

I-SHARE

By Delhi Chapter of ISHRAE

Indian Society of Heating Refrigerating & Air Conditioning Engineers

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SHAKTI 3.0

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PRESIDENTIAL ADDRESS

Dear Esteemed Members,

It is my privilege and honour to address you as the 46th President of the Delhi Chapter of ISHRAE and the first woman to hold this esteemed position for the Society Year 2026–27.

Delhi, as a rapidly evolving urban ecosystem, stands at the crossroads of opportunity and responsibility in shaping a sustainable built environment. This year, our focus will be to transform vision into action by creating meaningful impact through innovation, collaboration, and leadership.

Aligned with ISHRAE's mission of **Engineering a Greener Global Built Environment**, our chapter will actively contribute towards advancing sustainability, technology, and excellence in the Built Environment industry.

Our vision is to build a more inclusive, future-ready, and impactful Delhi Chapter — one that empowers members, strengthens industry engagement, and contributes towards the growth of the built environment.



Our Focus Areas for 2026–27

- **Inclusivity & Member Value** – Creating opportunities for every member to learn, contribute, and grow.
- **Knowledge & Skill Advancement** – Promoting technical excellence through continuous learning and industry collaboration.
- **Youth & Next-Gen Leadership** – Developing young professionals as future leaders of the industry.
- **Sustainability & Innovation** – Encouraging energy-efficient, responsible, and future-oriented solutions.
- **Industry Connect & Impact** – Strengthening partnerships and creating measurable contributions to society.

This year will be focused not only on ideas and planning, but on execution with purpose and measurable outcomes.

Opportunities for Women in Built Environment Industry

The Built Environment industry is witnessing rapid growth driven by energy efficiency, sustainability, and technological advancements.

Women bring diverse perspectives, innovation, and valuable skills that strengthen the industry. Their opportunities span across:

- Technical Roles • Research & Development • Design & Engineering • Project Management • Sales & Marketing • Entrepreneurship • Leadership & Advocacy

Encouraging more women to enter Built Environment will help create a stronger workforce, promote innovation, and build a more inclusive industry. With the right education, training, mentorship, and opportunities, women can achieve remarkable success and emerge as leaders in this sector.

It gives me immense pleasure to launch the inaugural edition of I-SHARE **Shakti 3.0**, a significant step towards recognizing and strengthening the contribution of women in the HVAC&R and built environment sectors.

I strongly believe that the true strength of our chapter lies in our members. With the guidance of our experienced mentors, the enthusiasm of young professionals, the support of our valued partners, and the dedication of our Chapter Working Committee, we will take the Delhi Chapter towards greater achievements.

I warmly welcome the Chapter Working Committee for the Society Year 2026–27 and look forward to working together to create meaningful impact.

Delhi Chapter of ISHRAE done some remarkable program (Q1) in Healthcare, Datacentre and Codes & Standards etc. Which were highly appreciated by the members.

In the members front, we have done around 110, that includes new members as well as renewals. DCI is thankful to all the respective chairs and committee for the achievements.

Finally, I am thankful to all our Annual Partners for this S.Y. 2026-27, ALP Aeroflex, Edgetech, Superflow Cooling , Advance Valves, Acama, Lehry Valves, The Refrigeration House, RR Shramik, Rayshen, K – Flex & Air Techno.

Let us unite to make Delhi a benchmark for sustainable engineering excellence.

Warm Regards,

Sukhda Tandon Satija

President, S.Y. 2026 - 27

Delhi Chapter of ISHRAE

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Editor's Note



Dear Readers,

It gives me immense pleasure to welcome you to the first issue of I-Share for the ISHRAE Society Year 2026-27. This edition is dedicated to "Shakti"—celebrating the leadership, innovation, and transformative role of women in shaping the future of the built environment.

Across sustainable design, energy efficiency, decarbonisation, research, and policy, women are driving solutions that are creating a greener, more resilient, and inclusive future. Through this issue, we recognize their contributions and the impact they continue to make across our industry.

The past quarter has been an exciting one for ISHRAE Delhi Chapter, marked by technical seminars, student engagement initiatives, internship drives, industry interactions, site visits, and knowledge-sharing programs. These activities reflect our continued commitment to advancing HVAC&R excellence, sustainability, and professional development.

As we work towards a low-carbon future, innovation must be complemented by diversity, collaboration, and inclusive leadership. The stories featured in this edition embody these values and serve as an inspiration for all of us.

On behalf of the Editorial Team and ISHRAE Delhi Chapter, I thank our contributors, volunteers, partners, and readers for their continued support. I hope this edition sparks new ideas, meaningful conversations, and renewed commitment towards a sustainable future.

Happy Reading!

Ashish K Jain

Editor, I-Share

ISHRAE Delhi Chapter, SY 2026-27

"The future of sustainable buildings will be shaped not only by innovation, but by the diverse minds that drive it."

I-SHARE

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Conducted by Delhi Chapter of ISHRAE

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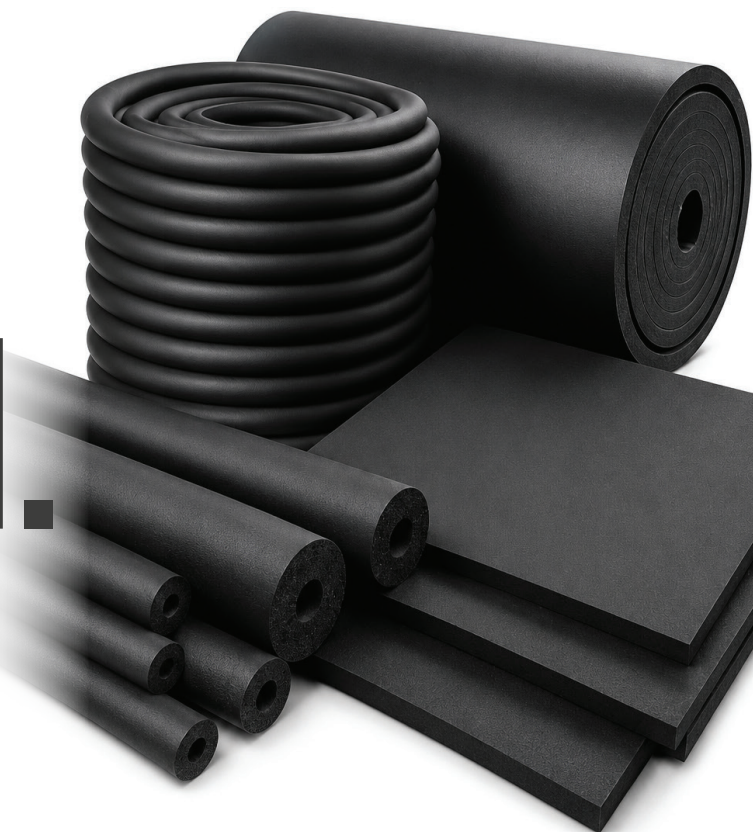
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Displacement Ventilation in Hospitals: Performance Evaluation and Applicability to Indian Healthcare Facilities

By **Samta Bajaj**



Abstract

Hospitals in India operate continuously under stringent requirements for infection control, indoor air quality (IAQ), thermal comfort, and acoustic performance, while also facing rising energy costs and diverse climatic conditions. Displacement ventilation (DV) represents a transitional air distribution approach positioned between conventional ventilation and intelligently integrated air-conditioning systems, combining high ventilation effectiveness with controlled thermal conditioning through low-velocity airflow. This paper evaluates the applicability of DV for hospitals in the Indian context with reference to the National Building Code (NBC), ISHRAE guidelines, and NABH accreditation requirements. An international benchmark case study of Lucile Packard Children's Hospital, Palo Alto, USA, is presented along with a comparison between displacement ventilation and conventional overhead mixing systems. The study demonstrates that DV can achieve higher ventilation effectiveness, improved patient comfort, reduced noise levels, and lower energy consumption, indicating its suitability for selected spaces in Indian hospitals when adapted to local conditions.

Keywords

Displacement ventilation, hospital HVAC, NBC India, ISHRAE guidelines, NABH, indoor air quality, energy-efficient hospitals

1. Introduction

Hospitals are among the most energy-intensive building typologies in India due to 24×7 operation, high ventilation rates, and strict infection control requirements. HVAC systems alone typically account for 45–55% of total hospital energy consumption (Fig.1). Most Indian hospitals rely on overhead mixing ventilation systems that supply air at high velocity from ceiling diffusers, aiming to dilute contaminants within the occupied zone.

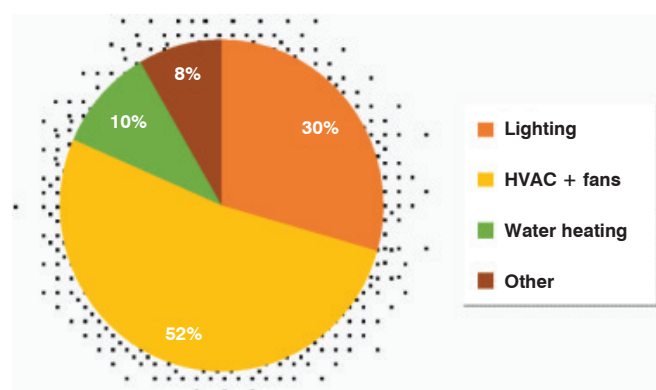


Fig.1 Energy Breakdown in Indian Hospitals

While overhead systems are familiar and code-compliant, they often result in high fan energy demand, elevated background noise, uneven thermal comfort, and extensive mixing of airborne contaminants. With increasing emphasis on patient-centric design, sustainability, and compliance with NABH accreditation standards, there is growing interest in alternative air distribution strategies that focus on ventilation effectiveness rather than airflow quantity alone (Fig. 2)

Displacement ventilation has gained recognition internationally and within ISHRAE technical discourse as a viable strategy for selected hospital spaces when designed under a performance-based framework consistent with NBC and NABH requirements. Also it is an accepted technology in hospital patient rooms, ICUs and waiting areas and can provide a cleaner, safer environment for patients, healthcare providers and visitors while providing energy savings through a lower air change requirement. ASHRAE standard 170 also officially recognises the use of displacement ventilation in healthcare facilities and provides guidelines for its use. (Fig.3 &4)

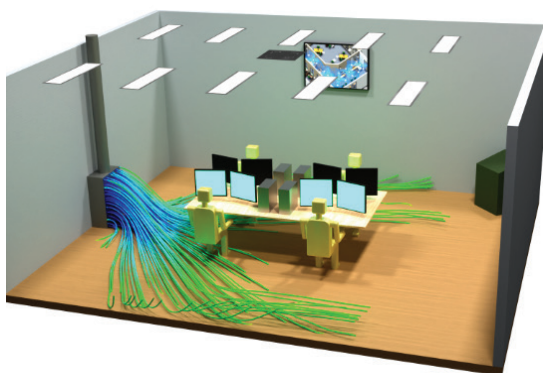


Fig.2 Displacement ventilation for high effectiveness

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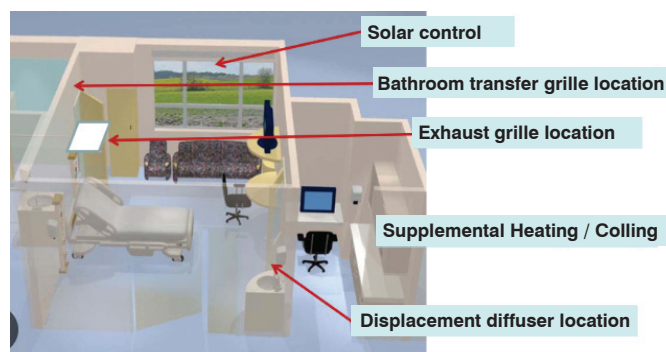


Fig 3 Displacement ventilation in typical patient room



Fig. 4 Working System of DV in waiting areas
Outlet in interior (A) or in wall (B)

2. Principles of Displacement Ventilation

In a displacement ventilation (DV) system, conditioned air is supplied at low velocity through diffusers located near the floor or low sidewalls. The supply air spreads gently across the floor, forming a clean air layer within the occupied zone. Heat sources such as patients, medical staff, lighting, and medical equipment generate thermal plumes that lift warm, contaminated air upward toward the ceiling, where it is exhausted. (Fig. 5)

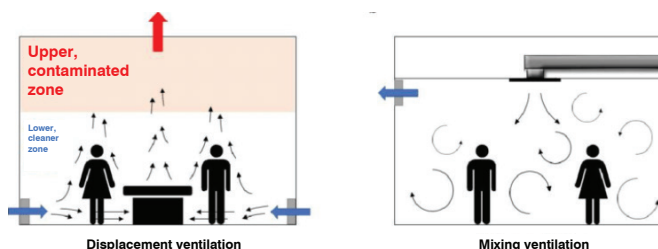


Fig. 5 Concept of Displacement Ventilation and Mixing Ventilation

Unlike conventional overhead mixing systems, DV relies primarily on buoyancy-driven airflow rather than forced mixing. This results in a stratified indoor environment in which the breathing zone is supplied with cleaner, cooler air, while warmer and more contaminated air is confined to the upper zone. When properly designed, this stratification improves ventilation effectiveness without compromising thermal comfort.

