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Publisher's Letter

Hello and welcome once again to *Cooling India*.

HVAC systems play a critical role in maintaining temperature and humidity in hospitals, which is especially important in operating rooms and other clean rooms. Also, healthcare facilities that are not properly ventilated, designed or controlled can lead to the spread of airborne pathogens throughout the facility. Therefore, HVAC systems deliver a safer environment for patients, staff and visitors in health care facilities by maintaining Indoor Air Quality (IAQ).

Today, IAQ has become a significant issue in any hospital setting. The prerequisite for any healthcare facility is to provide and ensure a good IAQ to safeguard patients, nursing staff and visitors from the hazards of occupational diseases and nosocomial or hospital-acquired infections (HAI). According to the World Health Organization (WHO), at any given time over 1.4 million people across the globe suffer from a nosocomial or HAI and about 80,000 deaths a year. As per a study by International Society of the Built Environment (2008) on indoor and outdoor air quality in hospitals, it was estimated that bacterial counts in ICUs, orthopedic wards, neonatal wards, dialysis wards and post-operative wards were found to be beyond the recommended levels.

GBS Sodhi, Director & Country Head India, Evergen Systems India reminds us why it is important for a healthcare facility to understand the wellbeing of its patients and workers and safeguarding their health whereas experts from Indian Pollution Control Association examines the factors effecting IAQ in hospital setting and methods to ensure acceptable IAQ in hospitals.

While investment in HVAC has always been a top priority in healthcare, major outbreaks not too long ago – including MERS, Zika and Ebola – have cast a spotlight on the industry's susceptibility to crises, and the need to improve facilities. Prasun Talukdar, Director – Key Verticals and Strategic Projects, Johnson Controls explains the need of a unified, central design as far as HVAC systems are concerned.

We hope you'll enjoy reading this issue as always! Please write to me at pravita@charypublications.in.


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• 100/- Per Copy
• 1000/- Annual Subscription

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Printed by Pravita Iyer and Published by Pravita Iyer on behalf of Chary Publications Pvt Ltd., and Printed at Print Tech, C-18, Royal Ind. Est., Naigaum Cross Road, Wadala, Mumbai 400031 and Published at 906, The Corporate Park, Plot 14&15, Sector - 18, Vashi, Navi Mumbai - 400 703.

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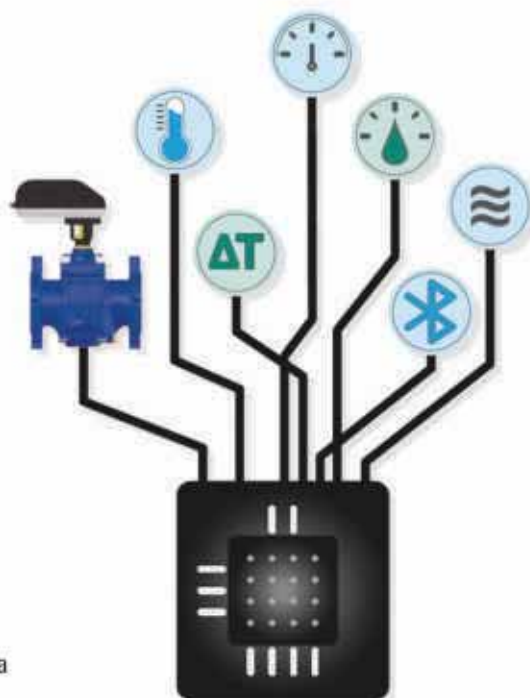
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About Airmaster Tape Industries Pvt Ltd

Airmaster Equipments Emirates L.L.C Ajman UAE was established in 1987 as a cost effective alternate to other major manufacturers of central air-conditioning outlets like Grills, Registers, Diffusers, Louvers and ducting accessories like Volume Control, Dampers, Plenum Boxes, Access doors, Flexible ducts, Silencers etc. We are a well established company completing 27 years and 'air master' products are well known and approved by most of the leading consultants in UAE and the Middle East.

Airmaster Tape Industries Pvt Ltd is our newly developed Tape manufacturing division to add a new range of product value in 'air master' brand. We are specialized in the manufacturing and supply of adhesive tapes in INDIA for the HVAC & Packaging industries along with insulation material and duct accessories.



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Insulated & Uninsulated Flexible Duct is available with Metalized jacket to provide ultimate strength and protection. Metalized polyester vapor barriers are reinforced with Fiberglass scrim for high durability, tear resistance and outstanding thermal insulation protection. Flexible duct is used for thermal insulation, heating, ventilating and air conditioning systems for residential and commercial applications. They are most commonly used to connect the Main duct to the plenums. In addition to this, flexible ducts are used in areas where manoeuvring of steel ducts are a challenge due to other services for shorter lengths.



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Flexible Duct Connector is a Duct Accessories used to eliminate duct system noises and vibrations for industrial and commercial applications while doing Thermal Insulation. The Basic use is to isolate the vibration and noises from the source with an air tight flexible joint consisting of a fabric fastened to steel metal on both sides. The flexible connector is fixed between the A/C equipment or fan and the ductwork. Various cloth types, cloth widths and steel widths are available in order to meet most of the installation requirements at job sites.



Airmaster Rubber Insulation (NBR) and Cross-linked polyethylene (XLPE)

Airmaster sheet & Roll Rubber insulation is used to retard heat transmission and control condensation from chilled-water and refrigeration systems. It also efficiently reduces heat transfer for hot water plumbing and liquid-heating and dual-temperature piping. Airmaster Rubber Insulation sheet & Rolls is ideal for applications: Duct work, Large piping and fittings, Tanks, Vessels, Curved and irregular surfaces and all types of fitting covers



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Eurammon to discuss futuristic cooling solutions

Natural refrigerants group Eurammon meets for its 2019 symposium in June when it will discuss future-proof solutions in cooling and heating applications. The symposium on June 27th and 28th in Schaffhausen, Switzerland, will provide a mix of lectures and a panel discussion. This year's theme will focus on the future-proof solutions that could master the challenges posed by statutory regulations such as the F-gas regulation. Participants will receive an insight into the current legislation and technical regulations, get to know new solutions for small-capacity ammonia refrigeration systems and discuss different refrigeration systems in the supermarket application.

Eurammon is a joint initiative of companies, institutions and individuals who advocate an increased use of natural refrigerants. As a knowledge pool for the use of natural refrigerants in refrigeration engineering, the initiative sees as its mandate the creation of a platform for information sharing and the promotion of public awareness and acceptance of natural refrigerants. The objective is to promote the use of natural refrigerants in the interest of a healthy environment, and thereby encourage a sustainable approach in refrigeration engineering.

Eurammon provides comprehensive information about all aspects of natural refrigerants to experts, politicians and the public at large. It serves as a qualified contact for anyone interested in the subject. Users and designers of refrigeration projects can turn to eurammon for specific project experience and extensive information, as well as for advice on all matters of planning, licensing and operating refrigeration plants. ■

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Cooling India

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Schaufler Academy offers a new type of training

Bitzer is offering a new type of training at its international training centre, the Schaufler Academy in Germany. Any person who's interested can now benefit from the training course 'Roadstar compressors for bus air conditioning'.

Training course participants can look forward to theoretical content alongside practical exercises with Roadstar compressors. Working in small groups, they address topics such as application ranges and mounting, selection and configuration, maintenance, compressor assembly and disassembly, and shaft seal replacement.

Bitzer Roadstar compressors have been successfully used in mobile air conditioning applications since 2011. The highly reliable aluminum compressors



were specially developed for mobile use and are suitable for air conditioning and refrigeration applications in all conventionally powered types of bus, as well as for refrigerated vehicles.

The single-day courses are ideal for installers, service technicians, planners, engineers and manufacturers alike, and offered throughout the year in both English and German. Dates, further information and registration can be found. ■

Indian Oil selects Emerson to modernise refinery

India's largest refiner Indian oil chooses Emerson to serve as automation contractor in major upgrade of emissions control operations as part of 2020 clean fuels strategy. Global technology and engineering company Emerson recently announced it has signed multiple contracts totaling \$12 million with one of India's largest commercial oil company, Indian Oil Corporation Limited, to modernise operations and emissions programs at the company's refineries.

Under the contracts, Emerson will serve as automation contractor, combining its deep refining expertise and advanced technologies to help Indian Oil meet the country's new BS-VI low-sulfur emissions standards, which take effect in April 2020. The BS-VI emission standards mandate a maximum sulfur content of 10 parts-per-million, which matches best practices set by Europe, the United States and other countries, and include limits on carbon monoxide, nitrogen oxides and particulate matter.

"Companies that leverage automation technologies and digital transformation programs will have a significant advantage in their goal of reaching top quartile performance," said Lal Karsanbhai, Executive

President of Emerson's Automation Solutions Business. He further added, "Indian Oil has long been a valued customer of Emerson, and we are proud to provide them with the technology and expertise they require to meet these new fuel regulations while also modernising operations."

The project will upgrade 14 different process units, including diesel hydro-treating units designed to reduce sulfur content and octane-boosting units either being installed or augmented with desulfurisation technologies.

As the country's largest commercial enterprise with a workforce of more than 33,000 Indian Oil plays a significant role in fueling the development of the economy. With a mandate to ensure India's energy security and self-sufficiency in the refining and marketing of petroleum products, Indian Oil impacts the entire hydrocarbon value chain, including refining, pipeline transportation, marketing of petroleum products, exploration and production of crude oil, natural gas and petrochemicals.

To help Indian Oil reach its goals, Emerson will install advanced technologies, including DeltaVTM distributed control systems; DeltaV safety instrumented systems and gas analyzers. ■



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Manufacturers face countdown to gain competitive advantage from Industry 4.0

Siemens Financial Services (SFS) has released a new research paper which focuses on digital transformation in the manufacturing industry stating that the key point is ceasing to be one of 'whether' to invest in transformation, but rather 'when'.

Research from SFS has found that the potential financial value of digitalisation is estimated to be between 6.3 per cent and 9.8 per cent of total annual revenue by 2025. In most marketplaces, early movers (first 50 per cent of players) to invest in new technologies or business models, are those that will be able to make the most of this competitive advantage. For the "laggard" half of the market, investment in the new technologies or models is still required. The research found that 70-80 per cent of large companies have implemented a significant pilot project for Industry 4.0 production solutions, compared to 40-50 per cent of SMEs.

Respondents to the research from SFS estimate that the "tipping point" – defined as when 50 per cent of the global manufacturing community will have substantially converted to Industry 4.0 production platforms

Challenges to implement digital transformation tend to pivot around the issue of finance. These include understanding the commercial benefits of Industry 4.0, knowing that there will be a reliable return-on-investment, and paying for Industry 4.0 technology at a rate lower than or matching the expected commercial gains, making the investment sustainable. The financing techniques that enable sustainable digital transformation are becoming known as 'Finance 4.0'. These techniques cover the full range of requirements, from the acquisition of a single digitalised piece of equipment, to financing a whole new factory, to even acquiring a competitor. ■

IVECO and Carrier Transicold team up to offer CNG powered solutions

Customers in France can now experience the performance, efficiency and environmental benefits of a CNG-powered solution for refrigerated trucks during field tests of IVECO's first Stralis NP refrigerated truck equipped with the Carrier Transicold's Supra CNG refrigeration unit. The truck was on display at the SITL tradeshow, Porte de Versailles, France March 26th-28th in IVECO's stand. IVECO is a brand of CNH Industrial N.V.

"The collaboration with IVECO began two years ago with a simple goal - to provide a complete sustainable solution to transport operators that are facing urban distribution challenges related to emission regulations," said Bertrand Gueguen, President, Truck/Trailer International, Carrier Transicold. "We have worked closely with IVECO to build a high performance and sustainable solution," he added.

Developed for use with rigid trucks, the Supra CNG unit uses one source of CNG fuel from a single refill point on the vehicle, which feeds independent tanks connected



to the truck's engine and the refrigeration unit. This configuration ensures the Supra CNG unit can maintain cold chain integrity, allowing for full autonomy of the refrigeration system even when the truck is idling or stopped – and making the refueling process faster and more efficient for the operator.

"As CNG-powered commercial vehicles grow in popularity across Europe for urban distribution, we are pleased to offer our customers a way to embrace this alternative fuel in their refrigeration units as well," added Gueguen. "This is another successful step toward more sustainable transport solutions." ■

Aspen Pumps win at the Gatwick Diamond Business Awards

The Gatwick Diamond Business Awards (GDBA) one of the UK's most recognised and prestigious business accolades were recently held with over 600 attendees from companies hoping to win. The awards recognise companies from all industries within the Gatwick Diamond, who set the standard for business excellence across a variety of different disciplines. Aspen Pumps won the award in the category of Innovation and Technology – an award which recognises continued growth and business achievement through product innovation.

Aspen's dedication to innovation started with the Mini Orange condensate removal pump back in 1998. Since then, the company has continually developed its pump features and technology, creating products which are designed for specific applications and environments.

Through continued innovation, Aspen offer a variety of pumps which are

designed to fit various installation scenarios or client requirements. When AC units were made smaller, the Mini Aqua was designed to fit neatly inside the units. For applications where noise reduction is paramount, the silent+ range of mini pumps provide reduced sounds levels and offer a host of time saving installation and maintenance features as standard.

Now, Aspen Pumps set the standard for linked innovations in its products, combining the most up to date technology and time saving features in all its condensate removal pumps. Kelly Butler, Aspens Group Marketing Director said, "I am delighted that Aspen has been recognised in this category and has won such a prestigious award. Innovation is at the heart of what we do and we understand how important it is to work closely with engineers, so that we can continue to innovate and develop our products in line with what they require." ■

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Charlotte's Bank of America Stadium wins award

Bank of America Stadium won a 2018 Energy Efficiency Leader award and recognition from Trane and Ingersoll Rand leaders for outstanding commitment to energy conservation. Panthers' President, Tom Glick, and Vice President of Stadium Operations Scott Paul accepted the award recently during a ceremony at the stadium.

"Fan comfort can go hand-in-hand with efforts to reduce the stadium's energy use," said Paul. "Our fans invest time and money to see their favourite team. Their game day experience can be fun and enjoyable, while also respecting the environment."

Managers of the 75,523-seat football stadium set out to improve fan comfort, reduce costs, and lower the venue's energy use. The solution included a comfort system facelift, which reduces the stadium's energy costs by \$80,000 per year.

"The Bank of America Stadium team shows unwavering commitment for the Charlotte community," said Ron Payne, District General Manager for Trane, a brand of Ingersoll Rand. "By focusing on energy efficiency and the fan experience at the same time, they demonstrate what it means to be an energy efficiency leader."

The Bank of America Stadium upgrades also align with North Carolina's statewide goal of reducing greenhouse gas emissions by 40-per cent by 2025; buildings are one of the state's most energy-reliant sectors. These upgrades reduce the stadium's energy usage by 1.7 million-kw hours per year, which is equivalent to taking 271 cars off the road or powering 190 homes each year, in terms of greenhouse gas emissions.

