in modern buildings
- Two key solutions
 - Use of software tools to design buildings for good natural ventilation (BEEP CFD Tool "Vayu Pravah")
 - Use of external movable shading system (EMSyS)
- Summary and way forward

Context: Natural ventilation and shading



 Natural ventilation is the process of supplying and removing air through an indoor space without using mechanical systems



Wind driven natural ventilation

Buoyancy driven natural ventilation Shading is the prevention of penetration of solar radiation into the building in summer, while allowing the needed solar gains in winter



Context: Traditional practice for natural ventilation and shading









Jaalies



Verandah



All these features are very effective in reducing the heat ingress to inside spaces and utilized outside air for natural ventilation

Chhajjas

Some of the key challenges in modern context





Dense high-rise construction (Population, urban centric, land prices...)



Aesthetics? Excessive use of glass with no shading



Speed of construction

Use of software tools to design buildings for good natural ventilation

• BEEP CFD Tool "Vayu Pravah": A freeware computational fluid dynamic (CFD) tool to simulate wind driven air flow around and inside the buildings

Can answer:

- How does the wind direction influence the air movement between buildings ?
- How does the building layout influence the air flow between building ?
- How does the façade design influence the cross ventilation ?









Vayu Pravah: Key features

- Can be used at district levels, single large projects and individual building
- Can be used by non-specialist like Architects
- Easy-to-use graphical user interface (GUI)
- Easy to understand/communicate result visualization
- Short simulation time faster evaluation of design alternatives and faster decision making







Vayu Pravah: Example of comparison of building layouts



• Wind availability for different layouts, try to maximise wind availability



Vayu Pravah: Example of internal flow analysis



- Long façade perpendicular to the wind direction
- Buildings which are not directly facing the wind receive poor airflow and the natural cross ventilation is limited



- Buildings are in parallel (165 degree) to the wind direction
- Good airflow throughout the project and hence good natural ventilation



External Movable Shading System (EMSyS)



• EMSyS units are installed outside the glazed surface of the building façade. They are dynamic and can be closed or opened as per the requirements of the occupant to control both the solar heat gains and natural daylight.



EMSyS can bring about up to 80% of reduction in direct solar heat gain from windows; while still providing good natural daylight

EMSYS potential: Real-life performance measurement

- Two identical spaces, one with EMSyS and one with Internal Curtain
- Performance measurement to assess impact of EMSyS product in two modes
- Naturally ventilated mode: Opening / closing windows, operating ceiling fan
- Air-conditioned mode: AC is ON keeping the same setpoint

Up to ~3.5°C lower peak inside operative temperature with EMSyS ~32% lower cumulative cooling demand (thermal) with EMSyS









EMSYS products and provisions in buildings





Retractable awnings



Vertical screens

• Provision for shading





Vertical louvers



Lamella blinds



- Shading and ventilation were important elements in traditional building design; which, somehow not practiced well in new buildings
- There is an immediate need to integrate these things in modern context with new tool, technologies and solutions / products
- Design tools like "Vayu Pravah" and solution like "EMSyS" have great potential to help better ventilation and shading in buildings
- Need a push-and-pull approach:
 - Integrating requirements in policy/ bye-laws (e.g. shading provision, showing minimum ventilation, ...)
 - Creating the demand among end-users (demonstrating and disseminating)



Thank you !!!

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