Thermal plume-Principle of DV

A thermal plume is a convection current caused by buoyancy forces that causes local air to warm and rise above the heat source, entraining surrounding air and increasing in size and volume as it loses momentum, as depicted in Fig.6. The maximum height to which a plume will rise is dependent on the strength of the heat source, as the initial momentum of the plume will increase. Also, a room with more stratification will reduce the relative density of the plume and, as a result, limit the height to which the plume will rise. Thermal plume is different in case of large objects and cylinder is better approximation of occupant/ large objects in space rather than a point source (Fig 7)

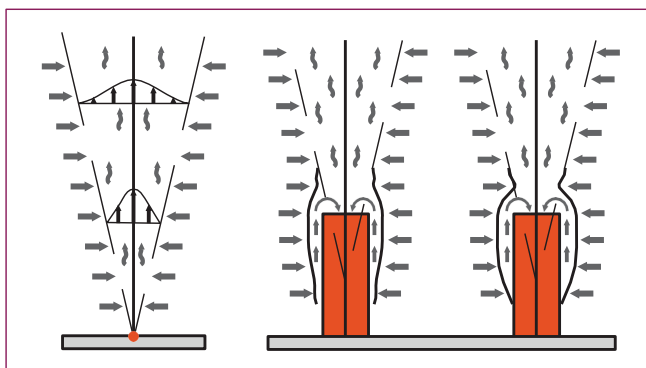


Fig. 6&7 Thermal plume from a point heat source and a heated cylinder

The principal design aspects governing displacement ventilation performance in hospital environments are summarized below:

- Controlled vertical temperature stratification, with head-to-foot temperature difference typically limited to 2–3 °C for seated or bedridden occupants in accordance with ASHRAE Standard 55 and ISHRAE comfort guidance.
- Higher supply air temperatures compared to overhead systems (generally 17–20 °C), resulting in higher return air temperatures (26–29 °C) and improved chiller and economizer efficiency. Refer Table-I as under:

Typical Design Parameters	IP	SI
Supply Temperature	63-68 °F	17-20 °C
Return Temperature	78-85 °F	26-29 °C
Supply Face Velocity Mainly Sedentary Occupancy	40 fpm	0.2 m/s
Ventilation Effectiveness (ASHRAE, 2004b)	1.2	1.2

Table 1: Typical DV parameters

- Low diffuser face velocities, usually limited to approximately 0.2 m/s (40 fpm) in occupied zones, minimizing draft risk and enabling very low background noise levels.
- High-level return air placement near ceiling level to ensure effective removal of stratified warm and contaminated air and to prevent short-circuiting within the occupied zone.
- Higher ventilation effectiveness ($E_z \approx 1.2$), allowing equivalent or superior IAQ performance at lower air change rates compared to conventional mixing ventilation.
- Best suitability for spaces with ceiling heights greater than approximately 2.7 m, moderate cooling loads, and predominantly warm contaminant sources, such as patient rooms, ICUs, recovery areas, and waiting spaces.

NBC Part 8 – Building Services does not mandate a specific air distribution strategy and permits alternative systems provided minimum ventilation rates, filtration efficiency, thermal comfort, and safety requirements are satisfied. Displacement ventilation therefore aligns well with the performance-based intent of NBC and healthcare accreditation frameworks.

Importance of Diffuser Selection and Types of Displacement Ventilation Air Outlets in Hospitals

A critical aspect of displacement ventilation design is that diffuser selection is primary to overall system performance. Unlike overhead mixing systems, where air distribution is driven largely by supply air momentum, the effectiveness of a DV system depends fundamentally on the diffuser's ability to deliver air uniformly at very low velocity without inducing drafts or unwanted mixing. Diffuser geometry, face area, discharge pattern, and placement directly influence temperature stratification, ventilation effectiveness, occupant comfort, and acoustic performance. As a result, diffuser selection and layout must be treated as a core design decision rather than a secondary equipment choice.(Fig.8)

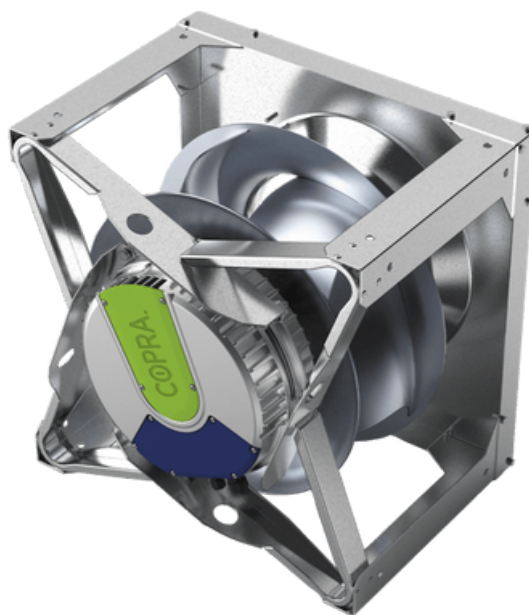


Fig. 8 : DV diffuser installed along the perimeter

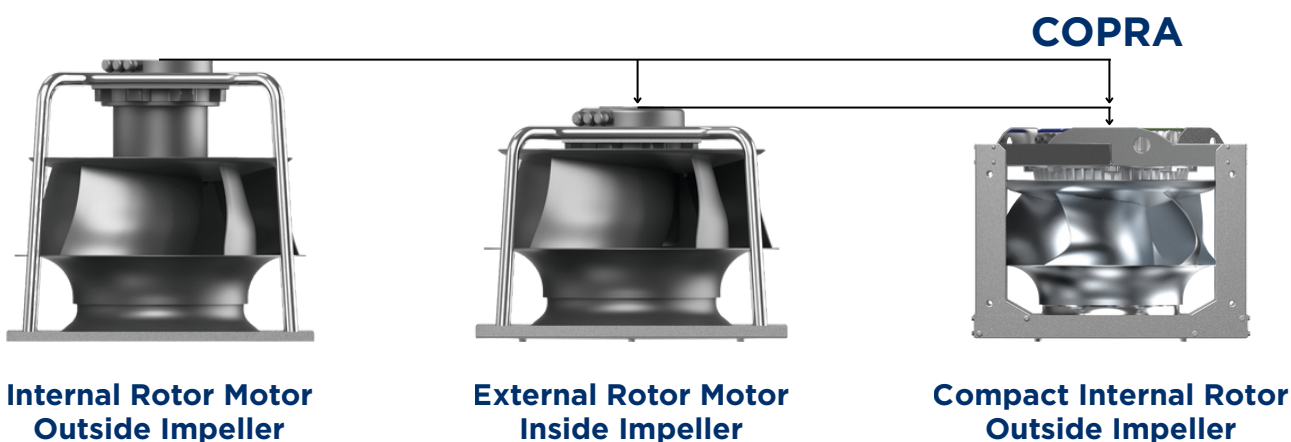
The selection and integration of appropriate air outlets are critical to the successful application of displacement ventilation in healthcare facilities. Common DV outlet types used in hospitals include:

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High Efficiency	Short Axial Length
✗	✓

High Efficiency	Short Axial Length
✓	✓



- Low-level wall-mounted displacement diffusers, typically installed along perimeter walls or beneath windows, supplying air directly into the occupied zone with minimal visual impact.
- Floor-mounted displacement diffusers, used in large open areas such as lobbies and waiting halls, delivering radial low-velocity airflow across the floor surface.(Fig.9)



Fig. 9 : DV floor mounted grills and diffusers

- Column-integrated displacement diffusers, where air is supplied through architectural columns or vertical enclosures, allowing seamless integration with interior design.

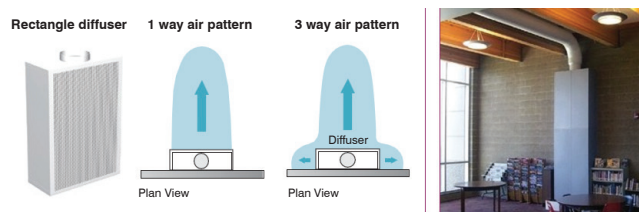


Fig.10 : Rectangle diffusers:DF installed against wall

- Furniture-integrated or millwork-integrated diffusers, concealed within cabinetry, bed headwalls, or architectural elements to preserve hygiene and aesthetics in patient rooms.
- Hybrid heat-cool displacement diffusers, capable of operating in displacement mode during cooling and switching to higher-velocity or linear discharge during heating to avoid buoyancy short-circuiting.(Fig.10)
- Ceiling-mounted displacement diffusers (used selectively), typically located near walls to take advantage of the Coanda effect and minimize entrainment of polluted upper-zone air where low-level installation is not feasible.(Fig. 11 &12)

Outlet selection is driven more by comfort and architectural constraints than by throw or spread, as airflow distribution in DV systems is governed primarily by thermal plumes rather than diffuser momentum.

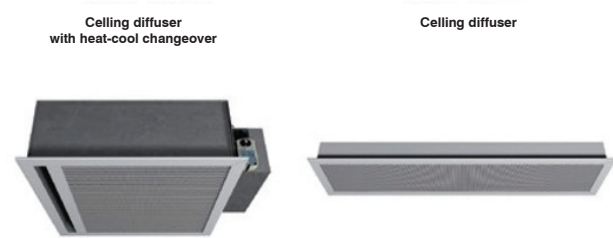


Fig.11 : Heat-Cool changeover diffuser in ceiling

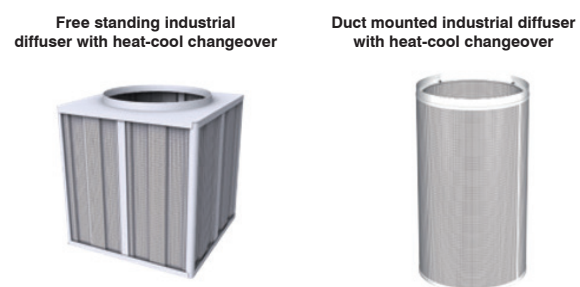


Fig 12 Free standing industrial diffuser for open areas

3. Alignment of DV system with Indian Codes and Accreditation Systems

3.1 National Building Code (NBC)

NBC Part 8 – Building Services specifies minimum ventilation rates, thermal comfort criteria, and filtration requirements but does not restrict the choice of air distribution strategy. Displacement ventilation complies with NBC when:

- Required air changes per hour (ACH) are achieved
- Filtration levels meet healthcare norms
- Thermal comfort aligns with ISHRAE comfort recommendations

3.2 ISHRAE Guidelines

ISHRAE promotes energy-efficient HVAC design through reduced fan energy, optimized air distribution, and improved ventilation effectiveness. Displacement ventilation directly supports these objectives by achieving higher IAQ performance at lower airflow rates.

3.3 NABH Accreditation Requirements

NABH emphasizes infection prevention, patient comfort, acoustic control, and reliability of building services. DV supports NABH objectives by:

- Improving IAQ in the occupied zone
- Reducing background noise levels
- Limiting cross-contamination through directional airflow

4. Case Study: Lucile Packard Children's Hospital, Palo Alto, USA



Fig. 13 Lucile Packard Children's Hospital, Palo Alto, USA -Recipient of ASHRAE Technology award 2020

4.1 Project Overview

Lucile Packard Children's Hospital, located in Palo Alto, California, is a large tertiary pediatric and obstetrics healthcare facility that serves as a global benchmark for the application of displacement ventilation in hospitals. The hospital comprises approximately 521,000 ft² (48,400 m²) of conditioned area and accommodates 364 patient beds, including acute care units, intensive care units (ICUs), operating and interventional suites, diagnostic imaging areas, and large public spaces.

The project achieved LEED Platinum certification, making it one of the few hospitals worldwide to reach this level of environmental performance. Although located outside India, the scale, complexity, and healthcare requirements of the facility are comparable to large Indian tertiary hospitals, making the findings directly relevant to Indian practice.

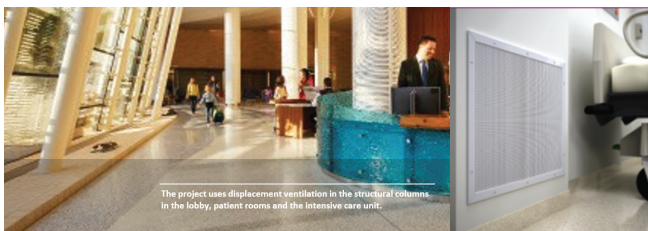


Fig. 14 Project uses displacement ventilation in the structural columns in lift lobby, patient rooms and the Intensive Care Units

4.2 Application of Displacement Ventilation

Displacement ventilation was adopted as a cornerstone HVAC strategy following extensive computational fluid dynamics (CFD) modeling, physical laboratory testing, and validation under healthcare ventilation standards.

DV was implemented in:

- Main lobby, where DV was integrated into structural columns to eliminate visible ceiling diffusers
- Patient rooms, using low sidewall air supply combined with radiant heating (Fig 14)
- Intensive care units, using hybrid diffusers operating in displacement mode during cooling and linear delivery during heating

Architectural integration allowed air delivery through otherwise unused spaces such as cabinetry voids and column enclosures, preserving aesthetics and usable floor area.