Bank of America Stadium's 33-acre footprint stretches across uptown Charlotte, and has extensive energy demands, including heating and cooling in suites, concessions and other indoor areas. ■

Wienerberger India launches Koramic Roof System Components

Wienerberger India launched a complete set of roof protection accessories-Koramic Roof System Components (KRSC) this year. The accessories include roofing underlays, insulating material, and other accessories. The components offer complete protection from heat and moisture, and long-lasting products that give continuous protection from water leakage at all vulnerable areas of the roof. These roofing systems are quick and easy to install and have roofed more than 1,500 households across South India.

The Koramic Roof Systems Components include Premium Reflex/Barrier ALU- roofing underlays that provides waterproofing and insulation, Koraflex – flashing tapes that protects the abutments, Koraroll – for under ridge protection from moisture and avoid mortar bedding below ridges, Valley Sheets – for waterproofing in valley areas, Tiles Clips- for wind protection and prevents tiles upliftment in storm /cyclones. Pitch roofs are a common feature for independent houses especially in hill stations and coastal areas owing to various functional



attributes as well as the aesthetic standpoint. To suit the attributes, the tiles used for pitched roofs must be strong, robust and flexible. Wienerberger's Koramic and Tondach tile solutions are genuine terracotta tiles that come in a wide range of profiles, finishes, and colors that give the architect enough design flexibility. The solution also offers the best protection for houses against weather and wet conditions. They are durable, energy-efficient and color that does not fade over time. On average, the company's clay roof solution covers more than 290,000+ roofs worldwide in a year and is a consistent leader in roof tile manufacturing in Europe for nearly two centuries.

Also, in places where there are heavy rainfalls, like Kerala where last year, there was 42 per cent more rainfall recorded than the previous years, erratic weather conditions make it necessary for roof tiles to have inbuilt defence mechanisms against such harsh conditions. ■

DHL SmartTrucking, Sneha Farms announce tie up

DHL SmartTrucking has signed up with Sneha Farms, a conglomerate engaged in poultry integration, feeds, premises, solvent extractions and refining of edible oils, to streamline their business operations with logistics.

Charles Devlin D'Costa, Chief Sales Officer - Cold Chain, DHL SmartTrucking, said, "In the cold chain business, temperature control and on-time delivery are the most important and Sneha Farms' sole business relies on the accuracy of the two. DHL SmartTrucking adheres to global standards for cold chain offerings and our reefer trucks maintain products in the range of (-)25 degree C to (+)25 degree C

for all perishable goods."

Shyam Sundar Bugata, Chief Marketing Officer, Sneha Farms, said, "DHL SmartTrucking provides several business benefits, including accurate temperature control, on-time delivery and a drive relay system – all of which are very crucial to a business operating in the cold-chain space. Furthermore, we save approximately 20-30 per cent of the delivery time since our association with DHL SmartTrucking." ■





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Elanpro showcases solar solutions at Aahar 2019

Eco-consciousness is a trend today. Solar products are fast expanding their reach in the commercial refrigeration industry. Underscoring the company's momentum to provide cutting-edge equipment, Elanpro, introduced Mobile Freezer at Aahar 2019. Elanpro Mobile Freezer operates without external power source and thus, has zero energy costs. The company is exhibiting its entire range of products catering to retail, bar and kitchen refrigeration at 33rd Annual International Food and Hospitality Fair held at New Delhi in March.

Elanpro Mobile Freezer harnesses the power of the sun via panel to cool products. An energy-efficient, lightweight (22 kg) solution, the refrigeration product is solar and battery powered. Once the battery is charged, it can run for 10-12 hours making it reliable even for the markets wherein electricity is a problem. Elanpro Mobile Freezer is multi-utility tool for retail or door step delivery. The product can be fitted on a two-wheeler as well for delivery of milk, cheese, butter, juices, frozen food and ice cream alternatively. The system can also be deployed for agricultural produce, dairy chilling, ice-making and other purposes.

Addressing the space issues faced by small retailers, Elanpro has showcased counter top chiller and freezer - EKG 55. With a small footprint and versatile, lightweight design, Elanpro EKG 55 is not only ideal for supermarkets but also restaurants, delis, bakeries, convenience stores, paan and chemist shops looking to expand their offerings display, while saving valuable counter space. A viable option for low selling rural market, EKG 55 is equally efficient in modern trade outlets as a POS near check-out counter for a last-minute sale. These energy efficient units are operationally noiseless. ■

Panasonic and Systemair sign partnership

Systemair, a leading ventilation company with operations in 50 countries, and Panasonic, a world leader in the development of HVAC solutions, recently unveiled a strategic partnership aimed at developing joint integrated and sustainable solutions for both commercial and residential premises.

The collaboration between Panasonic and Systemair will be based on the existing technology and expertise of both partners. In the first phase, Panasonic will introduce a new series of high-efficiency and eco-friendly heat pump chillers incorporating Systemair's innovative reversible cooling technology. The new integrated products are fully adaptable and suitable for use in creating solutions for specific projects (including in the light commercial sector) to meet all aspects of customer requirements.

Systemair and Panasonic are also engaged in a development collaboration on technology and functions to be



incorporated into cooling and heat pump technology products. The objective is to create more high-efficiency, eco-friendly and ultra-modern chiller and heat pump products for the European market. The collaboration will also make use of the companies' smart cloud-based services. The partners will strive for seamless integration between Systemair's ventilation products and Panasonic's high-tech heat pumps for residential and commercial properties, as well as its control technology and connection facilities. Through the collaboration, the two companies will be able to create a new, powerful value offer that meets their customer requirements. ■

USGBC announces 2019 green building leadership

The US Green Building Council (USGBC) recently announced Adidas and Knauf Insulation as the recipients of the 2019 Greenbuild Europe Leadership Awards. The Leadership Awards recognise outstanding individuals and organisations at the forefront of the green building movement. The recipients were announced at USGBC's Greenbuild Europe conference which was held in Amsterdam.

"Both Adidas and Knauf have demonstrated courage and purposeful intent – tirelessly championing green building, pushing to transform the environment and helping to improve the quality of life for people in their communities," said Mahesh Ramanujam, President and CEO of USGBC and Green Business Certification Inc. (GBCI). "With these types of leaders, I know our vision of green buildings for all within this generation can become a reality. This award recognises their outstanding contributions

to protecting the environment – both for people today and for future generations."

USGBC is the presenting organisation for Greenbuild. Greenbuild will take place in five cities worldwide in 2019, including Mexico City, Atlanta, Shanghai and Mumbai. Greenbuild Europe is the first event of the year, bringing together business leaders with a focus on creating a more sustainable built environment and a better quality of life for all.

Adidas is being recognised for its outstanding contributions to protecting the environment including the company's commitment to LEED and reducing its carbon footprint. Adidas's progressive sustainability roadmap and campaign 'Sport Needs a Space,' includes a holistic approach that looks at spaces where sport is made (all places where products are created, manufactured and shipped), sold (own retail, wholesale and e-commerce) and played (from the indoor court to the outdoor pitch all over the world). ■

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ISHRAE Mumbai Chapter appoints Mihir Sanghavi as its new President

ISHRAE recently appointed Mihir Sanghavi as the President of ISHRAE Mumbai Chapter. Previously working as the President Elect, Mihir Sanghavi assumed the role of the President by succeeding Sangita Jhangiani who was the President for ISHRAE Mumbai Chapter.

New committee members were also appointed for the year 2019-20 to serve ISHRAE's Mumbai Chapter. According to the new appointments, Rajendra Joshi will take over as President Elect, Kishore Karle will assume the role of Secretary.

The announcement ceremony took place in the presence of the National President Ishrae Vikram Murthy and previous committee members such as Sanjay Verma, Nasir Khan, Sanjay



Mumbai Chapter. I am sure he will leverage on his immense knowledge and expertise in nurturing the growth of ISHRAE Mumbai Chapter. The pace of change in today's energy efficiency practices has accelerated and ISHRAE is committed to ensuring that we not only stay at the forefront of this change but will also continue to innovate and fuel the development of the HVAC&R market as we have always done." ■

Jadhav, Sandeep Mehendiratta, Kunal Bhavsar, Vivek Marde, Jayant Patekar, Mukesh Suthar, Sangita Jangiani, Atul Kochrekar, Amey and more.

Vikram Murthy, National President, ISHRAE said, "It gives us great pleasure to see Mihir Sanghavi taking on the mantle of the President, ISHRAE

KPMG appoints Vinodkumar Ramachandran as new leader of Industry 4.0

KPMG International has appointed Vinodkumar Ramachandran as Global Leader for Industry 4.0 with effect from 01 April 2019. Vinod currently serves as the Automobile and Industrial Manufacturing Leader for KPMG in India.

Vinodkumar is a recognised expert in the automotive and industrial industries, with more than 25 years of consulting experience across key geographies. His expertise includes driving large scale topline and bottom-line transformation for clients, including turnaround across the automotive and industrial industries. Commenting on Vinodkumar Ramachandran's appointment Douglas K. Gates Global, KPMG Chair of Industrial Manufacturing and Global Head of Aerospace & Defense said,



Vinodkumar Ramachandran

"The knowledge, expertise and experience that Vinod Kumar brings to the firm as the leader of Industry 4.0 is unparalleled. Vinodkumar's deep understanding and passion for digital transformation across many sectors will help further strengthen and reinforce our position at the forefront of Industry 4.0 advisory services."

"Businesses today are faced with numerous challenges and disruptive technologies and clients rely on us to advise them and support them in implementing complex Industry 4.0 transformation programs. I look forward to leading the talented global network of KPMG professionals, as they continue to work and guide clients on the Industrial 4.0 journey," said Vinodkumar Ramachandran, Partner and Leader, Automotive and Industrial Manufacturing, KPMG in India. ■

CAREL continues reorganisation of the sales and marketing department

Following the appointment of Giandomenico Lombello as Group Managing Director, CAREL is continuing the reorganisation of the Sales and Marketing Department. Accordingly, Alessandro Greggio and Roberto Sandano have been appointed respectively as Group Chief Sales and Marketing Officer - Refrigeration and Group Chief Sales and Marketing Officer - HVAC. Both these appointments are aimed at strengthening the focus and coordination of the Sales and Marketing processes in a context of strong growth and increasing competitiveness in the markets where CAREL operates. Greggio and Sandano, now have the responsibility at



Alessandro Greggio



Roberto Sandano

a group level of working closely together to guide business development in their respective markets.

"The strong market focus that this organisation will enable also has the goal of reinforcing close synergy between sales and marketing", Alessandro Greggio commented. "I am thrilled at this highly-important opportunity, given CAREL's rate of

innovation in the HVAC/R market."

"I enthusiastically welcome this challenge," Roberto Sandano added, "And feel this is a new starting point for focusing even more closely on the demands and needs of our respective reference markets." ■

Former Star Refrigeration apprentice bags award

The Kenneth Lightfoot Medal, an annual prize awarded by the Institute of Refrigeration for the best research paper of the past 12 months, has been given to Star's Oxford branch Service Manager Chris Druce. His paper entitled 'The Impact of Refrigerant Charge on the Capacity and Efficiency of a System Containing Low GWP Refrigerants' impressed the IOR membership and he was awarded an engraved medal and £500 cash prize donated by Lightfoot Defence.

Chris first joined Star as an industrial refrigeration apprentice over a decade ago, and has progressed rapidly through his



career trajectory. This is not Chris' first recognition from the Institute of Refrigeration; he also picked up the IOR's Ted Perry award for his student research while completing his degree with Star.

The award was presented at the IOR Annual Dinner, and Chris also led a networking event to encourage engineers to share ideas and get more involved in the industry. Kevin Glass, President of

the IOR presented him with the award and remarked, "This paper explores a topic that is very current, the importance of correct refrigerant charge, and the results are relevant to a huge number of refrigeration systems." ■

CSMIA bags the Gold award at the ACI Asia-Pacific Green Airports Recognition 2019

Chhatrapati Shivaji Maharaj International Airport (CSMIA) recently bagged the Gold award at the ACI Asia-Pacific Green Airports Recognition 2019. The Airport Council International (ACI) Asia-Pacific announced the results of the Green Airports Recognition 2019. The eminent panel of judges lauded the Chhatrapati Shivaji Maharaj International Airport, Mumbai for its best practices towards creation of green airport infrastructure and its continuous commitment towards improving the environmental performance within the industry. The awards ceremony took place on the 3rd April, 2019 at the ACI Asia-Pacific/World Annual General



Assembly, Conference & Exhibition in Hong Kong, China.

Mumbai's Chhatrapati Shivaji Maharaj International Airport has completed several projects to address the challenges of climate change under environment management. These include airport carbon management system,

airport carbon neutrality, sustainability reporting, renewable energy installations, waste water recycling, effective waste management system, organic waste treatment, etc. Similarly, CSMIA keeps a close check on noise management, air quality monitoring, waste management and climate change helping minimise the aviation industry's impact on the environment. ■

Hecu CO2 been recognised as the innovation product 2019

China Refrigeration has recognised Hecu CO2 as the Innovation Product 2019 in the Refrigeration category. The panel awarded Hecu CO2 as a cutting-edge solution for the efficient use of natural refrigerants and underlined the potential of this system for widespread use in China. Hecu sistema is the CAREL high-efficiency solution for condensing units that use BLDC compressors driven by DC inverters, also available for natural refrigerants. It offers a wide range of cooling capacity modulation, so as to ensure low energy consumption at all times, especially at part load.

Hecu sistema also stands out for real-time communication



with the refrigeration units, allowing the implementation of advanced system optimisation logic, with dynamic set points and stable control, guaranteeing perfect food preservation and reducing food waste.

"For the third consecutive year, CAREL technology has received one of the most prestigious industry awards", commented

Eason Cheng, Marketing Manager - Refrigeration, APAC. He further added, "In 2018 the award went to the EmJ modulating ejector, while in 2017 Heos system was shortlisted. These awards are confirmation that our research and development are heading in the right direction, and that CAREL's efforts to be at the forefront at all times are being welcomed by the market." ■

HVAC For Healthcare Facilities

Hospitals require efficient HVAC systems to maintain good indoor air quality (IAQ), aseptic conditions, and to secure healthy, safe and suitable indoor thermal conditions (i.e. temperature, humidity, air quality and airflow) for the hospital personnel and the patients.



Hospitals are very complex environments that require special HVAC system design, maintenance and repair considerations. HVAC systems in healthcare facilities provide a broad range of services in support of populations who are uniquely vulnerable to an elevated risk of health, fire, and safety hazard. These heavily regulated, high-stakes facilities undergo continuous maintenance, verification, inspection, and recertification; typically, operate 24 hours per day, 7 days per week; and are owner-occupied for long life cycles. HVAC systems are responsible for keeping indoor air quality (IAQ) high

and providing a safe temperature for patients and staff alike. The air treatment in healthcare facilities is of prime importance. The patients feel more comfortable and heal early if the air circulation, temperature and humidity are maintained as per prescribed standard. Hospitals need a functional HVAC system to stay operational. This is especially true for places like a clean room or an operating room. Air-exchange, humidity, pressure and temperature have to be precise in such environments to minimize the risk of infection for patients. Every hour of the day, the HVAC system needs to contribute

to the overall goal of suppressing hospital-acquired infections. According to research by the Centers for Disease Control, one in 25 patients in the U.S. will suffer at least one infection acquired in the healthcare environment.