4.3 Ventilation Effectiveness and IAQ Performance

Tracer gas CFD modeling demonstrated that displacement ventilation operating at 4 ACH was 30–50% more effective than conventional overhead mixing ventilation operating at 6 ACH. DV promoted upward transport of contaminants, capturing particulates near the ceiling for exhaust, whereas overhead systems dispersed contaminants throughout the occupied zone.

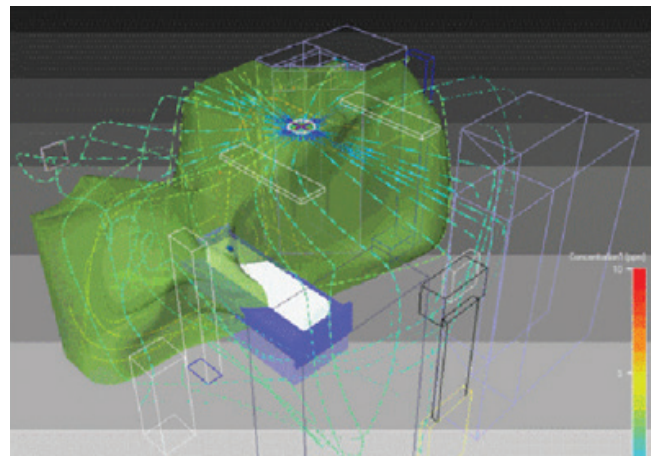


Fig. 15 CFD with conventional mixing ventilation

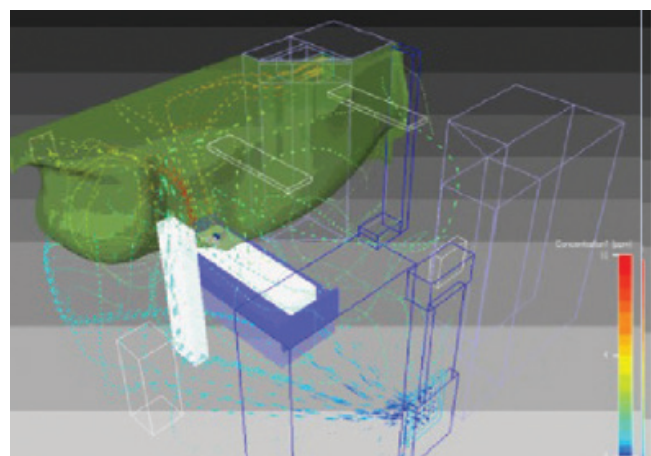


Fig. 16 CFD with displacement ventilation

Figure 15 shows visually overhead ventilation tracer gas particulate modelling, which shows dispersion of particulate throughout the room vs. Figure 16, which shows particulate modeling for DV, and particulate is captured at the top of the room and removed. The use of DV was tailored so the design could provide the benefits of DV while still complying with the applicable codes and, at the time of submission, these techniques had to be shown and proven effective to be acceptable by the authority having jurisdiction

4.4 Thermal Comfort, Acoustics, and Energy Performance

Patient rooms were maintained at a bedside temperature of approximately 22°C, with individual temperature control. Thermal comfort analysis showed:

- 94% patient satisfaction
- 90% visitor satisfaction

Low-velocity air supply enabled background noise levels as low as NC 25, supporting a healing environment. Energy benchmarking indicated a site EUI of 179 kBtu/ft²·yr, substantially lower than typical hospital benchmarks, with DV contributing to reduced fan energy, cooling energy, and reheat demand.

5. Comparison with Conventional Overhead Ventilation

Table 2. Comparison of Displacement Ventilation and Overhead Mixing Ventilation in Hospital Patient Rooms

Parameter	Displacement Ventilation (DV)	Overhead Ventilation (OV)
Air distribution principle	Low-velocity supply at floor/sidewall; buoyancy-driven removal	High-velocity ceiling supply; dilution by mixing
Typical air change rate	~4 ACH	~6 ACH
Ventilation effectiveness	30–50% higher	Baseline
Contaminant behavior	Directed upward removal	Dispersion in occupied zone
NABH infection control suitability	High	Moderate
Thermal comfort	Stable, draft-free	Less uniform
ISHRAE comfort compliance	Strong	Adequate
Acoustic performance	NC 25 achievable	Typically higher
Fan energy	Reduced	Higher
Cooling & reheat energy	Reduced	Higher
Integration with HEPA filtration	Lower pressure penalty	Higher pressure penalty
Architectural impact	Concealed diffusers	Visible ceiling diffusers
Suitability for Indian climate	High (with solar control)	High



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6. Implications for Indian Hospital Design

The Lucile Packard Children's Hospital case study demonstrates that displacement ventilation can meet stringent healthcare ventilation requirements while delivering measurable improvements in IAQ, comfort, acoustics, and energy efficiency. For Indian hospitals, DV is particularly suitable for patient rooms, ICUs (with hybrid systems), recovery areas, and waiting spaces.

Successful implementation requires early coordination between architectural, HVAC, and infection-control teams, control of direct solar gains, and selective application rather than universal deployment.

7. Relevance to Indian Hospitals and Need for Indigenous Case Studies

Although the referenced case study is international, its findings are highly relevant to Indian hospitals due to similarities in operational intensity, infection-control requirements, and patient-centric design goals. Indian hospitals additionally face challenges such as high outdoor PM₁₀ levels, rising energy costs, and constrained electrical infrastructure.

The demonstrated advantages of displacement ventilation—higher ventilation effectiveness at lower ACH, improved contaminant removal from the occupied zone, reduced noise levels, and lower fan and cooling energy—directly address these challenges. When adapted to Indian climatic conditions with appropriate solar control, envelope design, and filtration strategies, similar benefits can be expected.

At present, there is a lack of publicly documented, peer-reviewed displacement-ventilation case studies from Indian hospitals. This highlights the need for pilot projects, performance-based validation, and publication of indigenous data aligned with NBC, ISHRAE, and NABH frameworks.

8. Conclusion

Displacement ventilation represents a mature, performance-based ventilation strategy that aligns well with NBC provisions, ISHRAE design principles, and NABH accreditation requirements. The case study of Lucile Packard Children's Hospital provides strong evidence that DV can outperform conventional overhead ventilation in ventilation effectiveness, thermal comfort, acoustic performance, and energy efficiency. As Indian healthcare infrastructure evolves toward sustainable and patient-centric design, displacement ventilation offers a technically sound and regulation-compliant solution for next-generation hospitals.

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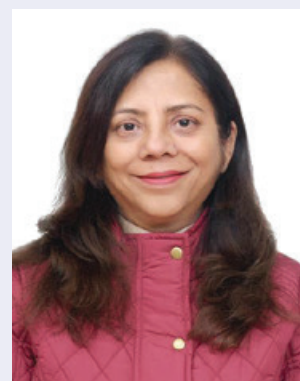
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By **Dr. Ruchi Grover**

Introduction

In this article, we will discuss various anti-corrosion coating technologies and coating processes.

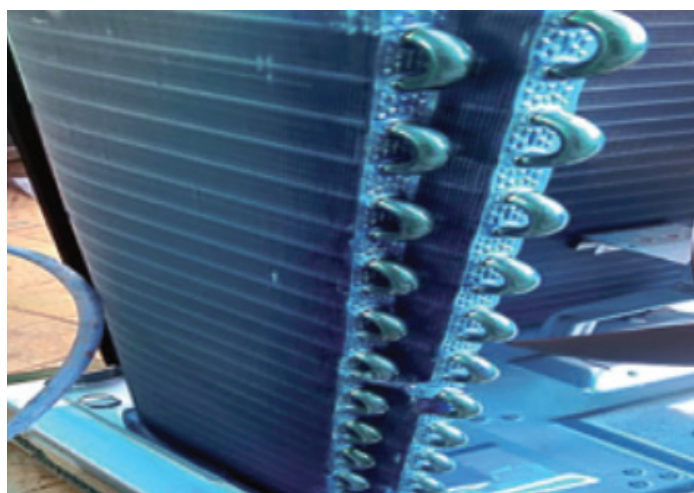
HVAC equipment and components are often exposed to moisture, chemicals, and other corrosive elements present in the air or the surrounding environment. Corrosion of HVAC coils can weaken metal surfaces, leading to cracks, holes, or perforations that may result in refrigerant leakage. Anti-corrosion coatings form a protective barrier on the coil surfaces, preventing direct contact with corrosive agents and prolonging the lifespan of the equipment.

Importance of Anti-Corrosion Coatings in the HVAC Industry

Anti-corrosion coatings on HVAC coils play a crucial role in preventing gas leakage and protecting the environment in several ways:

1. **Corrosion Prevention:** HVAC coils are often exposed to moisture, chemicals, and other corrosive elements in the air or surrounding environment. Corrosion of coils weakens the metal surfaces, leading to cracks, holes, or perforations that may cause gas leakage. Anti-corrosion coatings create a protective barrier, preventing contact with corrosive agents and extending coil lifespan.
2. **Gas Containment:** HVAC systems use refrigerants essential for cooling and temperature control. However, refrigerants like hydro-chlorofluorocarbons (HCFCs) and hydro-fluorocarbons (HFCs) can deplete the ozone layer and contribute to climate change if leaked. Anti-corrosion coatings maintain coil integrity, reducing refrigerant leakage and environmental harm.

I declare that this article has been published in ISHRAE's Corrosion Guidebook Second Edition, written by myself Dr. Ruchi Grover as co-author of the second edition of guidebook.



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3. **Energy Efficiency:** Corrosion on HVAC coils reduces heat transfer efficiency and cooling capacity, increasing energy consumption and operating costs. Protective coatings preserve coil efficiency, optimizing HVAC performance and reducing greenhouse gas emissions associated with energy generation.

4. **Lower Maintenance Costs:** By preventing frequent gas leaks, the need for costly refrigerant top-ups is minimized. Anti-corrosion coatings reduce maintenance expenses and ensure system reliability.

5. **Compliance with Regulations:** Anti-corrosion coatings help HVAC systems comply with environmental regulations and standards related to air quality, emissions, and refrigerant management. By minimizing risks of leakage and contamination, companies can avoid regulatory penalties and demonstrate environmental responsibility.

Types of Anti-Corrosion Coatings

Various types of anti-corrosion coatings are used in air conditioners and HVAC systems to protect metal surfaces. These coatings are applied to components such as coils, condensers, and heat exchangers. Common types include:

Epoxy Coatings

Epoxy coatings are widely used for corrosion protection due to their excellent adhesion, chemical resistance, and durability. These coatings form a robust barrier on metal surfaces, preventing exposure to moisture and corrosive agents.

Properties:

Adhesion: Excellent adhesion to metal ensures a strong bond between the coating and substrate, enhancing durability even in harsh conditions.

Chemical Resistance: Effective against acids, alkalis, solvents, and pollutants. Epoxy coatings are particularly suitable for areas with high sulfur content, such as Delhi NCR, Thane, Malad in Mumbai, and Gujarat.

Temperature Resistance: Withstands high operational temperatures, maintaining protective properties under thermal stress.

Flexibility: Hybrid epoxy coatings accommodate material expansion and contraction without cracking or peeling.

Ease of Application: Typically applied by brush on copper U-bends and joints, cured at room or elevated temperatures.

Polysiloxane Coatings (Nano-Coatings)

Polysiloxane coatings, also known as nano-coatings, are thin-film applications that protect aluminum fins in saline coastal environments, preventing galvanic corrosion caused by dissimilar metals like copper and aluminum. These coatings have high weatherability, chemical resistance and flexibility appropriate for a direct to metal coating application.

Properties

Thin Film: Minimal thickness ensures negligible impact on system COP (Coefficient of Performance).

Weatherability: Outstanding resistance to sunlight, rain, and temperature fluctuations makes them ideal for outdoor HVAC components.



Chemical and Humidity Resistance: High resistance to acids, alkalis, solvents, and industrial pollutants.

Flexibility and Adhesion: Uniform coverage of complex shapes and irregular surfaces ensures complete protection.

Low Volatile Organic Compounds: Environmentally friendly formulations comply with air quality standards, benefiting indoor air quality.

Aerosol Spray Coatings

Aerosol-based coatings, typically formulated with acrylic or polyurethane (PU) polymers, are a convenient option for providing corrosion protection while enhancing the appearance of air conditioner components. These coatings form a durable barrier on surfaces such as coils, condensers, and cabinets.

Properties:

Fast Drying: Acrylic aerosol coatings dry quickly, allowing for rapid recoating and minimal downtime. This feature is particularly advantageous for maintenance and refurbishment projects.

UV Protection: Some formulations include UV inhibitors that protect surfaces from ultraviolet (UV) radiation, preventing fading, discoloration, and degradation over time.

Ease of Application: The spray-can format ensures quick, uniform coverage, even on intricate or hard-to-reach surfaces, making it suitable for both professional and DIY applications.

Versatility: Available in various colors, finishes, and sheens, these coatings offer flexibility for aesthetic customization, whether a glossy, satin, or matte finish is preferred.

Polyurethane Coatings

Polyurethane coatings are a traditional method for protecting heat exchangers and HVAC components. These coatings are applied to both copper U-bends and aluminum fins to provide long-lasting resistance to moisture and UV radiation, ensuring durable protection.

Properties:

Weather Resistance: Excellent protection against rain, snow, and UV radiation, safeguarding outdoor HVAC units from harsh weather conditions.

Enhanced Durability: A tough, resilient layer that prevents wear and tear, extending the lifespan of coils and reducing maintenance requirements.



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Type	Size Range	Rating	Design & Qualification	Application
Dual Plate Check Valve - Retainerless Wafer, Lugged, Flanged	DN 50 - 2000 NPS 2 - 80	ASME CL 125 - 2500	API 594, API 6D, API 6FA, BS 6364 / ISO 5752, ISO 28921, ISO 10497	All Services including Cryogenic & Fire Safe, -196°C (-321°F) to 750°C (1382°F)
Axial Flow Check Valve Flanged	DN 25 - 1600 NPS 2 - 64	ASME CL 150 - 1500	ASME B16.34, API 6D	All Services including Cryogenic & Fire Safe, -196°C (-321°F) to 750°C (1382°F)
Butterfly Valve - Triple Offset Metal Seated Wafer, Lugged, Flanged	DN 80 - 3000 NPS 3 - 120	ASME CL 150 - 1500	API 609 Category B, API 607, API 641 ISO 5752, ISO 15848, BS 6364, ISO 28921, ISO 10497, SIL 3	All Services including Cryogenic & Fire Safe, -196°C (-321°F) to 750°C (1382°F)
Butterfly Valve - Double Offset High Performance Wafer, Lugged, Flanged	DN 80 - 3000 NPS 3 - 120	PN 10 - 25 ASME CL 150 - 300	API 609 Category B, BS EN 593, ISO 5752, IS 13095, AWWA C504/516	Water, Chemicals, Air, Oil, Gases up-to 200°C (392°F), Vacuum
Butterfly Valve - Concentric Integrally Molded Liner	DN 50 - 1200 NPS 2 - 48	PN 10 - 20 ASME CL 150	API 609 Category A, BS EN 593, IS 13095, UL 1991	Water, Chemicals, Air, Oil, Gases up-to 200°C (392°F), Vacuum
Butterfly Valve - Concentric Low Torque Replaceable Liner	DN 50 - 300 NPS 2 - 12	PN 10	API 609 Category A, BS EN 593 IS 13095	Water, Chemicals, Air, Oil, Gases -20°C to 120°C
Actuated Butterfly On-Off / Modulating	DN 50 - 3000 NPS 2 - 120	PN 10 - 16 ASME CL 150 - 1500	API 609 Category A & B, SIL 3	Electric, Pneumatic, Electro-Hydraulic Hydraulic, Controls & Accessories
Balancing Valve	DN 25 - 1200 NPS 1 - 48	Upto PN 16, PN 20 & PN 25	DIN 3202, BS 7350, BS EN 593 Face to Face - ISO 5752 Table 8	Water, Glycol, Brine Solution
Dynamic Large Size Balancing Valve	DN 400 - 1200 NPS 16 - 48	PN 16, PN 20, PN 25	Face to Face As per ISO 5752 Table 8	Water, Glycol, Brine Solution
Pressure Independent Control Valve (PICV)	DN 15-250 NPS 0.5 - 10	PN 16, PN 25	BS EN - 63534 - 5 (Testing)	Water, Glycol, Brine Solution

* Pre-Insulated Solutions available



Improved Heat Transfer Efficiency: By preventing dirt and debris accumulation, polyurethane coatings help maintain optimal thermal efficiency and energy savings.

Ease of Cleaning: Creates a smooth surface that simplifies routine cleaning and maintenance, ensuring performance remains optimal over time.

Zinc-Rich Coatings

Zinc-rich coatings, or zinc-rich primers, are widely used for cathodic protection. These coatings contain a high concentration of zinc particles that act as sacrificial anodes, protecting the metal

substrate of HVAC coils. In the event of damage to the coating or exposure of the metal surface to corrosive agents, the zinc particles corrode preferentially, sacrificing themselves to protect the underlying metal from corrosion.

Ceramic Coatings

Ceramic coatings provide exceptional resistance to corrosion, abrasion, and thermal stress. These coatings are ideal for specialized applications requiring enhanced performance, such as environments with high temperatures, aggressive chemicals, or abrasive conditions.

These are just a few examples of the types of anti-corrosion coatings used on air conditioners and HVAC systems. The selection of the most suitable coating depends on factors such as environmental conditions, performance requirements, cost considerations, and application methods. Proper surface preparation and application techniques are essential for ensuring the effectiveness and durability of anti-corrosion coatings on air conditioner components.

Application Guidelines

Applying anti-corrosion coatings to heat exchangers is essential for protecting them from corrosion, extending their lifespan, and ensuring efficient performance. Below is a typical method for applying anti-corrosion coatings to HVAC coils:

Surface Preparation: Thoroughly clean the surface of the coil to remove dirt, grease, or previous coatings. This can be achieved through methods such as pressure washing or chemical cleaning, depending on the severity of corrosion and the material of the coil. Avoid harsh chemicals by diluting them adequately with water, or use a mild detergent solution for cleaning. Rinse the unit thoroughly and allow it to dry completely.

Priming (Optional): Depending on the type of coating being applied, priming the coil surface may be necessary to enhance adhesion and corrosion resistance. Follow the manufacturer's instructions for selecting and applying the appropriate primer, if required. For heavy-duty performance, a thin layer of polysiloxane primer, zinc-rich primer, or acrylic primer can be applied as a base coat.

Selection of Anti-Corrosion Coating: Choose an anti-corrosion coating suitable for HVAC coils. Common types include epoxy coatings, polyurethane coatings, acrylic coatings, polysiloxane coatings, and aluminum oxide-pigmented coatings.

Application Process: The coating can be applied using various methods, such as spraying, brushing, or dipping.



1. Clean the coil using water, thinner, or a chemical solution to remove any dirt or oil, as explained above.

2. For new units, rub copper tubes, U-bends, and joints with sandpaper (grit 600 to 800) for better mechanical adhesion.

3. Apply a suitable primer (e.g., polysiloxane, acrylic, or zinc-rich coating) to copper U-bends and joints using a spray gun or aerosol application.

4. After the base coat becomes touch-dry, apply a top coat of the selected anti-corrosion coating (e.g., hybrid epoxy, polyurethane, or aluminum oxide-pigmented polyurethane) using a brush or spray, ensuring the recommended thickness. For areas with high sulfur content (e.g., near open drains or mangroves), epoxy coatings are highly recommended.

5. For running copper pipes, two coats of polysiloxane or polyurethane coating are sufficient.

6. For units installed in coastal areas, apply a thin layer of polysiloxane or polyurethane coating to all aluminum fins at the recommended thickness. Ensure both vertical and horizontal coats are applied evenly using a spray gun with an air compressor.

Curing/Drying of Coating: Allow the applied coating to cure as per the manufacturer's instructions. Depending on the type of coating, this may involve air drying or heat curing (especially for epoxy coatings during winter). Proper curing is essential to achieve the desired properties and durability of the coating.

Quality Control: After the coating has cured, conduct quality control checks to ensure it meets the required specifications. Inspect the coating for uniformity, thickness, adhesion, and any defects that may affect performance.

Reassembly and Testing: Once the coating passes quality control, reassemble the HVAC coil into the system.

24-Hour Shutdown of the ODU: Do not start the machine for at least 24 hours after coating to ensure optimal results.

Maintenance: Regular maintenance is essential to prolong the lifespan of the anti-corrosion coating and the HVAC coil. Schedule periodic inspections to check for signs of

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corrosion or coating damage. Re-coat as necessary to maintain protection, and follow manufacturer recommendations for cleaning and maintenance to ensure optimal system performance.

Testing and Qualification of Coatings

Salt Fog Test - ASTM B117

ASTM B117 is a standard test method issued by the American Society for Testing and Materials (ASTM) to evaluate the performance of coatings in a salt spray (fog) environment. While not specific to HVAC coil coatings, it is commonly used to test corrosion resistance in HVAC equipment.

The test involves exposing coated panels to a continuous spray of typically a 5% sodium chloride solution under controlled conditions, including temperature and humidity. Panels are inspected regularly for signs of corrosion, such as blistering, rust, or other forms of degradation. The duration of the test and the criteria for determining pass/fail vary depending on the specific requirements of the coating and the application.

For HVAC coil coatings, compliance with ASTM B117 may be specified by manufacturers or regulatory bodies to ensure adequate protection in harsh environments. A heat exchanger application typically requires anti-corrosion coatings to pass up to 10,000 hours of salt spray exposure on copper and aluminum as per ASTM B117. Compliance with this standard helps ensure the longevity and performance of HVAC equipment by preventing corrosion-related damage.

Temperature Resistance - ASTM D2485

ASTM D2485 assesses the ability of coatings to withstand high temperatures and environmental factors such as humidity, UV

radiation, and thermal cycling. Tests include:

Adhesion Test: Evaluates the bond strength between the coating and substrate.

Flexibility Test: Measures the coating's ability to withstand bending.

Heat Resistance Test: Tests the coating's performance under temperatures ranging from -25°C to 450°C.

Weathering Test: Simulates long-term exposure to sunlight, moisture, and temperature fluctuations.

Role of Coatings in Achieving the Objectives of Environmental Policies

Anti-corrosion coatings support the objectives of the Montreal Protocol, Kigali Amendment, and ESG norms by:

Minimizing Refrigerant Leakage: Creating a barrier against corrosion reduces refrigerant leaks, aligning with the goals of phasing out ODS and high-GWP refrigerants.

Environmental Protection: Preventing leaks reduces the environmental impact of HVAC systems, contributing to ozone layer protection and climate change mitigation.

Energy Efficiency and Sustainability: Protecting coils maintains optimal system performance, resulting in energy savings and reduced emissions.

Reducing the Need for Frequent Maintenance, Repairs, and Replacements: Reducing maintenance and



replacement needs aligns with sustainable practices and green building codes.

Next-Generation Coatings

Next-generation anti-corrosion coatings for air conditioners can be designed to meet the increasing demands of performance, environmental sustainability, and cost-effectiveness. These advanced coatings can offer improved durability, corrosion resistance, and overall system efficiency. Below are some of the key trends and technologies in next-generation anti-corrosion coatings for air conditioners:

Hydrophobic and Oleo-phobic Coatings: Some advanced nano-coatings can be designed to repel water and oil, reducing the buildup of moisture and contaminants on AC components, thus minimizing corrosion.

Self-Healing Coatings: Nanomaterials like micro-encapsulated agents are being used to develop self-healing coatings that can repair minor scratches and wear over time, prolonging the lifespan of air conditioners.

Fluoropolymer Coatings: PVDF coatings offer excellent resistance to corrosion, UV degradation, and high temperatures. Fluoropolymer coatings are best type of future generation coatings.

Anti-Fouling Coatings: Some fluoropolymer coatings reduce the buildup of dirt, dust, and pollutants on heat exchanger surfaces, helping improve efficiency and reduce maintenance needs. Such coatings can be designed for navy HVAC applications.

Hybrid Coatings: Coating, which combine the best properties of different types of resins (such as epoxy, polyurethane, and acrylics), offer enhanced corrosion



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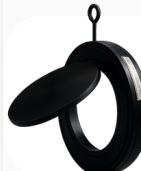
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resistance and can be customized to achieve high performance anti-corrosion coatings for HVAC applications.

Ceramic Coating can resist both high temperatures and corrosion. These coatings can withstand the thermal cycling that AC components often undergo, enhancing both the efficiency and lifespan of the system. Non-Stick properties of ceramic coatings can prevent the accumulation of dust, dirt, and other contaminants on the heat exchange surfaces, reducing maintenance and improving performance.

Water-Based Coatings: Eco-friendly water-based coatings are

becoming increasingly popular due to their low VOC content and reduced environmental impact.

Electrostatic and Conductive Coatings: These coatings can prevent corrosion by creating an electrical barrier on metal surfaces, thereby reducing the chances of electrochemical corrosion. Some next-gen coatings can be designed with conductive properties that can dissipate electrical charge, reducing the risk of galvanic corrosion between dissimilar metals in AC system.

Antimicrobial Coatings helps in preventing microbial growth that help reduce the buildup of bacteria, mold, and other microorganisms on the surface of coils and fins.

Conclusion

Anti-corrosion coatings are essential for protecting HVAC equipment, preventing refrigerant leaks, and reducing greenhouse gas emissions. By extending equipment lifespan and aligning with environmental standards, they play a vital role in green building practices and sustainable cooling solutions.

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Dr. Ruchi Grover is an accomplished expert in the field of corrosion science, holding an MPhil and PhD from IIT Bombay and Monash University, Australia. She is the founder of Oxycoats, a pioneering manufacturer specializing in anti-corrosion coatings for heat exchangers. With over 15 years of experience in corrosion science and coating technologies, she has made significant contributions to her field.

Her work has earned her prestigious recognitions, including an award from the National Association of Corrosion Engineers (NACE) for her innovation in corrosion science and another from Berger Paints for advancements in paint application technology. She is also being honoured by RATA Women Empowerment Award and ISHRAE HM Jhangiani Journal Award.