However, even outside of the operating room, HVAC systems are required to not only keep high IAQ levels, but maintain specific temperatures to minimise bacterial growth throughout the hospital. And not to mention, hospitals have to run 24/7 which leads to huge levels of energy consumption. A well-maintained HVAC system can help reduce operating costs in addition to



providing a safe environment.

There are stringent standards and many industry guidelines when it comes to the performance of a hospital HVAC system.

HVAC in Healthcare Facility

Increasing interest has been expressed towards intelligent heating, ventilation and air conditioning (HVAC) systems in hospital environments. Hospitals require efficient heating, ventilation and air conditioning (HVAC) systems to maintain good indoor air quality (IAQ), aseptic conditions, and to secure healthy, safe and suitable indoor thermal conditions (i.e. temperature, humidity, air quality and airflow) for the hospital personnel and the patients.

Hospital ventilation must be effective for controlling airborne transmission and preventing outbreaks of infectious diseases. A correlation exists between ventilation, air movements in buildings and the transmission of infectious diseases. Poorly designed, maintained (i.e. contaminated) and used HVAC systems are common in hospitals and often lead to poor IAQ.

Effect of breakdown of Hospital HVAC System

- Patient feel uncomfortable
- Risk of hospital infection spread
- Surgical procedures delay
- Emergency situations rerouted to other hospitals
- Fog in the hallways and operating rooms
- Damages to supplies which require refrigeration or lower temp
- Equipment failure
- Financial loss

HVAC & Infection Control

In a hospital environment, there tend to be high concentrations of harmful micro-organisms. From an infection control perspective, the primary objective of hospital design is to place the patient at no risk for infection while hospitalised. The special technical demands include hygiene, reliability, safety and energy-related issues.

Infections, which may result from activities and procedures taking place within the facility, are a cause for great concern. Three main routes responsible for infections are contact, droplet, and airborne transmission, which are quite affected by room design and construction factors.

An airborne infectious isolation room is constructed to minimise the migration of air from an isolation room to other areas of healthcare facilities. The risk of being infected through the airborne route is a function of particle concentration. The chance of a particle that is carrying an organism falling into an open wound increases with particle concentration. By reducing the concentration, one can reduce the chance of infection and, hence, the number of patients infected.

Recommendations for engineering controls to contain or prevent the spread of airborne contaminants center on general ventilation, air cleaning (primary and secondary filtration), and local exhaust ventilation (source control)

General Ventilation

The most effective means of controlling contaminants, odour and indoor air pollution is through ventilation, which requires simultaneous control of number

of conditions:

- Air change rates
- Pressure gradient appropriate with class of isolation
- Appropriate air distribution in the compartments being air conditioned
- High quality air filtration including absolute filtration
- Precise temperature and humidity control ensuring maintenance of the intended microclimate

Air Change Rates

Ventilation supply rates for healthcare facilities require large expenditure of fresh air to dilute and remove the contaminants generated in the space. The ventilation rates for healthcare facilities is expressed as air changes air per hour (ACH), which is a measure of how quickly the air in an interior space is replaced by outside (or conditioned) air. For example, if the amount of air that enters and exits in one hour equals the total volume of the space, the space is said to undergo one air change per hour. Air flow rate is measured in appropriate units such as cubic feet per minute (CFM) and is given by

$$Q = \frac{(ACH) \times (room\ volume)}{60\ min/h} = cu\ ft/min$$

In this equation,

Q is the volume flow rate of air being calculated, and ACH is the number of air changes per hour

To determine the airflow required to adequately ventilate an area,

- 1) Calculate the room volume to be ventilated Width x Length x Height = ft³ (cubic feet).
- 2) Calculate the air volume requirement by multiplying the room volume by the air change rate per hour = ft³/h.

Studies carried out by AIA indicate that just one air-change with fresh air can remove 63 per cent of suspended particles from the room air. If a ventilation system can perform 10 air changes per hour (ACH), it takes 14 minutes to remove 90 per cent of airborne contaminants in a room and 28 minutes to remove 99 per cent. Thus, increased number of fresh air changes per hour is effective for cleaning airborne contaminants. However, the higher air change rate (>20 ACH) may

cause turbulence and the cost for ventilation itself will be too high. Therefore, a recommended compromise of 12 ACH is proposed which should be achievable when the filters have reached their maximum pressure drop. Higher ACR also equates to higher energy use.

The selection of 12 air changes per hour is largely a matter of convention. Ventilation rates are voluntary unless a state or local government specifies a standard in healthcare licensing requirements. These standards typically apply to only the design of a facility, rather than its operation. Based on the scientific knowledge and professional judgment reflected in the AIA guidelines, ASHRAE and the American National Standards Institute (ANSI) have developed design recommendations for ventilation and pressure relationships for various patient-care areas. Healthcare facilities without specific ventilation standards should follow ANSI/ASHRAE Standard 62, Ventilation for Acceptable Indoor Air Quality or otherwise in the absence of any specified supply air change/hour following guidelines may be used:

- For the space to be maintained under negative pressure exhaust 10 to 15 per cent more air than the supply.
- For the space to be maintained under positive pressure, exhaust 10 to 15 per cent less air than the supply air.

Room Pressure Control

Building room pressurisation is a critical factor to monitor in a hospital as it can greatly affect the controllability of the environment. If the building pressure is allowed to become negative due to supply filters being loaded, supply fans running too slow, or return fans running too fast, humid and dirty air can be drawn into the building through cracks and openings. This air is completely unconditioned and can provide several of the necessary ingredients to promote mold growth (e.g., moisture, more spores, and nutrients.)

Building room pressure gradient is achieved by controlling the quality and quantity of intake and exhaust air, maintaining differential air pressures between adjacent

areas, and designing patterns of airflow for particular clinical purposes.

Special Challenges

A unique challenge occurs when a patient needs both the positive and negative room isolation. For example when there is an immune compromised patient who also has a communicable infectious disease such as TB. Studies indicate that approximately 15 per cent of HIV patients also suffer from TB, and this presents a unique design problem. This patient needs to be in a protective environment for his own health but also needs to be isolated to protect others from his communicable disease.

The solution is to house such patients in a positive pressure protective environment room with an anteroom that is under negative pressure relative to the corridor and protective environment.

Caution: Avoid designing systems to switch between positive and negative pressure.

Laminar Flow in Healthcare Facilities

Other mechanism of air distribution in ultra-clean areas of hospitals is the laminar or unidirectional airflow distribution. Laminar airflow ventilation systems are designed to move air in a single pass with parallel streamlines, usually, through a bank of HEPA filters either along a wall or in the ceiling.

Laminar flow systems use perforated ventilation grills across the entire ceiling or side wall at air flow rates significantly greater than normal to force a steady constant stream of air across the entire room, similar to a smooth steady flow out of an open water faucet versus one that splashes as the water comes out of the faucet.

Laminar flow distribution requires a very high volume of air flow and is designed for an air velocity of 90 + 20 ft/min. This unidirectional approach optimises airflow and minimises air turbulence and ensures that any contamination that is generated within the area is quickly and effectively removed.

Laminar airflow systems are often used in operating rooms to help reduce the risk for healthcare-associated airborne infections.

The data that demonstrates a bonafide application and support of laminar airflow in PE rooms is lacking. Given the high cost of installation and operation, the value of laminar airflow is questionable and shall be ascertained through lifecycle analysis.

Air Filtration

All of the air that is drawn into an air handling system is 'contaminated' to some degree. It is commonly accepted that airborne particles (solid particles, liquids, fumes, smoke, or bacteria) that are larger than 5 microns in size tend to settle quickly out of the air onto horizontal surfaces. Airborne particles that are less than 5 microns in size (especially, those less than 2 microns in size) tend to settle slowly out of the air and remain suspended (airborne) for larger period of time.

Concerns over hospital-acquired infections have propelled filtration solutions into the forefront as a primary tool for infection control.

All public areas of healthcare facilities are required to have two banks of filters — a 30 per cent (ASHRAE 52.1) pre-filter and 90 per cent final filter. Provided that the final filter is properly installed and maintained and provided that there is little or no bypass around the filter, the combined efficiency of two bank filters is nearly 100 per cent in removing particles of 1µm - 5 µm in diameter. This filtration system is adequate for most patient care areas in ambulatory care facilities, and the operating room environment.

A common metric for filter performance is the minimum efficiency reporting value (MERV), a rating derived from a test method developed by ASHRAE. The MERV rating indicates a filter's ability to capture particles between 0.3 and 10.0 microns in diameter. A higher MERV value translates to better filtration, so a MERV-13 filter works better than a MERV-8 filter. In healthcare facilities, a final filter of MERV-14 is satisfactory.

High Efficiency Particulate Air (HEPA) Filters

HEPA filters have a minimum initial efficiency of 99.97 per cent for removing particles 0.3 microns in size. This is a critical point as these filters are being used to remove mold and bacteria, typically 1 to 5 microns in size when airborne, as well as viral particles which are submicron in size (as a reference, *Aspergillus* spores are 2.5 - 3 μm in diameter). Each HEPA filter is individually tested at the factory in order to confirm their conformance to this standard. They may also be field-tested in order to confirm their ongoing adherence to efficiency requirements.

HEPA filters to be monitored (with manometers or other pressure indicating devices) on regular basis and replaced in accordance with the manufacturer's recommendations and standard preventive maintenance practices. Gaps in and around filter banks and heavy soil and debris upstream of poorly-maintained filters have been implicated in healthcare-associated outbreaks of aspergillosis, especially during times of nearby construction.

HEPA filters are a costly budget item. In order to extend the life of a HEPA filter and reduce ongoing replacement costs, it is strongly recommended to provide a roughing prefilter prior to the HEPA. Studies indicate that a low-efficiency prefilter may extend the life of a HEPA filter by 25 per cent, while adding higher efficiency intermediate filters such as a MERV 14 (95 per cent by ASHRAE 52.1 dust spot test) filter can extend the life of the HEPA filter by as much as 900 per cent. This concept, called 'progressive filtration,' allows HEPA filters in special care areas to be used for 10 years or more. HEPA filter efficiency is monitored with the dioctylphthalate (DOP) particle test using particles that are 0.3 μm in diameter.

Caution: HEPA filters replacements require bag-in or bag-out procedures to minimise risk of exposure of the maintenance personnel to the infectious material.

Odour Control

There are several areas within a healthcare facility where odour or gaseous contaminants are common. Some of these

contaminants may only be nuisance or comfort related, while others may represent a threat to personal health.

Fumes and smells can be removed from air by chemical processes such as 'gas sorption' which control compounds that behave as gases rather than as particles (e.g., gaseous contaminants such as formaldehyde, sulfur dioxide, ozone, and oxides of nitrogen). Gas sorption involves one or more of the following processes with the sorption material (e.g., activated carbon, activated alumina or chemically treated active clays).

Gas sorption units are available in variety of chemical treated clays, each performing differently for different gases. A prefilter is recommended upstream of the gas sorption unit to ensure that filter pores are not blocked with particulates. There are currently no standards for rating the performance of gaseous air cleaners, making the design and evaluation of such systems problematic.

Air Filtration to Protect HVAC Equipment

Accumulation of dust and moisture within HVAC systems increases the risk of spread of healthcare-associated environmental fungi and bacteria. The components of air handling units such as cooling coil, filters, and ductwork can be the ideal environments for breeding bacteria, fungus and mold. If not properly maintained, these will become reservoirs for infection causing molds. Common practices for protecting HVAC coils include locating the filter upstream of the coil and having a filter rating of at least MERV 8. The filters should fit snugly into the holding frames; be of rigid, moisture resistant construction; and be constructed from materials that will not support microbial growth. Care should be taken to ensure that no air bypasses around the filters. Bypass can be reduced by gasketing the filters to seal them in place and by installing filter blanks in spaces where the filter track does not contain filters.

Local Exhaust Ventilation

Local exhaust ventilation is designed to capture toxic gases, vapors, dusts, fumes

and mists near its source, before the contaminant has a chance to disperse into the workplace air. A proper design of an exhaust ventilation system is necessary for effective removal of airborne contaminants that would otherwise pollute the work environment resulting in health hazards.

A local exhaust ventilation system usually consists of number of separate exhaust hoods applied to several different operations and connected by system of branch and main ducts to a central air cleaning device and exhaust fan and discharge stack to the outside.

Laboratories and Special Procedure Rooms

Laboratories and special procedure rooms that are known to contain toxic and hazardous contaminants are typically designed under negative pressure to prevent these gases from spreading throughout the facility. Examples of these areas include cytology labs where xylene and toluene may be part of the process, autopsy exhaust, ethylene oxide (ETO) steriliser exhaust, X-ray film processing areas, infectious materials in waste (including regulated medical waste), steam sterilisers, areas using high-level disinfectants or morgues, where formalin may be used. These chemicals are both irritants and carcinogenic. Such areas typically employ 100 per cent pass-through ventilation where no air is recirculated within the facility.

Temperature & Humidity Control

Local temperature distributions greatly affect occupant comfort and perception of the environment. Temperature should be controlled by change of supply temperature without any airflow control; the temperature difference between warm and cool regions should be minimised to decrease airflow drift. Efficient air distribution is needed to create homogenous domain without large difference in the temperature distribution. The laminar airflow concept developed for industrial clean room use has attracted the interest of some medical authorities. There

are advocates of both vertical and horizontal laminar airflow systems. For high-contaminated areas, the local velocity should be greater than or at least equal to 0.2 m/s. For patient rooms 0.1 m/s is sufficient in the occupied area. The unidirectional laminar airflow pattern is commonly attained at a velocity of 0.45 ± 0.10 m/s.

Two essential components of conditioned air are temperature and humidity. After outside air passes through a low - or medium-efficiency filter, the air undergoes conditioning for temperature and humidity control.

Temperature Control

Control of temperature includes the operation of both heating and cooling systems to maintain temperature setpoints in the different areas of the building. Cool temperatures (68°F - 73°F) are usually associated with operating rooms, clean workrooms, and endoscopies suites. A warmer temperature (75°F) is needed in areas requiring greater degrees of patient comfort. Most other zones use a temperature range of 70°F - 75°F. Temperatures outside of these ranges may be needed on limited occasions in limited areas depending on individual circumstances during patient care.

HVAC systems in healthcare facilities have either single-duct or dual-duct systems. A single-duct system distributes cooled air (55°F) throughout the building, and uses thermostatically controlled reheat boxes located in the terminal ductwork to warm the air for individual or multiple rooms.

The more common dual-duct system consists of parallel ducts, one with a cold air stream and the other providing a hot air stream. A mixing box in each room or group of rooms mixes the two air streams to achieve the desired temperature. Temperature standards are given as either a single temperature or a range, depending on the specific healthcare zone.

Humidity Control

Efforts to limit excess humidity and moisture in the infrastructure and on-air stream surfaces in the HVAC system can

minimise the proliferation and dispersion of fungal spores and waterborne bacteria throughout the indoor air. Control of humidity includes the operation of both humidification and dehumidification systems to maintain a minimum and maximum humidity level in the facility.