Sustainability & Decarbonisation through Intelligent Indoor Air Quality

How and what IAQ technologies should be adopted
to achieve sustainability and decarbonisation in the built environment

Women Driving Decarbonisation & Innovation in the Future Built Environment

By **Bhawna Gaur**

1. The IAQ–Energy Equation Has to be Rewritten

Buildings account for roughly 30% of global final energy consumption, and HVAC systems are the dominant share within that. For decades, the conventional approach to better Indoor Air Quality (IAQ) has been additive — finer filters, more outdoor air, higher static pressures — each layer adding directly to fan and conditioning energy. Better IAQ, in this paradigm, has meant higher operating cost and higher carbon intensity.

That paradigm is no longer defensible. With India's commitment to net-zero by 2070, the GRIHA, LEED, and IGBC frameworks pushing for verifiable operational performance, and the BRSR mandate driving Scope-1 and Scope-2 disclosure, the HVAC industry is being asked a sharper question: can we deliver healthier air without expanding the energy and carbon footprint?

The answer is yes — but only if IAQ is treated as an engineered outcome rather than a fixed-cost assumption. This requires three shifts: optimising the pressure-drop profile across the filtration chain so that air-quality outcomes are decoupled from rising fan energy; instrumenting the air-handling system with sensors that turn assumptions into measurements; and applying data and AI to convert measurements into continuous optimisation.

2. Optimising the Filtration Energy Profile

2.1 Why pressure drop is the central decarbonisation lever

Fan energy in an HVAC system is, to first order, directly proportional to system static pressure. A filtration stage operating at 300 Pa instead of 100 Pa does not just consume more fan energy when new — its energy penalty grows steadily as the filter loads, often doubling before change-out. Across the operating life of a filter, this hidden energy creep is one of the largest, and most overlooked, sources of HVAC carbon emissions. It is also the single largest decarbonisation lever inside the filtration leg of the system.

2.2 Where the avoidable energy cost actually sits

The challenge is not filtration itself — it is filtration that has been over-specified, statically designed, and calendar-managed. Modern filter media has improved considerably; the decarbonisation gap lies less in the filter and more in how the filtration system is specified, sized, and operated. Several patterns drive the avoidable energy cost:

- MERV ratings specified for worst-case rather than for the actual contamination load and occupancy profile of each zone.
- Filtration banks designed at uneconomic face velocities, oversized for actual airflow demand, or with limited spare capacity for loading.
- Filters replaced on a fixed calendar rather than against measured loading — leading to either premature disposal or extended operation past the optimum Δp window.
- Sub-micron and bio-aerosol fractions addressed solely by escalating MERV or HEPA ratings, where complementary in-duct or in-space technologies would have been more efficient.

2.3 An engineered approach — the optimisation levers

A decarbonisation-led filtration strategy treats filtration as a system-level engineering problem with several complementary levers, all of which can sit comfortably within a conventional filter-led specification:

Right-sizing filtration to the actual load

The single largest opportunity in many existing systems is recognising that MERV ratings can be specified to the actual contamination load of each zone rather than to a uniform worst-case across the building. Laboratory and critical-care spaces warrant high-MERV or HEPA grades; large-volume commercial spaces with lower contamination loads can often be designed at a more appropriate grade without compromising occupant outcomes.

Modern low- Δp filter media

Filter media has improved meaningfully over the past decade. High-loft synthetic media, V-bank and mini-pleat configurations, and improved fibre engineering have reduced the pressure-drop penalty of high-MERV filtration. Specifying modern media — rather than legacy panel filters — is the lowest-friction decarbonisation intervention available to most existing buildings, and a positive avenue of collaboration between consultants, OEMs, and operators.

Demand-controlled fresh air with energy recovery

Outdoor-air conditioning is the largest controllable HVAC load in most Indian commercial systems, and the volume of fresh air is also what determines how hard the filtration stage has to work. CTFA units with integrated heat or

enthalpy recovery, combined with CO₂-driven demand control, reduce the volume of outdoor air that must be conditioned and filtered in the first place — the most direct route to easing the load on the entire downstream system.

Complementary technologies for specialised applications

Electronic Air Cleaners (EAC), Bipolar Ionisation (BPI) specified to UL 2998 ozone-free standards, and UV-C disinfection each have well-defined application envelopes — particulate-heavy outdoor environments, healthcare and hospitality bio-aerosol management, and certain laboratory and pharmaceutical contexts. These are not replacements for the filtration stage. They are adjunct tools that, used selectively, expand the engineer's design vocabulary and reduce the burden on any single technology. The decision to deploy them is properly a project-by-project engineering judgement, not a categorical preference.

Note: specific Δp values, removal efficiencies, and energy savings are project-dependent and a function of system design, climate, and operating profile. Performance for any installation must be validated against site-specific design conditions.

3. Intelligent Integration: Sensors as the Building's Nervous System

If Pillar 1 is about reducing the energy cost of moving air, Pillar 2 is about reducing the volume of air that needs to be conditioned in the first place — by replacing design-time assumptions with real-time measurement. The shift is from open-loop HVAC operation (treat the worst-case occupancy at all times) to closed-loop HVAC operation (treat the actual condition, as measured, right now).

3.1 IAQ Monitoring — establishing the measurement baseline

Continuous, multi-zone monitoring of PM_{2.5}, PM₁₀, CO₂, TVOC, formaldehyde, temperature, and relative humidity transforms IAQ from an annual commissioning exercise into an operational metric. The first value of an IAQM deployment is rarely the dramatic reading — it is the baseline. Once a building knows how it actually breathes, every subsequent design decision is anchored in data.

3.2 Smart Filter Monitoring — moving from calendar to condition

Differential-pressure sensors mounted across each filter stage capture the actual loading curve of every filter bank. Three operational gains follow:

- Replacement timing is condition-driven — filters are changed when they have actually reached end-of-life, not on a calendar date. This both reduces premature disposal and prevents extended operation at high Δp .
- Anomalies are surfaced early — filter bypass, gasket failure, and mis-installation produce characteristic Δp signatures that are detectable within hours rather than at next inspection.
- Filter health scoring becomes a maintenance KPI — a single composite score per filter bank, updated continuously, gives facility teams a clear operating dashboard rather than a backlog of inspections.

3.3 Demand-Controlled Ventilation (DCV)

Outdoor-air rate is one of the largest controllable HVAC loads in any space with variable occupancy — auditoriums, conference rooms, retail, places of worship, hospitality. CO₂-driven DCV modulates fresh-air intake to actual occupancy, materially reducing the conditioning load on the CTFA without compromising occupant well-being. The intervention is invisible to occupants but compounds steadily across the operating year.

3.4 Smart CTFA controls

The Smart CTFA platform integrates the above signals directly — modulating fan speed, outdoor-air damper position, and heat-recovery wheel rotation against measured demand. The CTFA stops being a fixed-output unit and becomes an actively managed asset, with operational data flowing back to the central dashboard.

Strategic takeaway: sensors are not a luxury layer. They are the mechanism that converts IAQ from a fixed cost into a variable, optimisable parameter. Without measurement, every other decarbonisation claim remains an assumption.

4. Data & AI: The Building as a Learning System

Sensors generate data. Data, on its own, generates dashboards. What converts dashboards into decarbonisation outcomes is a structured data-and-analytics layer that learns, predicts, and acts. This is where the IAQ engineering discipline meets the data discipline — and where the next decade of HVAC innovation will be concentrated.

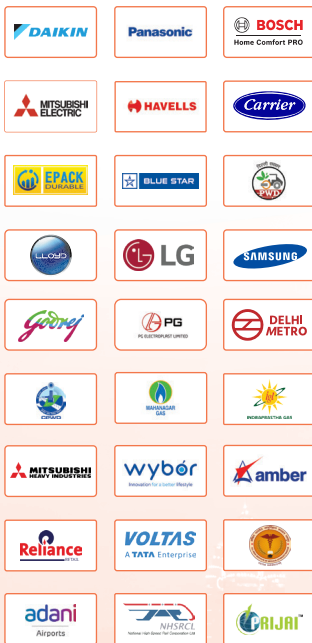
4.1 The data infrastructure

A modern IAQ deployment is built on a deliberate data architecture: edge collection from sensors and equipment controllers, gateway aggregation with local buffering, secure cloud time-series storage, role-based dashboards, and structured integration with the building's BMS/BAS through standard protocols (BACnet, Modbus, MQTT). The architecture matters because it determines whether data remains a reporting artefact or becomes an operational asset.

4.2 Predictive analytics — three concrete applications

- Filter life prediction — loading curves combined with seasonal PM_{2.5} patterns, particularly relevant in Delhi NCR and other high-PM regions, enable end-of-life forecasts weeks in advance. Procurement and maintenance cycles can be planned, not reacted to.
- Auxiliary equipment performance monitoring — UV-C lamp output, humidifier performance, ionisation device output, damper actuator response — any in-line device with a measurable output produces a characteristic signature that can be continuously verified rather than annually inspected.
- HVAC component health monitoring — bearing degradation, belt slippage, damper actuator drift, heat-exchanger fouling — all produce identifiable signatures across the sensor stack and BMS telemetry.

Approvals & Clientele



Our Product



Level Wound Coils | Inner Grooved Tube | Pancake Coils
Straight Pipe | PVC Coated Tubes | Medical Pipe | Capillary Tubes
Shell | Finned Copper Tubes

Products Applications



Product List

Level Wound Coils (LWC)

- Temper: Soft Annealed (O60, O), Light Annealed (O50, O), Light Drawn (H55)
- Size: 4.76mm - 19.05mm (3/16" - 3/4" OD)
- Packing: ETS, ETW, Jumbo Coil
- Coil weight: 90 kg - 200 kg (ETS, ETW) 300 kg - 900 kg (Jumbo Coil)



Inner Grooved Tube (IGT)

- Temper: Light Annealed (O50), Soft Annealed (O60, O)
- Size: 5mm - 12.7mm (5mm - 1/2" OD)
- Packing: ETS, Jumbo Coil
- Coil weight: 90 - 500 kg



Pancake Coils (PCC)

- Temper: Soft Annealed (O60, O), Light Annealed (O50, O)
- Size: 4.76mm - 22.22mm (3/16" - 7/8" OD)
- Length: Standard 15m / 15.24m / 50ft / 100ft
- Ink Marking Available
- Packing: Shrink Wrap Carton box Plastic wrap + Label Outer Cap



Straight Tube (SP)

- Temper: Soft Annealed (O60, O), Half Hard/Light Drawn (H55), Hard Drawn (H58)
- Size: 4.76mm - 50.8mm (3/16" - 2" OD)
- Ink Marking Available
- Packing: Bundle, Wooden box, Outer cap



ACR/Medical Straight Tube (MGPS)

- Temper: R220 (Annealed) R250 (Half Hard) R290 (Hard)
- Size: 8 mm - 50.8 mm (8mm - 2" OD)
- Length: Standard 3 m / 6 m / 10ft / 20ft
- Casing & Ink marking available
- Packing: Bundle, Wooden box, Outer cap



PVC Coated Tubes (polyvinyl chloride)

- Temper: Soft Annealed (O60, O)
- Size: 9.52 mm (3/8" OD)
- Coil: Standard (15.24m / 30.48m) (50ft / 100ft)
- Ink Marking available
- Packing: Bundle, Wooden Box
- LDPE White Sleeve or PVC Blue, Yellow, Red, Black



Capillary Tubes

- Temper: Soft Annealed (O60, O), Hard (HD)
- Size: OD: 1.80 mm - 4.76 mm ID: 0.66 mm - 3.03 mm Thickness: 0.57 mm - 0.87 mm
- Shape: Coil Form, Straight Length with Beading
- Length (Straight Capillary): 0.200 mtr - 6 mtr



Finned Copper Tubes (FCT)

- Temper: Soft Annealed
- Size Range: 12.7 mm - 25.4 mm
- Number of Fins: 19 - 60 / Inch
- Types: Knurling
- Inner Grooves 70
- Height of Fins: 0.7 mm - 1.6 mm
- Length: 300 mm - 6000 mm



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4.3 AI-driven optimisation

Machine-learning models layered on top of the data architecture learn the building's actual usage patterns — across hours, days, seasons, weather conditions, and event types. The HVAC operating schedule then optimises against actual demand rather than design-day assumptions. Pre-conditioning is shortened where it can be safely shortened; setpoint trajectories are smoothed to minimise peak draw; outdoor-air rates are tuned within compliant bands. Independent studies and pilot deployments typically report 10–20% energy savings on top of well-tuned baseline BMS control.

4.4 Verification, reporting, and ESG

For corporate clients, the auditable measurement-reporting-verification (MRV) trail is increasingly as valuable as the savings themselves. Continuous IAQ and energy data feeds directly into GRIHA, LEED, IGBC, WELL, and BRSR reporting frameworks, removing the dependence on point-in-time audits. Sustainability claims become defensible because they are continuously instrumented.

Strategic takeaway: AI does not replace HVAC engineering. It amplifies engineering judgement at the scale and frequency at which buildings actually operate.

5. The Decarbonisation Maths — How the Pillars Compound

Each pillar delivers a meaningful energy reduction on its own. The reason the integrated approach matters is that the savings compound — they are not additive. A lower-pressure-drop filtration system saves fan energy; sensor-driven DCV reduces the volume that needs to be moved at that lower pressure; AI optimisation tunes the residual operating envelope. Each layer multiplies on the previous one rather than simply adding to it.

Illustrative model (any commercial office):

- Filtration energy profile optimised through right-sized MERV grades, modern low- Δp media, and condition-based replacement: meaningful reduction in static pressure across the filtration leg, translating to lower fan energy.

- Demand-controlled fresh air with energy recovery: substantial reduction in conditioned outdoor-air volume during typical (non-peak) occupancy hours.

- AI-driven optimisation on top of the tuned system: incremental improvement on the already-reduced baseline, captured continuously.

Translated to the Indian grid emission factor (~ 0.71 kgCO₂/kWh), the combined effect across a typical commercial building can amount to tens of tonnes of avoided CO₂ emissions per year — verifiable, auditable, and reportable. The same intervention also reduces the building's operating cost over the asset life, which is what makes the business case self-financing rather than dependent on subsidy or mandate.

Caveat: these are directional figures. Actual savings depend on building type, climate zone, baseline efficiency, operating hours, and occupancy variability. The discipline of decarbonisation engineering is precisely to model and verify them per project, not to assert them generically.

6. Closing — Women Engineers as the Catalyst

The decarbonisation of the built environment is not, fundamentally, a technology problem. The technologies described in this note are mature, certifiable, and commercially deployable today. The transition is, instead, an integration problem — bridging HVAC, electronics, controls, data, sustainability frameworks, and finance into a coherent design proposition that the client, the consultant, and the contractor can all stand behind.

That integration requires a rare combination: technical depth, cross-disciplinary fluency, and the persistence to advocate for the redesigned solution against the inertia of the established one. Women engineers across the HVAC ecosystem are increasingly the people leading exactly this integration — in design firms, in OEMs, in client facilities teams, and in policy. The SHAKTI 3.0 platform exists to make this leadership visible, articulable, and amplified.

Better air and lower carbon are not in tension. They are the same engineering problem, approached with the right tools. The tools exist. The opportunity is to build the engineering judgement, the case studies, and the leadership pipeline that take them from available to default.



Bhawna Gaur is an Indoor Air Quality (IAQ) professional with 8 years of specialized expertise in healthy buildings, sustainability, and IoT-enabled environmental solutions, complemented by over 20 years of diverse professional experience. Her work focuses on transforming indoor environments through advanced air quality strategies, intelligent ventilation systems, smart monitoring technologies, and sustainable building practices.

With a strong commitment to innovation and environmental stewardship, she has contributed to enhancing occupant health, well-being, energy efficiency, and building performance across commercial, healthcare, educational, government, and residential sectors. Her passion lies in advancing clean air, sustainability, and data-driven building intelligence as essential pillars of healthier, smarter, and future-ready built environments.

The Invisible Architecture of Wellbeing

Air, heat, sound and light decide how India's public buildings actually feel — and how well the people inside them think, heal and learn. It is time we designed for all four.

By **Dr. Priyanka Kulshreshtha**

Co-founder, Society for Indoor Environment (SIE)

We notice a public building only when it fails us: the classroom that turns drowsy by mid-morning, the hospital corridor that never falls quiet, the office where the air feels thick by lunchtime. The rest of the time the indoor environment is invisible — which is precisely the problem. Indians spend close to ninety percent of their lives indoors, much of it in shared public spaces — schools, offices, hospitals, metro stations, courts and government offices. These rooms quietly set the terms on which millions breathe, concentrate, recover and learn each day.

Indoor environmental quality, or IEQ, brings those terms into the open. It rests on four interlocking pillars — air quality, thermal comfort, acoustics and lighting — and in a country facing severe pollution, intensifying heat and rapid construction, getting them right in public buildings is no longer a question of comfort. It is one of public health, of learning and clinical outcomes, and of basic dignity.

Four pillars, one experience

Occupants do not experience air, heat, sound and light separately; they experience a single room. A daylit classroom still fails if it is stiflingly hot; a perfectly cooled office still exhausts people if the air is stale and the clatter never lets up. Good IEQ balances all four at once, tuned to India's climate and how the building is actually used.



The four pillars of indoor environmental quality, with indicative public-building benchmarks.

Air quality: the pillar India can least afford to ignore

Indoor air in India carries a double burden. Outdoor pollution — especially fine particulate matter, PM2.5 — seeps in through windows, doors and leaky envelopes, so a Delhi classroom on a bad winter day can hold air nearly as foul as the street. Indoors, carbon dioxide builds up in crowded rooms; volatile organic compounds off-gas from paints, boards, adhesives and cleaning agents; damp corners breed mould. The body keeps the score: headaches, drowsiness, irritated eyes, asthma attacks and slower thinking.

The remedy is mostly fresh air, filtration and restraint at source. The National Building Code 2016 frames ventilation around adequate outdoor air per person, while CO₂ is a simple proxy for ventilation — below 1,000 ppm is sound practice, below 800 ppm better in classrooms. Where outdoor air is itself hazardous, mechanical ventilation with filtration becomes essential. Source control is cheapest of all: the cleanest pollutant is the one never introduced.

FEATURED CASE STUDY

A Tale of Eleven Cities: what India's classrooms actually breathe

In 2025 the Society for Indoor Environment (SIE) — with Techknowgreen Solutions Ltd. and YOGa Clean Air, supported by the Maharashtra Pollution Control Board — measured classroom air across eleven cities, from Delhi and Gurugram to Agra and eight cities of the Mumbai Metropolitan Region, comparing naturally ventilated, air-conditioned and hybrid rooms. In naturally ventilated classrooms, indoor PM2.5 simply tracked the polluted air outside, reaching 522 µg/m³ on a Delhi winter day; air-conditioned rooms filtered particulates well but let CO₂ climb past 1,000 ppm when fresh-air intake was poor.

Only hybrid classrooms — natural ventilation paired with mechanical filtration — held both pollutants within WHO's healthy thresholds at once: PM2.5 below 15 µg/m³ and CO₂ under 1,000 ppm, with filtration cutting particulates by as much as 99 percent. The lesson is this article's in miniature: clean air and fresh air must be designed together, never traded against each other.

Source: Society for Indoor Environment (SIE), with Techknowgreen Solutions Ltd. and YOGa Clean Air — *IAQ in Indian Schools: A Tale of Eleven Cities*(2025)

<https://societyforindoorenvironment.org/wp-content/uploads/2026/02/TALE-OF-11-CITIES.pdf>

Thermal comfort: designing for India's heat, not against it

For most of the year, across most of India, the thermal challenge is heat. The reflex — borrowed from cold-climate codes — has been to seal buildings and chill them to a uniform 22–23°C. That is energy-hungry, costly and, the evidence shows, wrong for Indian bodies. The India Model for Adaptive Comfort (IMAC), built from thousands of field surveys across India's climate zones, found that occupants of naturally ventilated buildings tolerate warmth far better than imported standards assume, staying comfortable from about 20°C to 28–30°C.

People adapt — they change clothing, open windows, switch on a fan — and a building that lets them do so keeps them comfortable on a fraction of the energy. Mixed-mode design — natural ventilation and fans for the milder months, air-conditioning reserved for the harshest — with shading, insulation and good orientation, holds comfort without a permanent cooling bill. The aim is to design with India's climate, not against it.

BY THE NUMBERS

The two-degree dividend

Indian offices have long been cooled to a rigid $22.5 \pm 1^\circ\text{C}$ to satisfy international "Class A" specifications written for other climates. Relaxing the set-point toward 26–27°C in line with IMAC, with fans and operable windows in support, typically cuts air-conditioning energy substantially with no measurable loss of comfort. Across a government estate of thousands of cooled rooms, that single, free decision compounds into very large savings.

Acoustics: the pillar hospitals and schools forget

Sound is the most neglected pillar, and it matters most in two building types: hospitals and schools. A noisy ward is not merely unpleasant — alarms, trolleys and hard surfaces shatter the sleep patients need to heal and stress the staff. The World Health Organization recommends ward background noise stay below about 35 dB(A) at night, a target Indian hospitals routinely miss. In classrooms the issue is intelligibility: where reverberation is high and corridor and traffic noise intrude, children at the back simply cannot make out the teacher — worst of all for the youngest pupils.

The fixes are well understood and often cheap: acoustic ceilings and wall panels, soft finishes, sound-rated doors and quieter building services. India's silence-zone norms cap noise around hospitals and schools at 50 dB(A) by day and 40 dB(A) by night, but enforcement is weak and acoustics rarely reaches the design brief. Treating sound as a core design parameter is among the highest-return, lowest-cost moves a public building can make.

CASE STUDY

Quieting the ward

Hospitals that take noise seriously begin by mapping it — logging decibel levels around the clock — and are usually startled to find night-time levels two to three times the WHO ceiling. The remedies are modest: sound-absorbing ceilings, rubberised trolley wheels, rationalised alarms, quiet-hour protocols and softer flooring. Patients sleep and recover better; staff make fewer errors. None of it needs advanced technology — only that acoustics be designed in, not discovered later.

Lighting: daylight first, then everything else

Light does two jobs: it lets us see, and it keeps our bodies in time. Generous, well-controlled daylight lifts mood, supports the circadian rhythms that govern sleep and alertness, and cuts electricity bills; poor lighting brings eye strain, headaches and fatigue. Indian standards set sensible, task-based targets — roughly 300 to 500 lux for offices and classrooms, far higher for fine and clinical work. But quantity is only half the story: glare can disable a space as surely as darkness.

The best public buildings put daylight first — deep window reveals, light shelves, courtyards and skylights that draw the sun in while keeping heat and glare out — then layer efficient LEDs governed by daylight and occupancy sensors. Views matter too: a glimpse of sky or greenery measurably lowers stress, aiding recovery in hospitals and focus in schools.

FLAGSHIP CASE STUDY

Indira Paryavaran Bhawan, New Delhi

Home to the Ministry of Environment, Forest and Climate Change and India's first net-zero-energy government building, the Bhawan shows all four pillars working together. About three-quarters of its floor space is daylit, while jaalis, deep overhangs and recessed windows — drawn from traditional Indian architecture — cut solar gain and glare. A central courtyard drives cross-ventilation and stack effect; low-VOC paints, recycled materials and bamboo furniture protect the indoor air; and an efficient chilled-beam system cools quietly. The result earned both a GRIHA 5-star rating and LEED Platinum.

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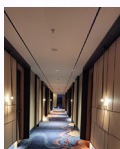
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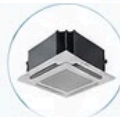
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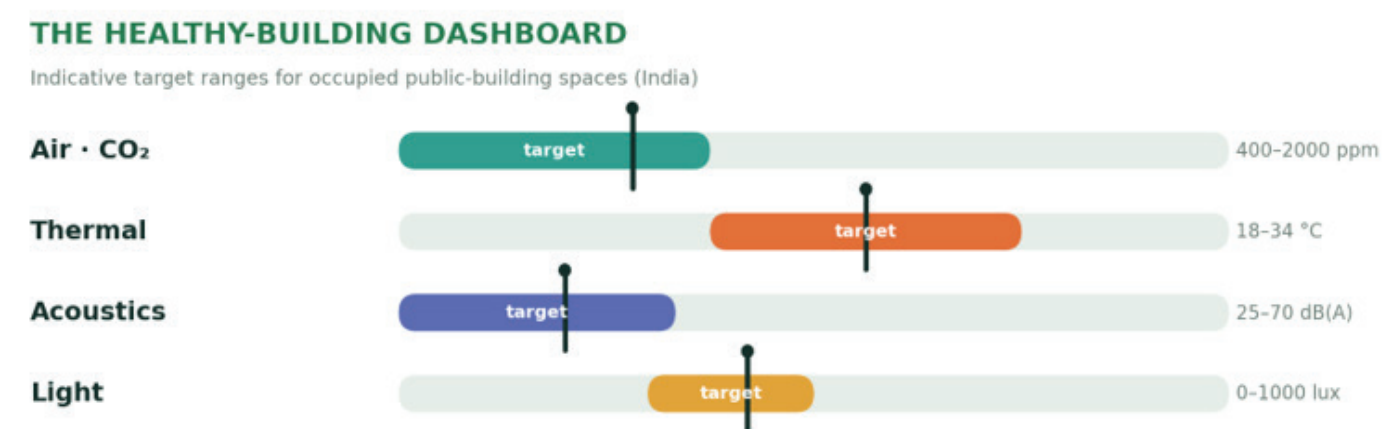


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Reading the room: a quick benchmark



None of these targets needs a laboratory. A handheld monitor, a thermometer, a sound-level app and a lux meter will tell a facilities team within an afternoon whether a building is treating its occupants well. The benchmarks below summarise what “good” looks like and where the standards live.

Pillar	Key indicator	Healthy target	Indian reference
Air quality	CO ₂ (ventilation proxy); PM2.5; VOCs	CO ₂ < 1000 ppm; low PM2.5	NBC 2016; CPCB / WHO
Thermal comfort	Operative temperature	~24–30°C adaptive band	IMAC; NBC 2016; ECBC
Acoustics	Background noise; reverberation	Wards < 35 dB(A); clear speech	WHO; CPCB silence zones; NBC
Lighting	Illuminance; daylight; glare	300–500 lux at the task	NBC 2016 / IS 3646; GRIHA

Indicative targets for occupied public-building spaces; refer to the full standards for design values.