Four measures of humidity are used to quantify different physical properties of the mixture of water vapor and air. These are relative humidity, specific humidity, dew point and vapor pressure. The most common of these is 'relative humidity,' which is the ratio of the amount of water vapor in the air to the amount of water vapour air can hold at that temperature. At 100 per cent relative humidity, the air is saturated. For most areas within healthcare facilities, the designated comfort range is 30 per cent- 60 per cent relative humidity. Relative humidity levels greater than 60 per cent in addition to being perceived as uncomfortable, promote fungal growth.

Contingencies for HVAC design

Hospital shall be fully functional under any circumstance, regardless of the unpredictability or severity of the situation. Understanding code requirements, performing a hazard vulnerability analysis, and understanding what role the medical facility has in the community during an emergency are all essential to designing a safe and reliable HVAC system for a hospital.

Energy Conservation

Depending on the climate, between 35 per cent and 60 per cent of the annual energy costs of the typical healthcare facility are related to the operation of the HVAC systems.

Intelligent HVAC System

An intelligent work environment should be able to sense the interaction between users and space, process this information and understand the context data, react in a way that adjusts to users' needs and enhances their endeavours in the environment, be active and autonomous, omnipresent and enhance the worker's flow of work and perception of their physical and

psychological well-being. An intelligent hospital HVAC system should take into account local climate and facility type of the hospital, conserve energy, increase safety, decrease the number of indoor air symptoms and improve the work atmosphere and efficiency. Intelligent HVAC systems have been increasingly implemented into hospital buildings.

Challenges concerning intelligent HVAC systems:

- Poor hospital design
- Lack of adequate sensors
- Poor data collecting, archiving and visualisation by building automation systems
- Complexity of airborne infection spread prevention
- Conflicting indoor air preferences between patients and staff
- Insufficient knowledge on HVAC systems

Conclusion

The air is not just a medium but it can be regarded as a guard in the critical health applications. The proper direction of the airflow increases the possibilities of successful pollutant scavenging from healthcare applications. The numerical tool, used here, was found to be so effective to predict the airflow pattern in the healthcare facilities at reasonable costs and acceptable accuracy. Good architectural design allows the HVAC system designers to properly locate the supply outlets and extraction ports in the optimum locations. Hospital HVAC repair is critical to operations. A hospital can't function without an HVAC system. Downtime simply is not an option for hospitals. Hospital HVAC repair and preventative maintenance to avoid downtime is crucial. Choosing a commercial HVAC partner you can trust pays dividends every day a hospital is operational. ■

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322 Field Hospital



Building Automation System Market to be worth USD 121.5 bn by 2024

The growth of BAS market is mainly driven by several factors, such as a high focus on designing and establishing energy-efficient and eco-friendly buildings and several benefits of BAS, development of wireless protocols and wireless sensor network technology for BAS, and rapid infrastructure growth in developing nations.



According to the new research report of Building Automation System (BAS) Market by MarketsandMarkets, the BAS market is expected to grow from USD 75.0 billion in 2019 to USD 121.5 billion by 2024 growing at a CAGR of 10.12 per cent. The growth of this market is mainly driven by several factors, such as a high focus on designing and establishing energy-efficient and eco-friendly buildings and several benefits of BAS, development of wireless protocols and wireless sensor network technology for BAS, and rapid infrastructure growth in developing nations.

Security and access control systems to hold largest share of BAS market by 2024

Security and access control systems accounted for the largest share of the BAS market in 2018, and a similar trend is likely to continue in the near future. The demand for home security solutions is growing at a rapid pace because of various factors, such as technological advancements, the rise in crime rates, the increased need for medical assistance to senior citizens at home and monitoring the children at home. Security and access control systems have become an integral part of the safety and

security of buildings and their occupants. These systems have revolutionised the building security and removed human intervention. These are installed in buildings to increase the security level, monitor activities, and keep a record of people entering and exiting the building. Worldwide governments are also investing heavily to develop reliable and robust security systems for safeguarding their citizens from terrorist attacks.

BAS market for industrial application to grow at highest CAGR from 2019 to 2024

The industrial application includes manufacturing facilities, distribution facilities, warehouses, and other infrastructure buildings of automotive, chemicals, metals, engineering, mining, pharmaceuticals, oil & gas, and other industries. The segment is expected to adopt smart building solutions to achieve energy and cost savings, higher productivity, enhanced identity and access management, and optimised surveillance. BAS has a wide scope for development in emerging economies such as India, China, and Brazil, having diverse manufacturing sectors growing at a high rate. In spite of having the largest manufacturing base,

these nations lack buildings equipped with energy-efficient infrastructure. This creates a tremendous market opportunity for all companies offering building automation systems to increase their viability in these nations on a large scale.

Increasing construction industry in developing countries such as China and India will boost the demand for BAS in APAC during the forecast period. The BAS market in APAC is expected to grow at the highest CAGR during the forecast period. The rapid growth of the construction industry in developing countries, such as China and India, and government initiatives toward energy conservation have contributed to the growth of the BAS market in APAC. Countries such as China and India have aggressively started developing smart cities. BAS is acting as a key enabler in achieving these objectives by the respective countries.

Honeywell International (US), Siemens AG (Germany), Johnson Controls International (Ireland), Schneider Electric (France), United Technologies Corp (US), Robert Bosch (Germany), Legrand (France), Hubbell (US), ABB (Switzerland), and Ingersoll-Rand (Ireland) are among a few major players in the BAS market. ■



Cleaner the Air, Better the Health

Hospitals need to maintain clean air in the facility, as cleaner the air, better the health. This article sheds light on importance of air quality in healthcare facilities.

– Supriya A Oundhakar, Associate Editor

An HVAC system is necessary to perform the functions of air filtration, cooling, heating, humidification, dehumidification, etc. These functions determine Indoor Air Quality (IAQ) in a building. IAQ can be defined as the nature or quality of air as it affects the health and well-being of building occupants. As per National Institute for Occupational Safety & Health (NIOSH) shows indoor pollutant level may be 10 to 100 higher than outdoors.

Poor indoor air quality can manifest respiratory diseases such as asthma and COPD. The burden of COPD in India has been estimated to about 15 million cases, causing about 5,00,000 deaths per year. Several large studies suggest that pollutants exert significant effects on the cardiovascular system. It has been shown that for any increase in mortality caused by pollutants, two-thirds of the effect was

accounted for by cardiovascular diseases.

If the air inside a room is not cooled or heated as per the occupant's satisfaction level, he or she may experience thermal discomfort. Further, proper dehumidification is also necessary for occupant's health otherwise it may accelerate microbial growth. Similarly, proper air pressure in patient isolation rooms is necessary to prohibit unwanted circulation of airborne pathogenic bacteria. Moreover, it is prudent to exhaust unnecessary chemicals properly from laboratories as these chemicals may travel in nonlaboratory spaces through air.

For these reasons, hospitals or healthcare facilities or clinics need to be more alert in ensuring proper IAQ in order to protect patients and staff from infections and occupational diseases.

The WHO data also shows that 9 out of 10 people breathe air containing high

levels of pollutants. This has certainly created a huge amount of fear in the minds of people. The new data further reveals a stronger link between indoor and outdoor air pollution which can cause harm to many critical healthcare industries. While both indoor and outdoor pollution affect health, recent statistics on the impact of household indoor pollutants (HAP) is alarming, informs Ashwin Satish Bhadri, CEO, Equinox Labs.

Surendra Shah, Founder Chairman, Panasia Engineers, says, "Other than medical and physiological remedies, healthcare facilities are also required to take maximum care to provide a clean and pathogen free environment with controlled temperature, humidity and extremely efficient air filtration. Quantity and direction of air flow and the fresh air percentage are also controlled. There are strict standards that must be followed without exception.



All this is not possible without a modern HVAC System specially designed for the purpose.

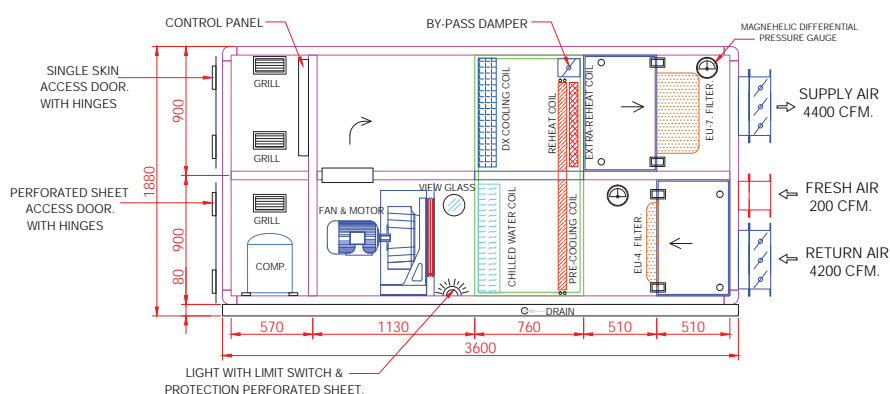
According to a survey, every 100 hospitalised patients, seven in developed and ten in developing countries acquire at least one healthcare-associated infection. Medical entities have to bear a huge cost due to the healthcare infections. It has been surveyed that Europe alone had to face 37,000 unnecessary deaths and extra days of hospital stays due to HAI. There's a huge misconception that outdoor air is dangerous and indoor air isn't. Whereas indoor air is much more harmful and can cause many uncertainties to human lives, Bhadri further adds.

Maintaining IAQ in Healthcare

The enrichment of air quality in hospitals, clinics, and other healthcare settings is an imperative factor of modern airborne hygiene procedures. Its value also extends to the occupational health and safety requirements in medical institutions. An enhanced air quality provides a healthier and pleasant atmosphere for patients, staff and visitors. This also leads in saving huge costs as it acts as a preventive infection control measure.

In healthcare facilities, the air quality levels in healthcare settings differ from department to department. Some areas require high-efficiency filtration of airborne microorganisms to protect patients, staff and visitors e.g. in operation suites, ICU and TB isolation rooms, whereas other areas require the filtration of gaseous contaminants, chemicals and odours to provide a safer and more pleasant working environment e.g., in laboratories, autopsy rooms, dental surgery rooms, pharmacies.

In laboratories, air quality is a vital factor in achieving production and research quality. Impure air can, at worst, lead to product recalls, expensive investigations



SECTIONAL VIEW OF A TYPICAL AHU FOR OPERATION THEATRE

and moreover a lower image and credibility. It is important that the authorities protect the staff from the particles by enforcing air filtration devices. The control of airborne microorganisms such as bacteria, viruses and fungal spores is of major importance in medical settings due to the fact that a number of diseases and infections can be transmitted by airborne pathogens. Due to the presence of such air pathogens, off lately HEPA filtrations have become quite popular in the medical facilities to dissolve these issues. Several areas within the medical and healthcare industries use HEPA filtration, some of which are obvious and some of which are less so, according to Bhadri from Equinox Labs.

Bhadri mentions that the neonatal department, the most sensitive department should be safe from any bacteria or virus that can harm the newborns. The use of HEPA filters on the incubators ensure that the air passing in and out is of a higher quality. HEPA filters are also used for daily cleaning purposes that helps to improve the air quality. With an antimicrobial coating, HEPA kills microbes and bacteria on contact ensuring these are off the sensitive surfaces. The HEPA filters are used for a number of things such as for cleaning equipment, industrial vacuum systems, medical laboratories in order to keep the air and surfaces clean.

Apart from patients, doctors and the entire staff can face the consequences of indoor air pollution health effects. The safety of healthcare staff can be ensured through efficient air filters that help to

reduce particulate matter and allergens.

Shah from Panasia Engineers enlists the following new and stricter criteria for hospitals:

- Lower temperature – Between 18- and 22 Degrees C.
- Lower Humidity – Between 20 and 45 per cent
- Better filtration – Down to 0.3 microns
- Higher fresh air percentage – Up to per cent in some cases
- Air distribution – Low velocity laminar unidirectional flow
- Pressurisation – Positive, to prevent infiltration of untreated air from passages. However, it must be negative during fumigation to prevent pungent smell from leaking out.
- All walls, floor and ceiling must be impervious to moisture.
- Frequent and thorough cleaning including the filters and coils.

It is obvious that the HVAC equipment must be specially designed to meet these criteria. Given below is a drawing of a typical AHU for Operation Theaters.

The increasing awareness of poor IAQ has led the healthcare sector to be cautious and take preventive steps whilst mending the existing conditions. The sector thus cannot risk the health of thousands of patients and the faculty that are an integral part. Hospitals and other medical facilities thus will find its way to superior indoor air quality by working with the air impurities removal systems enrich a good living, concludes Bhadri of Equinox Labs. ■



T&M sector on progressive curve of growth

Testo is one of the world market leaders in the field of portable and stationary measurement and testing solutions. Testo India offers a wide product range that includes portable measuring instruments and systems for temperature, humidity, pressure, air velocity etc.

Kalidas Bhangare, Managing Director, Testo India gives his insight on latest trends, growth drivers, outlook for industrial HVAC during an interaction with **Cooling India**.

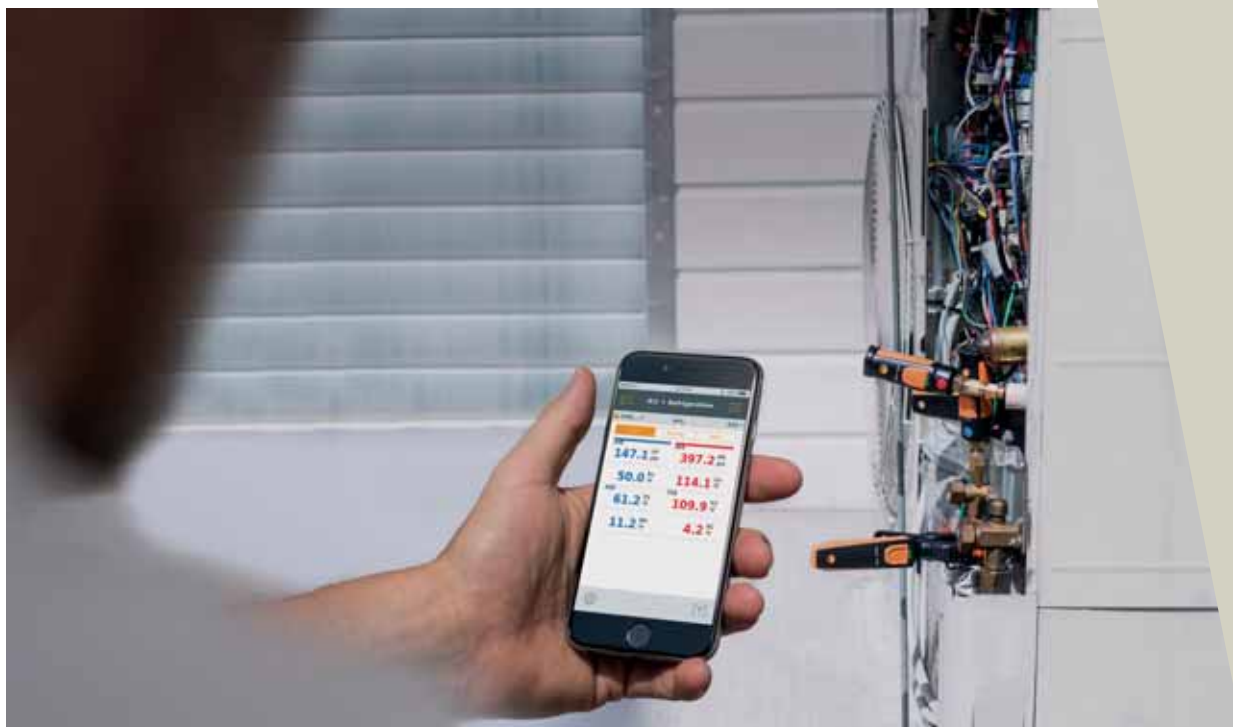
“We also assume that the testing and measurement sector will surely be placed on a progressive curve for the coming year due to the increase in demands for measuring equipment.”