The framework already exists

India already has the scaffolding to do this well. The National Building Code 2016 covers ventilation, lighting and acoustics; the Energy Conservation Building Code sets efficiency floors; and the major green-rating systems — GRIHA and the Indian Green Building Council’s ratings — reward daylight, comfort, low-emitting materials and acoustic performance. IMAC gives the country its own, climate-appropriate basis for thermal design. What is missing is not knowledge but consistent application: IEQ provisions are treated as optional, specialists are rarely on the team, and almost no public building is checked to confirm it performs in use as it did on paper.

Why it pays

To a finance officer, IEQ can look like a cost. It is closer to an investment with one of the clearest returns in the built environment. Better air and light raise test scores and cut absence; quieter, better-lit wards shorten hospital stays and reduce errors; comfortable, well-ventilated offices sharpen focus and cut sick days. Because salaries and human outcomes dwarf energy and rent over a building’s lifetime, even small gains repay good design many times over — and much of it is retrofittable.

India is in the middle of the largest building boom in its history, much of it public. The decisions taken now — whether a classroom is daylit or dim, a ward calm or clamorous, an office’s air fresh or stale — will shape citizens’ health and capability for decades. Indoor environmental quality is the invisible architecture of that future. Making it visible, measurable and non-negotiable is among the most cost-effective public-health investments the country can make.

Acknowledgements
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She is an academican, researcher, and policy advocate with over two decades of experience in Indoor Air Quality Management (IAQM), currently serving as Assistant Professor at the University of Delhi and Founding Member & National Secretary of the Society for Indoor Environment (SIE). She work sits at the intersection of science, policy, and practice—focusing on indoor environmental quality (IEQ), exposure assessment, and public health. She has contributed to national-level policy development, including IAQ guidelines with the Central Pollution Control Board, and have been involved in international collaborations such as the European Union’s HEALTHVENT project. As an editor, reviewer, and author of numerous peer-reviewed publications, she actively contribute to advancing global discourse on air quality and sustainability.



Gender Responsive with Sustainable Agriculture Cold Chain

By **Khushboo Gupta**



Cooling with Intent: How Gender-Responsive Built Environments Can Revolutionize Sustainable Agricultural Cold Chains

In the global race to mitigate climate change and secure food systems, the agricultural cold chain has emerged as a critical battleground. Globally, roughly one-third of all food produced is lost or wasted, and a staggering 14% of that loss occurs between harvest and the retail market. In India, various research reports have highlighted that a vast majority of harvest losses are driven by a severe lack of localized, cold-chain infrastructure.

Solving this crisis is not merely a technical or an infrastructural challenge of manufacturing efficient refrigeration systems, building cold-chain infrastructure, or deploying cleaner refrigerants. It is a spatial, architectural, and deeply social dilemma. The cold chain must be physically anchored within the built environment—the human-made spaces, buildings, and infrastructure where trade, transport, and processing occur. Furthermore, the built environment is not neutral; it is experienced differently based on gender.

By analyzing the intersection of sustainable agricultural cold chains, the design of the built environment, and the distinct socio-economic roles of gender through the lens of clean energy research, we can unlock systemic solutions that simultaneously address food insecurity, climate resilience, and social equity.

Rethinking the Built Environment: From Centralized to Distributed Cooling

Agricultural cold chains have traditionally followed a centralized model, with large cold stores concentrated near urban centers, industrial hubs, and consumption markets. While efficient for large commercial operations, this model often excludes smallholder farmers, who face significant barriers in accessing distant facilities.

This challenge is particularly evident in India, where cold-chain infrastructure remains heavily concentrated around select commodities and urban markets. The result is a persistent "first-mile" bottleneck—the gap between where produce is harvested and where temperature-controlled storage becomes available.

A more sustainable approach requires decentralized cooling infrastructure embedded within rural and peri-urban communities. This could include:

- Solar-powered aggregation hubs that enable farmers to cool produce immediately after harvest.
- Climate-responsive building design, including passive cooling strategies such as high-thermal mass materials, natural ventilation, and reflective roofs.
- Thermal Energy Storage (TES) solutions that store cooling energy during periods of high solar generation and maintain temperatures during power disruptions.

By integrating cooling infrastructure closer to farms and local markets, decentralized systems reduce spoilage, lower transport requirements, and improve resilience in underserved regions.

The Gender Dimension of Agricultural Cooling

The location and design of cold-chain infrastructure have important gender implications. Across many agricultural systems, women are heavily involved in post-harvest handling, sorting, processing, and marketing of highly perishable commodities such as fruits, vegetables, and dairy products.

Unlike grains and other non-perishable crops, these products require rapid access to cooling. Yet women often have the least access to cold-chain infrastructure due to mobility constraints, limited asset ownership, and lower access to capital.

The absence of localized cooling forces many women farmers and traders into distress sales, where produce must be sold immediately—often at reduced prices—to avoid spoilage. As a result, postharvest losses disproportionately affect women's incomes and economic security.

Viewed through this lens, cold-chain infrastructure is not simply a logistics solution; it is also a mechanism for reducing gender-based economic inequalities.

Mobility, Safety, and Marketplace Design

The built environment shapes not only access to cooling but also the ability to participate in agricultural markets.

Many women face mobility constraints due to limited ownership of vehicles and reduced access to commercial transport services. When cold storage facilities are located far from production areas, the costs and logistics of transporting produce can become prohibitive.

Market infrastructure presents additional challenges. Across many regions, women operate in informal marketplaces characterized by inadequate shelter, poor thermal conditions, and limited storage facilities. Extreme heat accelerates product deterioration while reducing worker productivity and wellbeing.

The absence of secure overnight storage creates another significant barrier. Unsold produce must either be transported home, abandoned, or guarded overnight—often exposing women to financial losses and personal safety risks.

A gender-responsive built environment would treat marketplaces as critical infrastructure. Investments in solar-powered walk-in coolers, shared cold storage facilities, and secure storage lockers can help extend product shelf life, improve safety, and increase women's bargaining power by allowing them to choose when and where to sell their produce.

Designing for Inclusion

Infrastructure alone is not enough; the way it is designed matters.

Cold storage facilities should be accessible and user-friendly, incorporating features such as intuitive interfaces, manageable loading systems, and layouts suited to small-scale users. Infrastructure designed primarily for large commercial operators can unintentionally exclude women and smallholder farmers.

Equally important are inclusive business models. Since many women face barriers to accessing formal credit and asset ownership, purchasing refrigeration equipment outright is often unrealistic.

Models such as Cooling-as-a-Service (CaaS) offer a promising alternative. Under this approach, service providers own and operate cooling infrastructure while users pay affordable, pay-per-use fees. By converting cooling from a capital-intensive asset into an accessible utility, CaaS can significantly expand access for women farmers and traders.

Conclusion: The Triple Win of Inclusive Cooling

Connecting sustainable agricultural cold chains with the built environment and gender dynamics reveals that infrastructure is never just a matter of engineering. The physical placement, scale, and accessibility of cooling facilities directly dictate who prospers and who is left behind in the agricultural economy.

Transforming our built environment through decentralized, solar-powered cold hubs and climatesmart marketplace architecture is not simply an environmental necessity to curb greenhouse gas emissions and food waste. It is a powerful structural lever for social justice. When we design agricultural infrastructure with gender equity at the core, we secure a triple win: we slash food loss, build climate-resilient cities and villages, and drive the economic empowerment of women globally.



MS. KHUSHBOO GUPTA

Principal Research Associate

AEEE

Dr. Khushboo Gupta serves as a Principal Research Associate at the Alliance for an Energy Efficient Economy (AEEE), where she leads initiatives aimed at advancing sustainable cold-chain infrastructure across India. With over eight years of experience in the sustainability domain, Dr. Gupta collaborates with central and state policymakers to develop and implement energy-efficient and climate-resilient cold-chain action plans. She engages with technology providers to integrate renewable energy solutions, ensuring the adoption of low-carbon refrigeration technologies. At the grassroots level, Dr. Gupta works closely with farmers and rural entrepreneurs to co-create viable business models that reduce post-harvest losses and enhance livelihoods. By aligning technical innovation with policy frameworks and community needs, she aims to transform India's cold-chain sector into a more sustainable and inclusive system.



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RELIABLE
PERFORMANCE



ADVANCED
ENGINEERING



SUSTAINABLE
TOMORROW



CTI-CERTIFIED BENEFITS

- Assured Performance & Quality
- Verified Thermal Performance
- Energy Efficiency
- Higher Reliability
- Global Industry Recognition
- Customer Confidence



THERMAL PERFORMANCE BENEFITS

- Verified Thermal Performance
- Accurate Heat Transfer Efficiency
- Reliable Cooling Output
- Optimized Water & Air Flow
- Improved System Efficiency
- International Quality Benchmark



ENERGY SAVING BENEFITS

- Reduced Power Consumption
- High Thermal Efficiency
- Energy-Efficient Fan Operation
- Optimized Airflow Management
- Lower Operating Costs
- Long-Term Energy Savings



IDEAL FOR INDUSTRIES



Power
Generation



Petrochemical



HVAC
Systems



Pharmaceutical



Food &
Beverage



Process
Industry

WHY CHOOSE SUPERFLOW COOLING TOWERS?

- CTI-Certified Performance Assurance
- Advanced Cooling Tower Technology
- High Efficiency & Reliable Operation
- Designed for Industrial Applications
- Quality-Focused Engineering
- Customer-Oriented Solutions



Superflow Cooling Towers Pvt. Ltd. (CTI-Certified)

+91-9810337622 | sales@sfcoolingtower.com | www.sfcoolingtower.com

Program & Events

DISTINGUISHED LECTURE

Distinguished Lecture was held on 13th December 2025 at Hyatt Place, Haridwar. 180 Attendees, 80 Members and 100 Non-Members participated.



Distinguish Lecture was held on 23rd December 2025 at Park inn By Radisson, New Delhi. 19 Attendees, 15 Members & 4 Non-Members participated.



Pharma Connect

Pharma Connect was held on 13th December 2025 at Hyatt Place, Haridwar. 180 Attendees, 80 Members and 100 Non-Members participated.



Full Day Workshop

Full Day Workshop was held on 13th December 2025 at DCI Office, Saket, New Delhi. 15 Attendees, 09 members and 06 Non-Members participated.



Half Day Workshop

Half Day Workshop was held on 19th December 2025 at Bunkerman House, East of Kailash. 17 Attendees, 4 Members and 13 Non-Members participated.



Youth Summit

Youth Summit was held on 14th December 2025 at Summit Hotel & Resort, Rishikesh. 14 Attendees and 14 Members participated.



ISHRAE KNOWLEDGE TALK

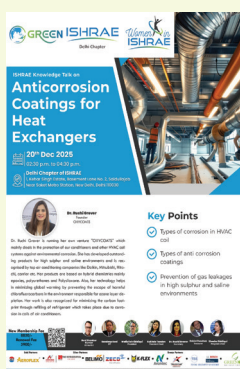
IKT (Climate Change and the Power of Less: e-consumption and Energy Transition) was held on 20th December 2025 at DCI Office, Saket, New Delhi. 5 Attendees and 5 Non Members attended the event.



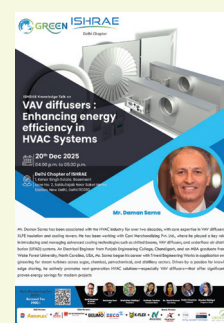
IKT (Electrical safety) was held on 20th December 2025 at DCI Office Saket, New Delhi. 9 Attendees and 02 Members participated.



IKT (Anticorrosion Coatings for Heat Exchangers) was held on 20th December 2025 at DCI Office, Saket, New Delhi. 6 Attendees, 1 Members & 5 Non-Members attended the program. – 5



IKT was held on 20th December 2025 at DCI Office Saket, New Delhi. 7 Attendees, 3 Members and 4 Non-Members participated.



IKT (The Role of Filtration in Pharma) was held on 30th December 2025 at Perfect Air, Okhla, New Delhi. 19 Attendees, 2 Members & 17 Non-Members participated.



IKT was held on 29th December 2025 at Perfect Air, Okhla, New Delhi. 19 Attendees, 2 Members & 17 Non-Members participated.



IKT was held on 31 January 2026 at DCI Office, Saket, New Delhi. 18 Attendees, 08 Members and 10 Non-Members participated.



K-12

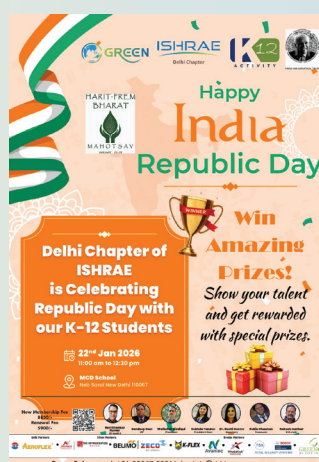
K12 program was held on 21 January 2026 at MCD School, Neb Sarai, New Delhi. 40 Attendees participated.



K12 was held on 20 January 2026 at Sunshine NGO, Saket, New Delhi. 40 Attendees participated.