What is your take on the latest trends on Industrial HVAC?

Majorly everything in the industrial HVAC has now gone smart and intuitive. Every application, all the work processes and operations are getting automated. Safety and maintenance have become the top priority and because of which T&M instruments are now the most necessary thing. This paradigm shift is good news for the sector as it ensures great outputs and improved efficiency with reduced system down time, wastage & errors. Benefits are endless and for everyone related to the industrial HVAC.

What are the growth drivers of industrial HVAC?

IIoT or the Industrial Internet of Things has become a new establishment in the industrial operation and functioning. Globally, it has shown tremendous impact on almost every sector in a short span of time. IIoT has promoted the usage of smart and networked equipment that reduce down time of any facility, keep lesser human involvement, and imply automatic operation of devices that can communicate, interpret and adjust of its own seamlessly. Concepts look very promising and is sure to govern the HVACR sector. Another highlight would be the Indoor Air Quality measurement which would have higher implications and can turn out



to be a concern for the test and measurement industry. Testo already offers products like testo 440, testo 400 intuitive air velocity and IAQ measuring instruments which can carry out measuring tasks on air conditioning and ventilation systems reliably under control with just one versatile instrument and multiple range of probes.

What are the products and services offered by you for industrial HVAC?

With so much vibrancy in the industry, Testo brings out its latest and the smartest solution for the HVAC sector. We have a range of Smart Probes which equip the users with smart and easy measurement techniques using the smartphone interface. These can be wirelessly and intuitively operated by smartphone via a free app. For HVACR contractors and technicians, measurement is now more mobile than ever before, with the new Testo Smart Probes. Testo 420 air capture hood for measuring the air volume flow has made the measurements easier even at the turbulent inlets or outlets. Testo has a range of electronic refrigeration manifolds or analysers that not only helps to measure pressure but also calculates accurately the sub-cooling and superheating temperatures, based on the refrigerants selected. In addition to electronic refrigeration manifolds, Testo also has digital vacuum measuring instrument like testo 552 for the evacuation of refrigeration or air conditioning systems and heat pumps. Testo provides and

which should be a part of every professional's refrigeration technology equipment is testo 316-3 - electronic leakage detector for refrigerants. It detects even the smallest leaks, thanks to its high level of sensitivity. It helps the engineer to trace the leaking spots and thus, saves the expensive gas from leaking which also is a reason for an inefficient system. Testo also has products like testo 440, intuitive air velocity and IAQ measuring instrument which can carry out measuring tasks on air conditioning and ventilation systems reliably under control with just one versatile instrument and multiple range of probes. And as the latest contribution to the industry, testo rings in the new generation of IAQ measurement technology: The new testo 400 which is the universal measuring instrument for all air flow and IAQ applications, and impresses with smart technology, fast readiness and convenient application.

What growth do you envisage for industrial HVAC the next fiscal?

India is termed as an emerging market and the numbers are only growing. In a very short span of time the HVAC sector has seen many inventions, technological advancements and applications. Even the government has also become so focused on the upcoming concepts like smart cities, air quality, human comfort etc that the HVAC industry is sure to see a great future ahead as the applications are going to increase. With that we also assume that the testing and measurement sector will surely be placed on a progressive curve for the coming year due to the increase in demands for measuring equipment. With multiple new launch products, we hope to offer solutions that will help Testo touch the new zenith of technology and support the HVAC market. ■



Air Humidification in Healthcare Facilities

Humidification is an aspect more important than one would think for the operativeness of a hospital facility due to its great impact on the well-being and performance of patients and medical staff.

What emphasis do we put on proper air hydration throughout a healthcare facility? We know that pathogens thrive, traveling further and living longer in dry air (< 40 per cent RH). We know that the flu virus itself decreases significantly in viral infectivity in well hydrated air, >40 per cent RH (Noti, et al 2013). We know that people are healthiest in a properly hydrated environment, between 40 per cent – 60 per cent RH (Sterling, et al 1985). Our respiratory tract stays healthy and protective. As well as our nasal mucosa are able to trap dust and

other particles from reaching the inner portions of our bodies. Many facilities barely track the RH levels outside of critical areas such as OR's, NICU's or sterile supply rooms. Significant patient hours are spent in the facility, but outside of these areas such as patient recovery rooms and Step-Down units, etc. Nursing stations are a central location for all staff, commonly visited directly after working with patients. Does it seem like we should consider addressing the proper air hydration levels in these areas and throughout the entire facility, or at least be

consistently monitoring these areas to identify potential problem areas? Could we improve staff healthiness and patient outcomes by adding this area to our protocols?

We can see how humidity strongly affects the capability of bacteria to develop, propagate and overcome our defences. Therefore, if suitably managed, it can result in an excellent tool to limit the number of hospital infections, and safeguard health.

The true challenge when managing humidity therefore, goes from eliminating

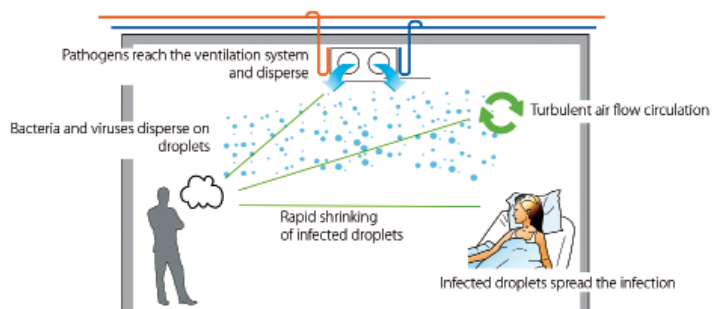


Image 1

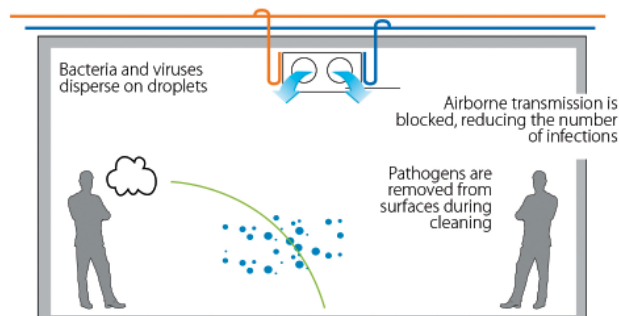


Image 2



pathogens to impeding their transmission and helping our natural defenses to ward them off. Several researches suggest in fact how relative humidity is the most important factor in environmental control for the airborne transmission of bacteria and viruses.

A first study, conducted for one year in a US hospital, monitored all environmental parameters in ten rooms as well as the medical conditions of the patients who stayed in these rooms. Relative humidity was the variable with the closest connection to the number of infections contracted by the patients.

When relative humidity reaches and exceeds 40 per cent, infections are drastically reduced from a maximum to 10/month to zero! Infectivity dropped from 80 to 20 per cent once relative humidity was between 40 and 70 per cent. This is due to the fact that the influenza virus can no longer remain suspended for a prolonged period of time and to the reduced lifespan of many airborne bacteria and viruses in this relative humidity range.

In addition to hindering the growth of microbes and bacteria, suitable humidity monitoring has the effect of drastically reducing their transmission rate and is absolutely essential in environments such as hospitals, where pathogens and

exposed patients particularly sensitive to infections coexist.

Humidification to guarantee the correct functioning of machinery

Air humidity can be a tool to protect electronic equipment against the damage caused by electrostatic discharge. The damage could include the destruction of some components, the turning off of the machine, wrong measurements, the cancellation of saved data and the accumulation of static electricity on X-ray films and might in any case irreversibly compromise the functioning of expensive machinery.

Once again, humidity management can be a suitable tool to solve these problems, as it influences the capability of our skin and of objects in general to accumulate electrostatic charges. Water helps lower air resistance when a current passes impeding the accumulation of charges to dangerous values in favour of a gradual dispersion towards areas with a lower potential. The formation of a thin layer of water on the object surfaces also helps to spread the charges by reducing their concentration to a certain area.

Considering the delicate function played by most of the equipment in hospitals, it is important to prevent the problems caused by dry air. To avoid electrostatic charge problems, it is recommended to maintain relative humidity above 35 per cent, taking care not to neglect other anti-ESD precautions, especially, those concerning the machine's construction.

Humidifying to ensure the well-being of room occupants

The main reasons why humidity management in hospital is essential are the reduction of the infectiousness and transmission of bacteria and the protection of the equipment. Humidification is also very important for the well-being and comfort of those living and working in the hospital.

Air temperature is the parameter we can most easily identify as the cause of discomfort, but humidity also plays a

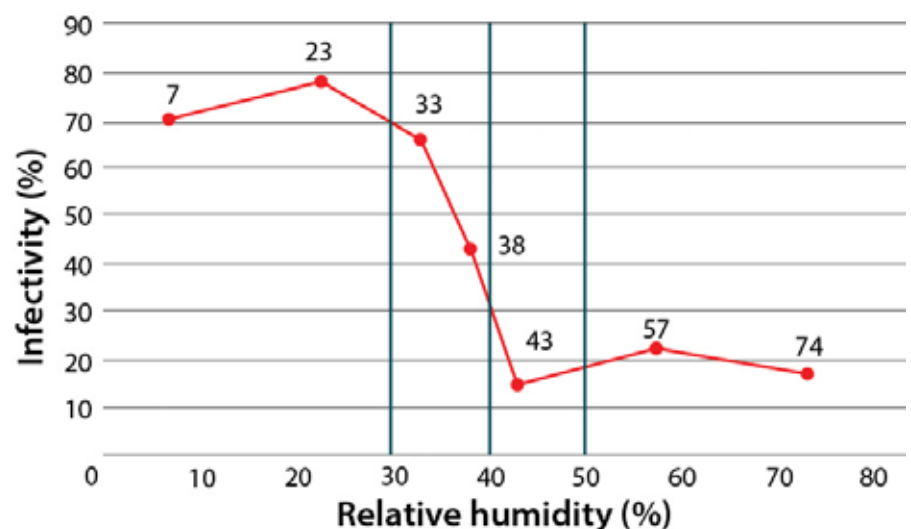


Image 3

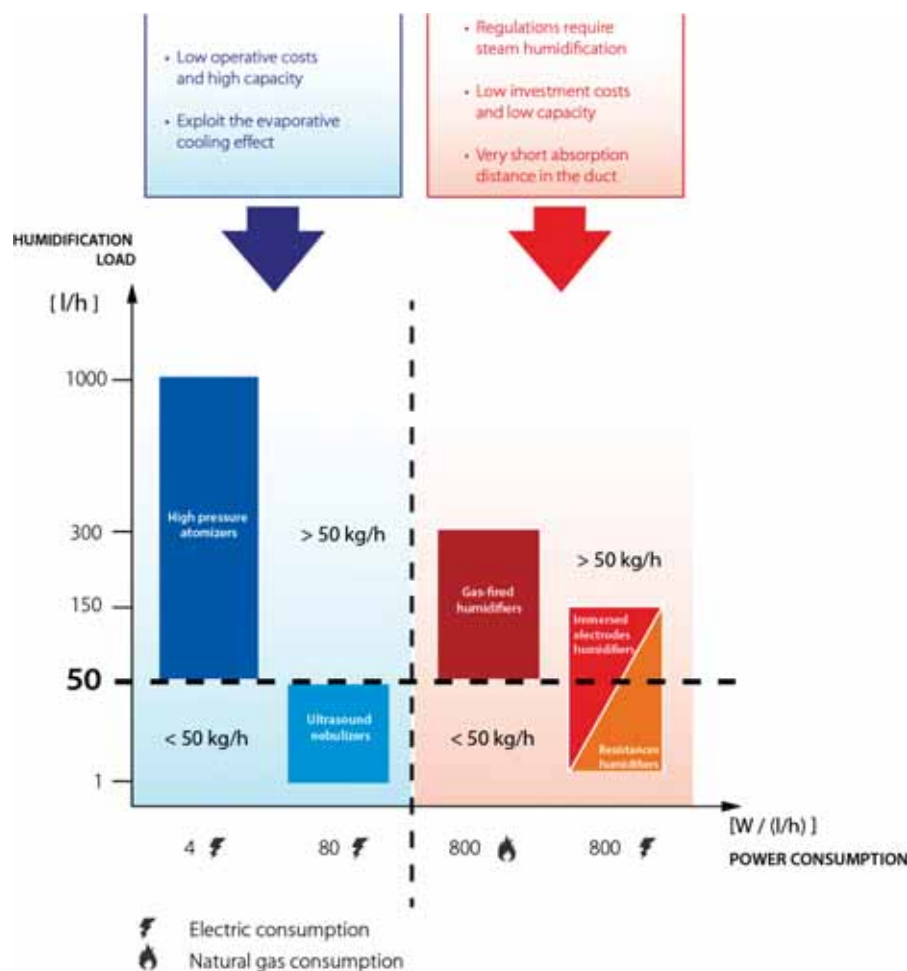


Image 4

considerable role as it alters our perception of air temperature and affects skin transpiration as well as our internal energy balance. A suitable level of relative humidity prevents excessive skin, eye and respiratory tract dryness and enables us to breathe and perspire more easily. This way, we can avoid subjecting our thermoregulation system to excessive effort that may cause discomfort. Managing humidity correctly also makes it possible to reduce any dust particles in the air by making them adhere to the walls. In a dry environment, they would remain suspended for longer, accentuating the feeling of dryness and discomfort.

The effect of all these issues is in any case an air quality that affects the health of people spending time in these environments.

Requirements of the humidification system

Hospital humidification systems

usually humidify fresh air in the ducts rather than directly in the room but, aside from this, their main components are not dissimilar from those for other applications. However, considering the importance of the processes carried out in these facilities, specific manufacturing measures must be taken to guarantee the hygiene and reliability of installation.

It is important that all humidification system components, and humidifiers in particular, comply with specific requirements so as to be suitable for use in critical and delicate environments such as hospitals. The following are essential characteristics:

- Hygiene
 - Reliability
- Secondly:
- Energy saving
 - Connectivity

Hygiene

The humidification system must be

designed so as not to provoke the indoor accumulation and diffusion of bacteria and harmful elements.