K12 program was held on 22 January 2026 at MCD School, Neb Sarai, New Delhi 40 Attendees participated.



Refrigeration Program

Refrigeration Program was held on 23rd December 2025 at Park Inn By Radisson, New Delhi. 19 Attendees, 15 Members & 4 Non-Members participated.



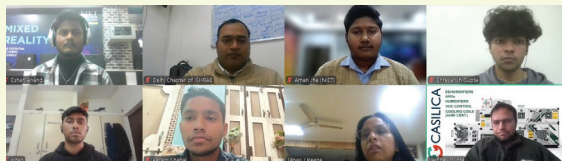
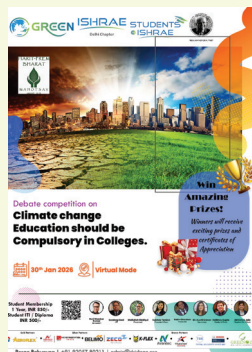
FemTech 2026

FemTech was held on 23 January 2026 at Holiday Inn, Mayur Vihar, New Delhi. 60 Attendees, 35 Members & 25 Non-Members participated.



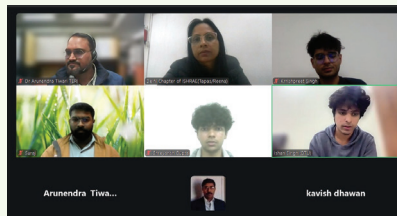
Student Debate Competition

Student Debate Competition was held on 30 January 2026 (Virtual Mode). 10 Attendees & 10 Members participated.



Student Competition

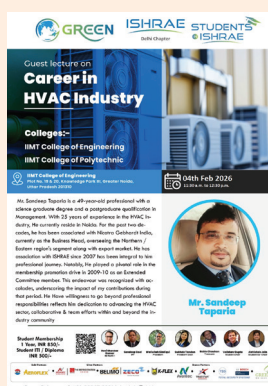
Student Competition was held on 28 January 2026 (Virtual Mode). 6 Attendees and 6 Members participated.



STUDENT GUEST LECTURE



Student Guest Lecture was held on 03 February 2026 at Jamia Milia Islamia College, New Delhi 50 Attendees, 30 Members and 05 Non-Members participated.



Student Guest Lecture was held on 04 February 2026 at IIMT College of Engineering. 60 Attendees, 40 Members & 05 Non-Members participated.



Student Guest Lecture was held on 04 February 2026 at IIMT College of Engineering. 60 Attendees, 40 Members and 05 Non-Members participated.



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HVAC Design (Level - 1)

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CDR. ATUL KUMAR BOHATGI
 FOUNDER HEAD - HVAC DESIGN
 WASHNET DESIGN BUREAU - DELHI

BENEFITS

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- Gain a competitive edge with recognized expertise.
- Get listed on the ISHRAE website for increased visibility.

DATES & VENUE
 Module 1: 8th, 9th & 10th Jan, 2026
 Module 2: 22nd, 23rd & 24th Jan, 2026
DELHI

FEES (Exclusive of INR GST)
 3 ISHRAE Members: **INR 9,500**
 3 Non-Members: **INR 13,000**

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- Engineering Professionals
- Regulators & Policy Makers Involved in Building Codes and Energy Standards

ISHRAE Knowledge Centre Delhi
 1, Khehar Singh Estate (Basement)
 Lane No. 2, Saidulajab, Near Saket Metro Station, Gate No. 2, Delhi-110030

Atul Kumar Bohatgi
 92057 80208 | Delhi Chapter
 Mr. Anand Kumar - Central Coordinator in HQ
anandkumar@ishrae.in

*Laptops are not required for the training session. If you choose to bring one, feel free to use the data. Complimentary lunch and tea will be provided to all course participants.



ICP

ICP @Module 1 was held on 8th, 9th & 10th Jan, 2026 and Module 2 on 22nd, 23rd & 24th Jan, 2026 at DCI Office Saket, New Delhi. 22 Attendees, 08 Members and 14 Non-Members participated.

Aquest

AQUEST was held on 06 February 2026 at DCI Office, Saket, New Delhi. 14 Attendees, & 14 Members participated.

STUDENTS **ISHRAE** **GREEN**

aQUEST
 The ultimate engineering face-off
QUARTER FINAL

North Zone's Aquest Quarter Final Will Be Held AT

DELHI CHAPTER

DATE
 06th Feb 2026
REPORTING TIME
 12:00 PM

VENUE
 1, Khehar Singh Estate (Basement)
 Lane No. 2, Saidulajab, Near Saket Metro Station, Gate No. 2, New Delhi-110030

*Prizes offered for 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th, 101st, 102nd, 103rd, 104th, 105th, 106th, 107th, 108th, 109th, 110th, 111th, 112th, 113th, 114th, 115th, 116th, 117th, 118th, 119th, 120th, 121st, 122nd, 123rd, 124th, 125th, 126th, 127th, 128th, 129th, 130th, 131st, 132nd, 133rd, 134th, 135th, 136th, 137th, 138th, 139th, 140th, 141st, 142nd, 143rd, 144th, 145th, 146th, 147th, 148th, 149th, 150th, 151st, 152nd, 153rd, 154th, 155th, 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25-26-27

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For more details
ishrae@delhi.ishrae.org
www.ishrae.org
www.ishrae.org

Half Day Workshop on Decarbonizing India's building sector: Viksit Bharat 2047 to Net Zero 2070 & Anticorrosion Coatings for Air conditioners @14th May 2026 | CBRE Office, Gurugram

MEMBER :- 5
NON-MEMBER :- 13
TOTAL NO. OF DELEGATES :- 18



IKT on HVAC Systems Balancing the Adiabatic Line Equilibrium @16th May 2026 | DCI Office, Saket

Publication : All About AHU's

MEMBER :- 18
NON-MEMBER :- 4
TOTAL NO. OF DELEGATES :- 22



Full day Program on "Masterclass on Datacenter" at Roseate House Aerocity, New Delhi @5th June 2026



IKT on Air Filtration - Capturing Particles, Ensuring Clean Air @16th May 2026 | DCI Office, Saket

Publication : Fundamental of Air Filters for HVAC

MEMBER :- 18
NON-MEMBER :- 4
TOTAL NO. OF DELEGATES :- 22



DL Program on "Reimagining HVAC: Standards Powering the Green Building Revolution by Delhi Chapter at ParkInn, New Delhi @ 6th June 2026



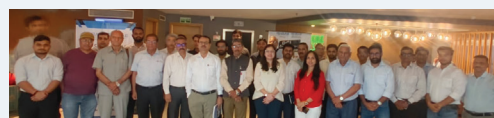
Product Presentation by Vertiv at Roseate House Aerocity, New Delhi @5th June 2026



DL Program on "Hybrid Eco-logical & Eco-nomical Technologies by Mr. Jagdeep Singh at ParkInn, New Delhi @ 6th June 2026



Full Day Workshop on HVAC Engineering for Healthy Built Environment in Healthcare @02nd May 2026 | Park Inn by Radisson



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Distinguished Lecture on Hospital HVAC Automation Design Guide @02nd May 2026 | Park Inn by Radisson



ITD Program(Plantation Drive) on World Environment Day by Delhi Chapter at Lajpat Nagar, New Delhi @ 6th June 2026



Advocacy Programs with ASHRAE INDIA CHAPTER @ 24 – 25 April, Hotel Pullman



IKT on HVAC Systems Balancing the Adiabatic Line Equilibrium @16th May 2026 | DCI Office, Saket



IKT on Air Filtration - Capturing Particles, Ensuring Clean Air @16th May 2026 | DCI Office, Saket

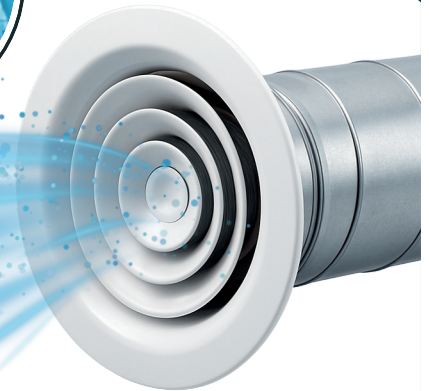


IIMT College of polytechnic reinstallation on 15 April 2026@ IIMT College of polytechnic, Greater Noida





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24th - 25th October 2026
1000+ Delegate



ACRESERVE
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28th November 2026
200+ Delegate



Climate Summit 2.0
11th December 2026
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ACRECONF 2027
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Guest Lecture on Career in HVAC Industry 15 April 2026 @ IIMT College of polytechnic, Greater Noida



Industrial Visit 18 April 2026 @ Truestar Air System Equipment Pvt. Ltd., Greater Noida



K-12 on World Earth Day :- Tree Plantation Drive 22 April 2026 @ Pratibha MCD School, Neb Sarai New Delhi



Student Internship @30th April 2026 | IIMT College Of Polytechnic, Greater Noida

MEMBER :- 60
NON MEMBER :- 90
TOTAL NO. OF DELEGATES :- 150



K-12 on The Great Indian Science Festival @16th & 17th May 2026 | PACIFIC MALL , FARIDABAD

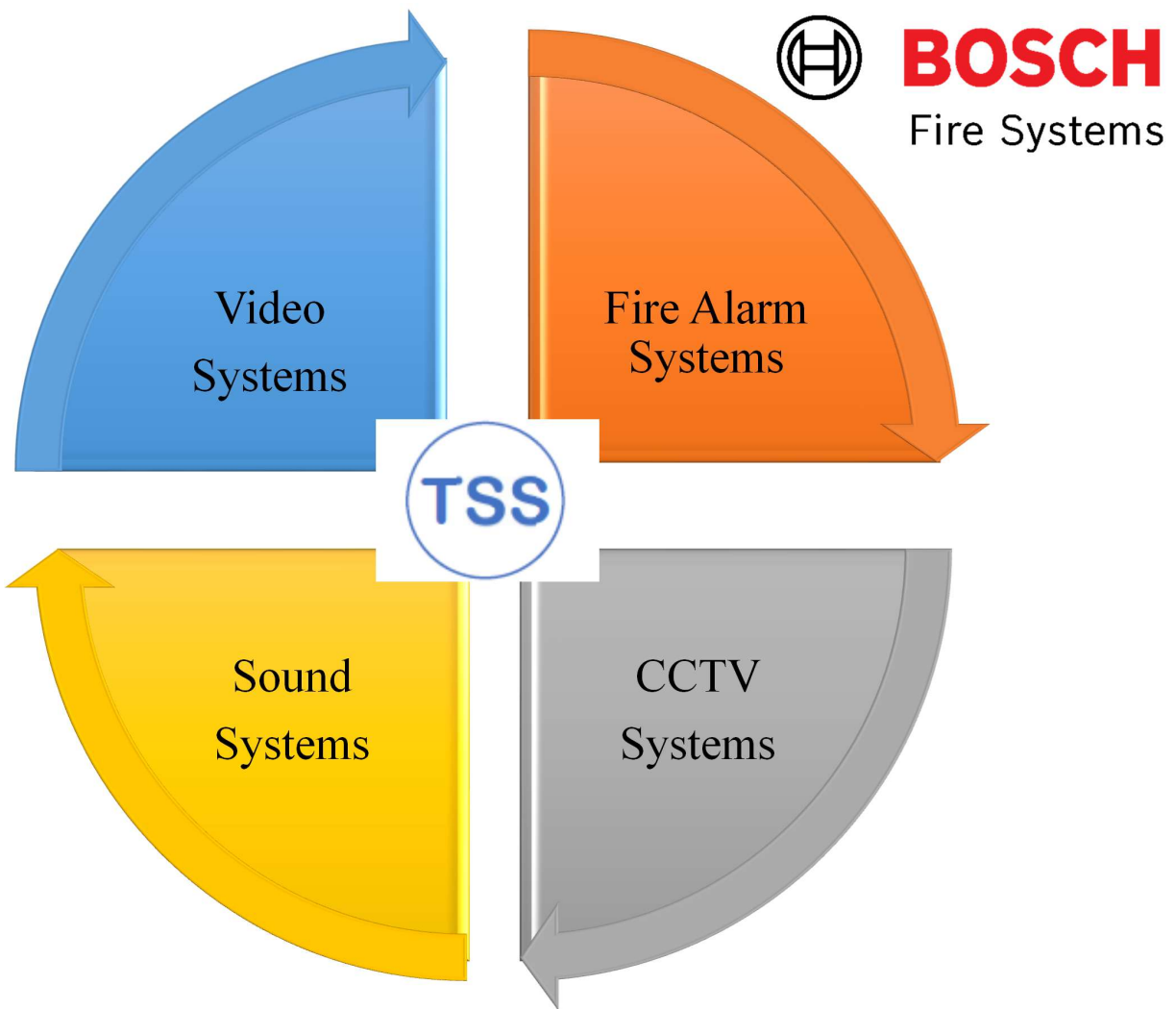
TOTAL NO. OF DELEGATES :- 60



Student Technical talk on AI, Education & Employability Building the Future Workforce @30th April 2026 | IIMT College Of Polytechnic, Greater Noida

MEMBER :- 60
NON MEMBER :- 90
TOTAL NO. OF DELEGATES :- 150





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