For example, specific precautions must be taken against the *Legionella* bacteria, which have a very high mortality rate and have caused many deaths connected to nosocomial epidemics in the past. This is why isothermal humidifiers are historically more widespread in hospitals, as water is boiled at 100 degree C to produce steam, guaranteeing aseptic conditions and therefore a hygienic system.

Their use is at times required by law in some hospital areas such as operating rooms, as to prevent the humidification system from being the cause of the diffusion of pathogens such as *Legionella*.

The *Legionella* bacteria is in fact instantly deactivated when the temperature exceeds 70 degree C, therefore, being completely eliminated by isothermal humidifiers.

Certain types of adiabatic humidifiers, such as high-pressure and ultrasonic ones, can also be used in hospital applications, as long as they are manufactured in such a way as to be hygienically safe.

The Carrel high-pressure humiFog system, for example, consists of a pumping station, a distribution system and a droplet separator made entirely from stainless steel, a material resistant to dirt build-up and corrosion. humiFog also does not allow any water to stagnate inside, carrying out drain cycles during periods of inactivity and periodic washing cycles, so as to prevent the creation of areas where bacterial colonies may form and grow.

In addition, the quality of input water must also be monitored, as any excess mineral salts and micro-organisms may spread into the environment if they are not filtered. Carrel, therefore, also supplies reverse-osmosis systems, commonly-used technology for producing demineralised water that guarantees excellent filtration performance.

Carrel also integrates into its systems UV-ray lamp treatments carried out to eliminate any bacteria that survived reverse

osmosis treatments. Alternatively, chemical biocides could be used. These, however, are rather expensive and require special provisions to dispose of waste water as well as frequent bacterial load analyses. In addition, in case of a failure in the biocide management and distribution system, humidifiers might continue to function with hygienically impure water: it, therefore, is not an intrinsically safe solution and anyway unsuitable for hospital applications.

Further, safety can be guaranteed by limit probes. They are sensors that, placed in ducts or in the room, detect when humidity exceeds a set threshold. To prevent condensation, some humidifiers are equipped with a remote ON/OFF function, which blocks humidity production should the duct ventilation system not function.

Finally, the presence of certifications issued by specialised bodies must also be checked, such as the German VDI 6022. These prove that the manufacturer has adopted solutions that safeguard the hygiene of the system.

Reliability

Hospitals are facilities of primary importance that need to be reliable also in case of malfunctions, maintenance or special weather conditions. The humidification system must therefore be reliable and keep machine down-times to the minimum to guarantee absolute service continuity.

A first suggestion is to choose systems that minimise the need of down-time to carry out maintenance operations. In general, the humidifiers requiring less maintenance are those operating with purified water, as there is less limestone and therefore cleaning or periodical replacements are not needed as much.

This aspect penalises some humidification technologies such as the immersed electrode one, as they cannot function with purified water and, depending on quality, may require frequent interventions to replace or clean the cylinders.

On the contrary, heater humidifiers are

preferred, as they can operate on a wide range of feedwater and require less maintenance. Some humidifiers, such as Carel's heaterSteam Titanium, use titanium heaters that are unique on the market, guaranteeing the highest possible reliability and continuity of service.

Higher reliability means shorter idle-time, during which the machine is active but is not actually capable of dealing with the humidity load. In case of isothermal humidifiers, solutions that pre-heat the water in the cylinder and reduce the frequency of water flushes to avoid limescale are preferable.

Humidifiers equipped with rotation and redundancy functions are strongly recommended. Rotation enables the alternation of humidifiers so as to maintain them all in operation and extend the interval between maintenance. Redundancy enables operations to be carried out continuously. In case of machine down-time due to maintenance or malfunctioning, the production of steam is not interrupted as other humidifiers compensate for it. A humidification system with both these

the point of view of consumption, as the power needed to supply high-pressure atomizer pumps (< 4 W) and to vibrate ultrasonic humidifier transducers (< 80 W) is extremely low. Despite the little power needed to supply low-pressure pumps, wetted media humidifiers significantly increase the unit's fan power consumption with a permanent increase on load losses.

If you want to take advantage of the cooling effect of evaporation in summer months, then adiabatic humidifiers are the perfect option. This type of application guarantees the best performances in warm dry environments, as it humidifies and cools down air while at the same time maximising energy saving. The cooling effect is of 0.7 kW for each litre of evaporated water, with insignificant power consumption. By humidifying and cooling return air before it passes through a recovery exchanger, cooler air can be obtained in summer months even before recurring to air conditioning systems, thus reducing energy consumption (indirect evaporative cooling).

Hospitals are facilities of primary importance that need to be reliable also in case of malfunctions, maintenance or special weather conditions. The humidification system must therefore be reliable and keep machine down-times to the minimum to guarantee absolute service continuity.

characteristics (functioning with purified water and with rotation or redundancy functions) is the ideal solution to ensure reliability - the production of humidity is not interrupted, even during maintenance.

Energy savings

Installing efficient systems that use less energy has the double benefit of saving on operating costs and complying with the most recent regulations in terms of air conditioning. Some technologies and humidifiers available on the market are equipped with special features which justify a higher investment by providing higher savings in the long run.

Adiabatic humidifiers are better from

Connectivity

Connectivity functions are not strictly necessary, but they are preferable and are becoming increasingly important due to the growing need to manage, monitor and collect information in complex systems with different set points such as hospitals. This is why it is more and more common to find HVAC systems managed by a BMS (Building Management System) that also monitors the humidification system, thus providing a centralised multi-site management. In this context, it is essential that humidifiers integrate the most popular communication protocols such as Modbus and BACnet.

Some state-of-the-art humidifiers are

also equipped with an integrated web server. It is a system that enables the management, supervision and monitoring of the entire humidification system on a local network directly from PC or tablet. If connected to a suitable supervision system, it can also be managed remotely, making it easier to monitor the multiple units installed in hospital facilities.

All of the latest generation Carel humidifiers have an integrated webserver, and are preconfigured to be connected to a dedicated remote supervisory service.

Conclusions

Humidification is an aspect more important than one would think for the

operativeness of a hospital facility due to its great impact on the:

- Development of pathogens and transmission of patient infections;
- Protection of medical machinery against electrostatic discharges;
- Well-being and performance of patients and medical staff.

Numerous studies show that the optimal relative humidity range is between 40 and 60 per cent and the standards regulating the installation of ventilation and humidification systems in hospitals instruct the maintaining of similar values.

This is why humidification systems are compulsory in hospitals and the various components must be selected so as to be

suitable for application needs regarding hygiene, reliability and connectivity. When possible, choose adiabatic or high-performance isothermal humidifiers as they combine humidification needs with the energy saving objectives to be reached in energy-consuming facilities such as hospitals. This choice has a relevant effect on both the medical condition of patients and the related expenses for the entire community. ■

Andrea Oscar Frisiero
Application Specialist - HVAC
Commercial Marketing Unit,
CAREL



Honeywell Recognises Top Performing Channel Partners At 2019 Asia Pacific Conference

Honeywell Process Solutions (HPS) recognised its high-performing channel partners at its seventh Asia Pacific (APAC) Channel Partner Conference in New Delhi. The winners from various countries in APAC were awarded for outstanding contribution in distributing and integrating Honeywell industrial automation solutions across the region.

Jinan Huahui Science and Technology from China received the 2018 Honeywell APAC Channel Partner of the Year Award, the highest honor given to a channel partner. "We're honoured to be recognised for our business performance in 2018," said Yanhua Wang, General Manager, Jinan Huahui Science and Technology. "Our partnership with Honeywell provides us with not only new knowledge and training, but also the latest product innovations to continuously serve our customers better."

Additional winners of the Honeywell APAC Channel Partner Awards are:

- Konark Equipment, India, in the Regional Channel Partner of the Year – India category
- Seoul Controls, South Korea, in the Regional Channel Partner of the Year - South Korea and Japan category
- The Auto Info Co Ltd, Thailand, in the Regional Channel Partner of the Year - Southeast Asia Pacific category
- Beijing Orient Delta Science & Technology, China, Regional Channel Partner of the Year – China category
- Artee Flow Control, India, in the Process Measurement and Control category



- B&C Engineering Co Ltd, South Korea, in the Thermal Solutions category
- PT Advanced Technology Solution (ATS), Indonesia, in the Advanced Solutions and Matrikon category
- Yung Loong, Taiwan, in the Smart Energy category

"Honeywell continues to strengthen its channel partner network and operations in the APAC region with the introduction of new innovations for the automation industries," said Asheesh Arora, Vice President, Global Channels, Honeywell Process Solutions. "Events like this provide regional channel partners with new knowledge, product training and networking opportunities to better address their customers' challenges and drive sales for the coming year."

More than 300 attendees from 15 countries including Australia, China, India, Malaysia, Singapore, South Korea, Thailand, Japan and Indonesia participated in the event. ■



Keeping cool in the Middle East

Power quality specialist supplies filters to support HVAC applications.

"Temperatures in the United Arab Emirates (UAE) can reach as high as 50-degree Celsius and HVAC systems are not so much a luxury, but rather a necessity in the region," explained Steve Hughes, managing director of REO UK. "Conscious of global emission reduction targets, policy makers have introduced several HVAC-related guidelines such as the LEED certification to make sure commercial and residential buildings adhere to energy efficiency standards."

He adds, "At REO UK, we've created a series of products like the REOWAVE Passive filters to comply with HVAC guidelines and mitigate the chances of equipment failure or interruption, which could result in discomfort to homeowners and guests. This is particularly important in apartment buildings where there are more sophisticated building management systems, with electronics controlling everything from the lifts to the doors, which can all be compromised by poor power quality." Poor power quality can damage HVAC components including heat exchangers, fans, pump motors, condensers and furnaces, reducing their lifespan and raising energy costs. During the assessment stages of the contract bid, the average savings made from the reduction in the total harmonic distortion of the input current (THDi) because of REO UK's harmonic filters was estimated at 21.3 per cent.

Based on the estimated savings, the building management company identified that REO UK's products could result in an exceptionally short amortisation period for the original capital investment. Against the final other two shortlisted companies, REO was also identified as having an extensive support network and exceptionally high product quality standards.

To tackle power quality problems including current harmonics, businesses can use REO UK's calculator REOWAVE to see how they can reduce energy costs, increase return on investment and achieve longer product life. ■

Power quality specialist REO UK has completed a contract in the Middle East worth €300,000, supplying a building management company with its REOWAVE Passive harmonic filters. The company's filters were chosen as the most cost effective and energy efficient solution to support the project's heating, ventilation and air conditioning (HVAC) systems.

A company in the Middle East responsible for the integration of several building features, including alarm systems and lift controls, found that the installation of HVAC systems adhering to the country's energy management standards could not be achieved alone.

REO UK has developed an entire suite of products dedicated to eliminating power quality problems in HVAC applications and was selected to support the project, because of the potential savings offered by its REOWAVE Passive harmonic filters.





With our new offerings, we bundle and bring forward technology innovation that will lower the energy consumption and have long-term sustainability.

Sanjeev Seth, Country Leader, HVAC & Transport, India & SAARC Markets, Ingersoll Rand

Advanced HVAC Technology to Fight Climate Change

Starting January 1, 2019, the Kigali Amendment of 2016 (to the Montreal Protocol) calls for slashing the future use of powerful climate-warming gases in refrigerators, air conditioners and related products. Accordingly, India is looking at phasing out of HCFCs. In an interview with **Subhajit Roy, Ingersoll Rand's Country Leader, HVAC & Transport, India & SAARC Markets, Sanjeev Seth** explains his company's Sustainable Development Goals (SDGs).

How do you see the role of advanced HVAC technology to fight climate change?

HVAC is an integral part of the modern infrastructure ecosystem and is regarded as a key utility system. While new technology trends towards energy efficient, sustainable and innovative products that are making the system more environmentally responsible and transitioning to adopt low GWP solution.

Over the years, climate change has taken a centre stage with Kigali Agreement fostering strong global climate commitment from various countries. India being an active member of Kigali Agreement, it supports and nurtures the landmark climate agreement to phase down HFCs refrigerants in a gradual manner. Thus, the role of advanced technology is evident from innovation and regulatory standpoint to develop and offer solution that have a drastic impact to lower energy consumption and reduce carbon footprint.

Your newly launched High Speed Magnetic Centrifugal chillers is designed to bring down the operating cost. How is that possible?

We have recently launched High Speed Magnetic Centrifugal chillers (HSWA), which shows Trane's commitment to provide a solution that is efficient, reliable, compact and environmentally sustainable. Trane is constantly moving forward with cutting-edge products that offer the highest efficiency, lowest emissions, most reliable performance and proven technology.

The full load efficiency of this chiller is outstanding that exceeds ASHRAE 90.1-2016 Standard by 40 per cent. The multi-stage compression enables stable operating range. The chiller is equipped with advanced oil-free magnetic bearing compressor and CHIL next-generation heat exchanger and brings down the operating cost exceptionally. Its CHIL evaporator and next generation heat exchanger, optimises the refrigerant flow and reduces the charge.

What are some of your products that help counter climate change?

At Trane, we provide next-generation technologies and service solutions which will transform the future of HVAC solutions for buildings. We are focused on developing products to improve lives with innovative and efficient solutions. Being a responsible solutions provider, we have recently introduced key products in

view of the long-term sustainability.

We have already launched Trane EcoWise portfolio of product which use next generation HFO refrigerants such as R514A, R1233zd(E) with near zero ODP and very low-GWP refrigerants with outstanding energy efficiency and offer efficiency rating that exceed industry standards. Trane's Air-Cooled Screw Chiller - RTAF, Water Cooled Centrifugal Chiller - ECTV, Water Cooled Screw Chiller - RTHF and High-Speed Magnetic chillers GVAF/GVWF are part of this portfolio.

We have recently launched High Speed Magnetic Centrifugal chillers (HSCA), with 40 per cent better performance, exceeding AHRAE 90.1-2016 IPLV standard.

Further, we have also expanded our commercial unitary portfolio, Genyue5+, advanced 5th Generation Full DC Inverter VRF System. This series is better in efficiency with distinct class leading IPLV (cooling) up to 8.7. It provides 26 per cent better efficiency (exceeds ASHRAE 90.1-2016 standard for VRF Heat Pump) compared to conventional system. It is compact and saves up to 30 per cent installation space.

With our new offerings, we bundle and bring forward technology innovation that will lower the energy consumption and have long-term sustainability.

Ingersoll Rand has established long-term sustainability targets in 2014 to address the environment and society. Could you brief us on your

Sustainable Development Goals (SDGs)?

At Ingersoll Rand, sustainability is at the very foundation of our business. In 2014, we established long-term sustainability targets to address one of the biggest issues to our environment and society, including the company's operational footprint. Ingersoll Rand made a commitment to significantly reduce greenhouse gas emissions (GHG) from its products and operations by 2030. The company's Climate Commitment includes: 50 per cent reduction in GHG refrigerant footprint of its products by 2020 and lower-GWP alternatives across its portfolio by 2030; \$500 million investment in product-related research and development to fund long-term GHG reduction; and 35 per cent reduction in the greenhouse gas footprint of its own operations by 2020.

Taking our commitment to the environment further, Ingersoll Rand introduced EcoWise chillers, a portfolio of products designed to lower environmental impact with next-generation, low-global warming potential refrigerants and high efficiency operation. By 2030, the company expects to reduce its carbon footprint by 50 million metric tons.

How are you committed to India in terms of attaining sustainability targets?

In India, Ingersoll Rand has been present for around 100 years. Our commitment to sustainability extends to the environmental impacts of our people, operations, and products and services. As a global enterprise leading the way to a more sustainable future, Ingersoll Rand is committed towards India and are implementing strategies for its products. We continue to find ways to reduce the company's impact on the environment and follow sustainability throughout our businesses.

In India, we are the market leaders and first movers in offering Low GWP sustainable chillers. We have recently launched Next Generation EcoWise portfolio of products, using HFO refrigerants with near zero ODP and very low-GWP refrigerants without compromising on energy efficiency and safety. These products offer efficiency rating that exceeds industry standards and are compliant with existing and proposed regulation which are included in National Building Code which is approved by various government agencies like NBCC,

HSCC, CPWD, AAI, etc.

With this, we continue to lead the industry with energy-efficient systems, technologies and innovations that lower environmental impacts. ■



High Speed Magnetic Centrifugal chillers (HSCA)

Reducing Risk of Poor IAQ in Hospitals



IAQ of a healthcare facility involves multiple factors such as thermal comfort (temperature and humidity), concentration of airborne particles, chemical contaminants, outdoor air quality which affect the exposure and wellbeing of the patients.

The primary role of a Health Care Facilities (HCFs) is to provide effective medical treatment and nursing care to the patients. Recently, Indoor Air Quality (IAQ) has become a significant issue in the hospital settings in urban and rural areas in India. The various departments in healthcare facilities include operating theatres, intensive care units (ICUs), inpatient wards, outpatient departments (OPDs), pharmacies, radiology departments and laboratories. Each department has its specific functions which differ in their day to day functioning from other facilities. IAQ of a healthcare facility involves multiple factors such as

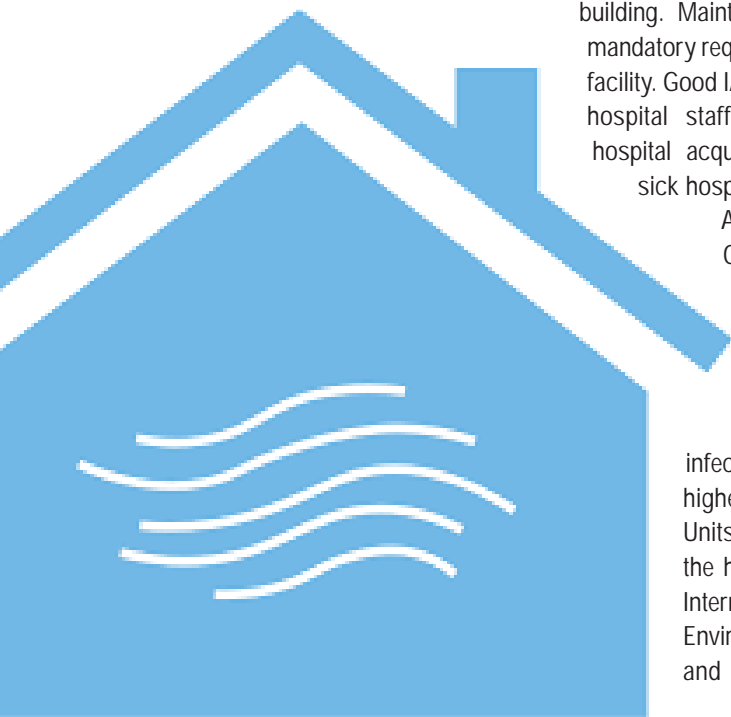
thermal comfort (temperature and humidity), concentration of airborne particles, chemical contaminants, outdoor air quality which affect the exposure and wellbeing of the patients. Poor hospital IAQ can result in various severe and acute building related illnesses, ranging from minor headache, fatigue, eye and skin irritation to respiratory and cardiovascular diseases and eventually premature mortality. In hospitals, the occupants primarily exposed to poor IAQ are patients, healthcare workers, and visitors.

Occupant diversity in healthcare facilities has made hospital environment more complex than any other commercial building. Maintaining a good IAQ is the mandatory requirement for any healthcare facility. Good IAQ safeguards the patients, hospital staffs and visitors from the hospital acquired infections (HAI) and sick hospital syndrome (SHS).

As per World Health Organization (WHO), at any given time over 1.4 million people across the globe suffer from hospital acquired infections (HAI). Hospital acquired infections (HAI) prevalence is higher in the Intensive Care Units (ICUs) than other areas of the hospital. As per a study by International Society of the Built Environment (2008) on indoor and outdoor air quality in

hospitals, it was estimated that bacterial counts in ICUs, orthopedic wards, neonatal wards, dialysis wards and post operative wards were found to be beyond the recommended levels. Poor IAQ in hospitals may also be related to Sick Hospital Syndrome (SHS) in its micro-environment. SHS may result in acute discomfort, dizziness, eye, nose, skin and throat irritation amongst the exposed population. In many ways, SHS is linked to the efficiency of hospital ventilation and performance of air conditioning system in the micro environment. Achieving good hospital IAQ is a humongous challenge to the hospital engineers, planners and hospital workers. IAQ can be improved and maintained when engineers, architects and the hospital staff have an innate understanding of the various components affecting the indoor environment.

Indoor Air Quality (IAQ) in a hospital setting primarily depends on these five major factors of exposure: patients, staff, visitors, building and the outdoor environment. By looking at each of these components, architects or engineers can develop a sound methodology that can help in improving the IAQ. Visitors and hospital staff are always more prone to catching infections from the patient. If air quality is not maintained and certain hygiene practices are not followed within the hospital premises, then risk of spreading contaminants increases by manifolds.



Indoor Air Pollutants in Hospitals

The indoor environment in HCFs contains a variety of particles and gaseous contaminants such as carbon dioxide (CO₂), Carbon Monoxide (CO), Formaldehyde (CH₂O), Total Volatile Organic Compounds (TVOCs), Respirable Suspended Particulates (RSP), Radon (Rn), Glutaraldehyde (C₅H₈O₂), Nitrous Oxide (N₂O), latex allergens, and total bacterial count. These contaminants are commonly referred to as indoor air pollutants in the healthcare facilities.

Determinants of IAQ in hospitals

In healthcare facilities, IAQ determinants falls into four major categories: patients, staff, indoor environment within the hospitals, and the outdoor environment.

If an active TB patient coughs or sneezes, it exposes the other patients or staff or visitors to infectious microbes which can trigger respiratory illness in healthy individuals. Patients are a major source for contaminating the indoor air and are the main reason to improve the Indoor Air Quality (IAQ). Patients at these facilities are suffering and being treated for different health concerns. Patient coughing can introduce contaminants into the air and onto adjacent surfaces. Bodily fluids as a result of wounds, infections, incontinence can be transferred from the patient to clothing, bedding, and other surfaces. Odour is also a big problem in hospitals due to wounds, infections, diseases, medicines and various medical procedures.

If certain procedures and hygiene practices are not followed by the hospital staff, then there is a potential risk of spreading contaminants generated within the hospital by patient and other factors. Chemicals used to disinfect medical equipment such as glutaraldehyde and ethylene oxide (carcinogenic) which contribute significantly to IAQ problems. There are standards which define the acceptable limits of IAQ but some population may show reactions to even smaller concentrations. In addition to the

patient- borne illnesses, indoor environment within the healthcare facilities is one of the most common sources of airborne pollutants. Chemicals used to clean and disinfect the indoor environment in hospitals are the major source of airborne pollutants. Outdoor air could possibly be the major source for indoor air pollutant concentration. Several factors including vehicular emission, industrial emission, crop burning, wind speed, wind direction and emission from various building can contribute to the high pollutant concentration in outdoor air

Factors Effecting IAQ in Hospital Setting

Several factors including various practices used within the healthcare facility for cleaning or disinfection, operation or maintenance of fresh air purification system and the installation and maintenance of filtration system installed and maintained can affect the IAQ in hospital settings.

Rampant use of chemicals and disinfectants

Rampant use of chemicals and disinfectants by housekeeping employees for keeping the building clean is a prominent source of IAQ contamination. The chemicals used for cleaning can introduce the objectionable smell in to the indoor environment and the wet surface left after cleaning can lead to the menace of mold growth.

Ventilation system in the hospitals

The ductwork within the hospital building used to distribute air throughout the facility can become dirty over a time period and trap various contaminants such as dust, dirt, and even biological organisms. Moisture from HVAC humidification can condense within the duct system and can also seep in from breaches in the building envelope, concealed leaks, or even overspray from the cleaning process. This moisture can initiate mold growth over time, which is often left undetected until the problem becomes substantial.

Concentration of outdoor air

Outdoor air quality can also be a

potential detriment to IAQ. Air quality within the healthcare facility depends upon the conditions of outdoor air and from where it is drawn. At times, harmful contaminants may be drawn along with outdoor air if outdoor pollutant source is present near to the fresh air intake point e.g. Traffic and emergency-generator exhaust are the two very common contaminants can be drawn in with the outdoor air intake.

Inappropriate filtration system

Insufficient (where not enough filtering is provided) or deficient (where filters have not been properly replaced when necessary) filtration within the air-handling systems also offer the opportunity for various contaminants to be distributed via the airstreams throughout the building.

Methods to ensure acceptable IAQ in hospitals

Clean fresh air is likely the first thing that comes to mind when one considers the concept of good IAQ. In order to achieve acceptable IAQ, the system that delivers fresh air to spaces within a building, the entire path travelled by the fresh air, contaminant sources identification must be analysed and mitigated carefully before designing the mechanical system. After the installation of right fresh air supply system (FASS), proper maintenance of the system is required for maintaining healthy indoor air quality. Acceptable IAQ within the hospital premises can be achieved through following steps:

Ventilation

Safe, comfortable and healthy environment to the patient, visitors and healthcare staff can be provided through ventilation. ASHRAE handbook provides specific ventilation requirements for different areas of the hospital. This handbook provides specific requirements for ventilation and filtration to dilute and remove contamination such as airborne microorganisms, viruses, hazardous chemicals and radioactive substances. ASHRAE has also specified the different temperature and pressure requirement for different areas and these requirement changes as per season and occupancy level.

Indoor air pollutants can be diluted through effective mechanical ventilation by introducing filtered outdoor air into the hospitals and exhausting the contaminated indoor air.

Fresh air intake path in to the building starts from the point from where it enters the building. Fresh air intake into the building should be located in such a way that it is not taking any contamination from any major outdoor source. Vehicular traffic and emissions from different building or factories and machinery exhausts could be the possible reason of high pollutant level in the fresh air coming into the building. Ventilation rate depends upon the outdoor air quality, season and the total area that needs to be served. Once the fresh air is drawn into the system it needs to be filtered at different steps.

Filtration

Contaminant including airborne particles and microbiological pathogens can be trapped effectively in filters and removed from the circulating air. For a healthcare facility, proper filtration system must consist of prefilters, Electronic filters, HEPA filters, Carbon filters and UV light.

Prefilters with 25-30 per cent dust spot efficiency can be used in the air handling unit before the final filters. Use of prefilters helps in maintaining the prolonged life of other filters. In addition, these are easy to

maintain comparative to other filters and are also cost effective. Final filters High efficiency particle arrestance (HEPA) and ultra- low particulate arrestance (ULPA) should have at least 90 per cent efficiency to collect particles, fungal spores and colony forming bacteria.

Different requirements for the filtration system can be adopted from different IAQ standards. Different types of filters are rated in terms of efficiency with a minimum efficiency reporting value (MERV).

As per the ASHRAE standard 52.2: Methods of testing general ventilation air-cleaning devices for removal efficiency by particle size MERV rating for the filters range from lowest efficiency at 1 to highest efficiency at 16. Filters with MERV rating 1 can capture particle larger than 10 micron (dust and pollens) and filters with MERV rating of 16 can retain particles of 0.3 micron (smoke and bacteria). HEPA filters are 99.97 per cent efficient at removing particles 0.3 microns in size and ULPA filters are 99.999 per cent efficient at removing particles of 0.02 microns in size.

Gaseous pollutants can be filtered with chemical filters. Carbon filter is the most common type of gasphase filter used in hospitals. Charged particles can be trapped with electronic air filters. Electronic filters work best for the particles less than 10 micron in size. To achieve disinfection

in hospitals, Ultraviolet germicidal irradiation (UVGI) disinfection can be the best mean through which it can be achieved. UV radiation is the most commonly used in the air handling units (AHUs), cooling coils, duct works and insulation to reduce fungal growth. UV radiation of wavelength 220–300 nm can penetrate cell walls and inactivate tiny airborne droplet nuclei by disrupting their reproductive mechanisms.

Air Change Rate (ACH)

ASHRAE standard has recommended the total air change rate for hospitals in term of air changes per hour (ACH). The outdoor air change rates are based on the outdoor air quality and total space need to be served with fresh air. Outdoor air must be treated first to reduce the contamination before it is drawn into the hospital facility. 100 per cent ventilation is required in the critical areas of the hospitals like operation theatres and delivery rooms. In some areas, air change rate is highly dependent on the number of occupants serving for the pollution concentration in the area.

Differential pressure control

It is of utmost importance to maintain a differential pressure between two adjacent areas, such as isolation room and corridor to prevent hospital acquired infection. In order to ensure clean to less clean air flow in the hospital, air pressure distribution among hospital facility should be controlled efficiently. Interference due to door opening, elevator movements, leakages and other activities should be taken under consideration. These interferences can be taken care of, if differential pressure is maintained at least 2.5 Pa (0.01 in. of H₂O). Constant attention to air balancing is basic requirement to maintaining a differential pressure. Prefilters and HEPA filter load can cause the pressure drop and reduce the fresh air supply and thus a positively pressurised space can become negatively pressurised. Thus, the regular maintenance and attention of filtration system is required. Leakages within the building, ducting system needs to be identified and should be taken care. Tight fitting door with a door grille, proper insulation of the ducting



Ventilation system to reduce hospital infections.
Photo Courtesy: www.salud.carlosslim.org

system should be used to facilitate the differential pressure control.

Directional Air movement

Within in an enclosed environment air flow should be as per clean to less clean zone principle. Air must flow from clean to progressively greater contaminated area. In hospitals especially in operation theatres unidirectional airflow should be maintained to avoid undesired air turbulence. Air turbulence may result in the mixing of airborne pollutant /pathogens that in turn increase the risk of hospital acquired infection. Horizontal (from wall to wall) and vertical (from ceiling to floor) unidirectional flow method must be used in the hospitals. Contaminants spread by the surgical team can be removed effectively by Vertical air flow. In vertical air flow clean air comes from the ceiling vertically towards surgical site and takes all the contaminant towards the exhaust to the side of floor level. To check the actual air flow direction a simple smoke test can be performed to see the flow of air. Accordingly the necessary measures can be taken to maintain the unidirectional airflow.

Maintenance of the fresh air ventilation system

Maintaining the mechanical ventilation systems is very essential for the effective operation and outcomes of the fresh air ventilation system. Otherwise the risk of unwanted IAQ conditions may arise within the hospital premises even if the correct ventilation system is installed. The need for the maintenance can be signaled by performing IAQ parameters testing. IAQ parameters testing should be performed time to time to ensure healthy environment within the hospitals. It will also help to identifying the type of contamination of a given ventilation installation.

It is recommended to check and clean the ventilation and ducting system once a year or every two years, but everything depends on the quality of the air in the area, the type of ventilation or the building material.

Different parts of central air-conditioned system demand different maintenance procedures at different time intervals. Prefilters in the air handling units (AHUs)

Table 1: Differential Pressure control

Area	Differential Pressure
Infectious isolation room	Negative
Darkroom	Negative
Equipment sterilization room	Negative
Laboratory	Negative
Intensive care unit	Positive
Protective isolation room	Positive
Operating/ Surgical room	Positive
Delivery room	Positive
Pharmacy	Positive
Patient room	Equal

▪ Negative pressure means the pressure of the facility is lower than the adjacent area.

need to maintain weekly and can be washed. Whereas the electrostatic precipitators (ESPs) should be maintained twice a week depending on the outdoor pollution level in the area. ESP should be washed with water at very high pressure to remove particles deposited within the plates of ESP. Cleaning method is different for the different type of filters. HEPA filters should be cleaned weekly to maintain the acceptable IAQ and to prevent filters from getting clogged or choked. These filters can be vacuumed to remove the particles deposited between the different plates of filter. Activated carbon filters can also be vacuumed but mainly it needs replacement after a particular time period. UV lamps within the air handling unit, cooling tower and ducting should be maintained on a weekly basis to ensure the effective working of the ventilation and filtration in the HVAC system.

One can choose any one of the following method of cleaning the ventilation system as per the requirement:

Brushing: In ventilation ducts, brushing is the most common and effective solution of maintaining it. Cleaning robots or devices with flexible rollers and brushes can be used to perform the cleaning of ducting system.

Vacuuming: It is an extremely effective method of maintaining the filters within the air handling units and easily accessible

ducts or in large ducts, if a specialist can enter inside.

Compressed air: This method should be used instead of a brushing and can serve as an efficient method of dealing the area with limited access.

Steam and high-water pressure: Water is mixed with detergent and high-pressure water stream is used to remove the impurities from the areas of limited access and greasy contaminations.

Mechanical ventilation systems in hospital buildings should be designed and operated not only to heat and cool the air, but also to draw in and circulate outdoor air. This system itself may contribute to the indoor air problem if it is poorly designed, installed and maintained.

Health and wellbeing are the very important benefits of the carefully installed and maintained ventilation system in any building including the hospital facilities. Regular cleaning and time to time replacement of the filters in the ventilation system reduce the risk of poor indoor air quality in the hospitals. Intake of right amount of filtered fresh air per person or as per space requirement, maintenance of the right pressure gradient within the different spaces of hospital and regular maintenance of all the Heating, Ventilation and Air conditioning systems can surely help in improving the indoor air quality of the hospitals. ■

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Harind Chemicals:

One Stop Solution against Corrosion

Nanova Care Coat is a technology-driven company and manufacturer of functional smart coatings, based on latest cutting-edge technologies like nanotechnology.

Dr Swapan Kumar Ghosh, Director, Harind Chemicals gives a sneak peek of company's cooling business, its products, its unique advantages, working of thin-film nano-coating for HVAC&R coils and many more in an interaction with **Cooling India**.

Nanova Care Coat is a technology-driven company and manufacturer of functional smart coatings. How significant is your cooling business?

Anti-corrosive coating for the HVAC segment forms a significant plan of our business. We have assessed the potential which can be created and converted and more than one-third of our revenue plan is from the HVAC segment. Today, our product has been approved and used by most of the large brands. We have developed products not only for factory application, but also for on site installed machines and have developed a separate application team to offer a complete solution to our customers. Even for sales, we have a separate and dedicated team focusing on the HVAC segment.

What gives you an upper edge over other competitors?

We are a technologically driven company with strong research team, our scientists are continuously working on new innovations in nano-technology coatings. Further, we have state-of-the-art R&D center at Mumbai with all testing facilities and have manufacturing plant at Khopoli, Mumbai. Our products are developed indigenously with backward integration of raw materials. We synthesise our own polymers and nano materials to design the coating. All our products are patent protected. Most of available nano-coatings today in India are imported; hence we can offer better cost and logistic support with on time service to customers. We offer customise solutions and have a strong technical service team for after sales support.

What is your take on the recent status of cooling industry in India?

India has a huge untapped market. It is a sub-tropical country with scorching heat in summers and penetration of ACs is only four per cent. India today has one of the lowest access to cooling across the world but is poised for rapid and significant growth in cooling demand. India's cooling energy consumption is top in the list and expected to grow around 2.2 times in 2027 over the current baseline. Hence, energy efficient cooling system would be the deciding factor

Rising disposable income of emerging middle class is expected to propel the AC growth. As per data, today only 52 per cent of middle-class families on an average own one AC per house. Usage of AC is expected to be doubled by next five years.

India is proactively working on reducing the energy consumption due to which regulations have been defined to reduce energy load of building including HVAC services, hence, demand for inverter AC will rapidly grow. Space cooling in buildings will continue to dominate India's cooling energy demand at around 60 per cent share and room AC stock-in-use will reach 170 million units in 2027. Fans and air coolers will consume more electricity than all large AC systems combined in the next decade.

Recent increase in import duty will force all manufacturing companies to set up in-house manufacturing facilities which certainly opens up the opportunity for these anti-corrosion coatings at factory level. Further due to initiatives from the government to increase the energy ratings, manufactures have to find the other alternative in alloys for better performance and energy efficient product in such case aluminum micro channel coils will be ideal choice. However, aluminum coils are more prone to corrosion and non-repairable. So, this will generate huge demand for coating to address these concerns.

What are the products offered by the company catering to HVACR sector?

Nanova has developed pioneering new nano-coating; Ultracorr ACX series specifically for HVAC corrosion protection. These anti-corrosion products are offered in both water and solvent based technology.

The coatings offered are thin nano coating which provides a long-lasting corrosion protection of copper and aluminum condenser coils at lower thickness (10-15 microns), thereby, preventing leakage of gas due to atmospheric and chemical corrosion, saving huge energy cost and additional expense of coil maintenance and replacement. We also offer anti-microbial coating under the Microb 150 for the AC filters and panels.

Nanova has pioneered in development and sale of nanotechnology-based coating products designed and manufactured totally indigenously. What are its unique advantages?

The coatings meet international standards and being based on the nano technology, which offers protection at a very low film thickness without affecting heat transfer and pressure drop. Products meets RoHS compliance guidelines. We can offer products that offers salt spray resistance having more than 3000 hours as per ASTM B 117 standards at 15 microns DFT with excellent flexibility and weather resistance.

The system can efficiently be applied in the factory as well as on-site and for both new and old coils or machines. We are a one stop solution for protection of coils against corrosion. We not only manufacture and supply the coatings but also offer complete coating solution to the customers by taking up supply apply jobs at factory or installed machines at sites. We have in-house application specialist for coating application and onsite technical support.

The specialised product with simple application procedure makes Ultracorr ACX series the best choice to prevent air conditioning failure and unnecessary energy consumption due to corrosion.

How does thin-film nano-coating for HVAC&R coils & condensers work?

Conventional anti-corrosion coatings are generally applied at higher thickness (50-300 microns) to give the desired corrosion resistance, which blocks the fins of the AC coils and do not allow the heat to dissipate properly, leading to drop in cooling performance of AC system. The energy cost rises along with the risk of fire due to extra heat accumulation. To address these issues, you need to have a thin film coating (8-15 microns) offering high corrosion resistance along with heat dissipation properties.

Are you looking to expand your overseas footprint as far as cooling business is concerned?

Our products are approved with all the major players in the HVAC segment. We have already started supplies and execution of jobs with some of the major brands in Bangladesh, Middle East, etc. We are also in discussion with one of the large players for supply of our coatings for all plants across South East Asia. Currently, our focus is to capitalise on the conversion of the potential in domestic market, which we believe is huge by itself. Strategically we may look seriously at the overseas opportunities from 2020-21 onwards. ■



Circular Economy Impacting HVAC

The circular economy cannot be defined by a singular course of action. Rather, it is a multi-faceted approach to waste and materials management. At a product level, goods are increasingly being designed to become a part of this system, employing materials that can be reused and recycled.

HVAC is the highest energy consuming part of human life having highest impact on ecology. Hence, it is essential to consider it from totally different perspective related to Reduce-Reuse-Recycle techniques.

A framework for an economy that is restorative and regenerative by design.

The circular economy

Popularised through the concept of the 'circular economy', the potential for resource efficiency to reduce environmental burdens and to increase resilience to resource scarcity is increasingly recognised globally.

A circular economy seeks to rebuild capital, whether this is financial,

manufactured, human, social or natural. This ensures enhanced flows of goods and services. The system diagram illustrates the continuous flow of technical and biological materials through the 'value circle'.

Highlights

- Circular economy approaches could reduce energy use in economic activity by 6 per cent to 11 per cent.
- Energy savings complement energy efficiency approaches and equal their potential.
- Large potentials in material efficiency, refurbishment, reuse and construction.
- Potential benefits enhanced by widespread (level and location) adoption of approaches.

What is a circular economy-based projects?

Looking beyond the current take-make-waste extractive industrial model, a circular economy aims to redefine growth, focusing on positive society-wide benefits. It entails gradually decoupling economic activity from the consumption of finite resources, and designing waste out of the system.

Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles:

- Design out waste and pollution
- Keep products and materials in use
- Regenerate natural systems

OUTLINE OF A CIRCULAR ECONOMY

PRINCIPLE

1

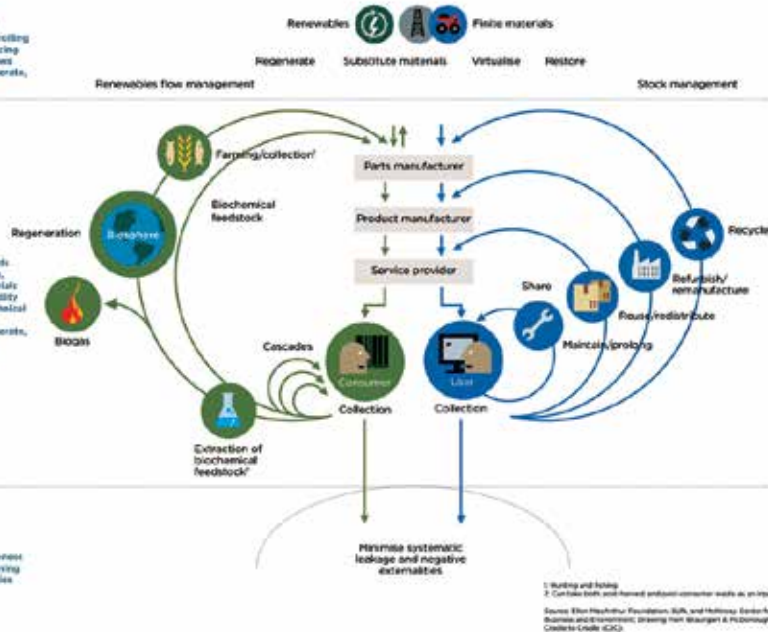
Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows. RESOLVE: regenerate, virtualise, exchange

2

Optimise resource yields by circulating products, components and materials to use at the highest utility at all times in both technical and biological cycles. RESOLVE: lower, regenerate, share, optimise, loop

3

Fixate system effectiveness by reusing and designing out negative externalities. RESOLVE: lower



Re-thinking Progress: The Circular Economy

There's a world of opportunity to rethink and redesign the way we make stuff. 'Re-Thinking Progress' explores how through a change in perspective we can re-design the way our economy works - designing products that can be 'made to be made again' and powering the system with renewable energy. It questions whether with creativity and innovation we can build a restorative economy.

The concept of a circular economy

In a circular economy, economic activity builds and rebuilds overall system health. The concept recognises the importance of the economy needing to work effectively at all scales – for large and small businesses, for organisations and individuals, globally and locally.

Transitioning to a circular economy does not only amount to adjustments aimed at reducing the negative impacts of the linear economy. Rather, it represents a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits.

Technical and biological cycles

The model distinguishes between technical and biological cycles. Consumption happens only in biological cycles, where food and biologically-based materials (such as cotton or wood) are designed to feed back into the system through processes like composting and anaerobic digestion. These cycles regenerate living systems such as soil, which provide renewable resources for the economy. It is need of the hour to extend

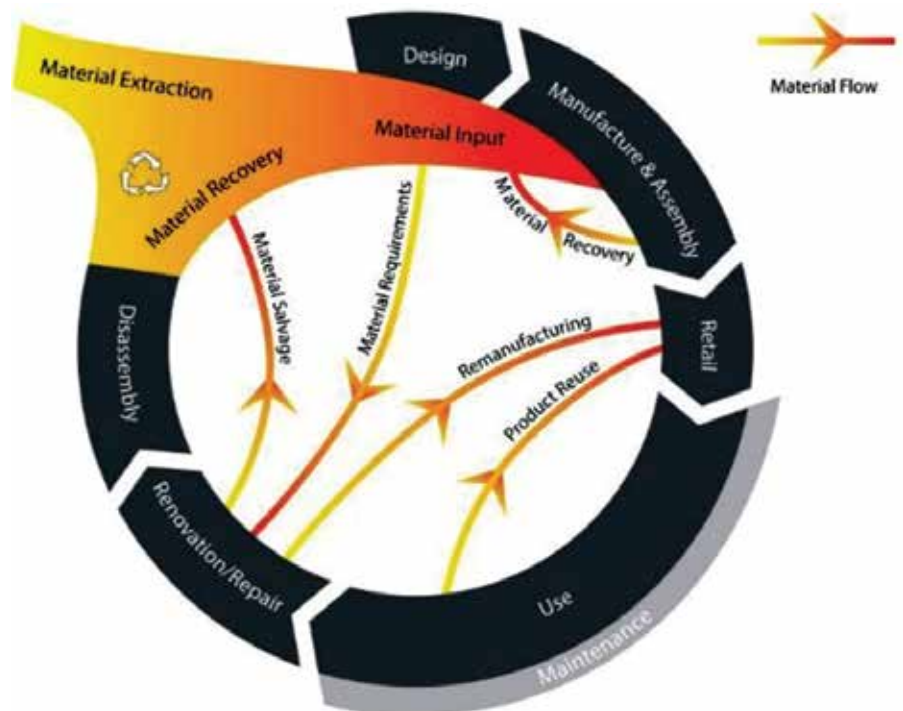
this concept to HVAC sector by adopting technical cycles recover and restore products, components, and materials through strategies like reuse, repair, remanufacture or (in the last resort) recycling.

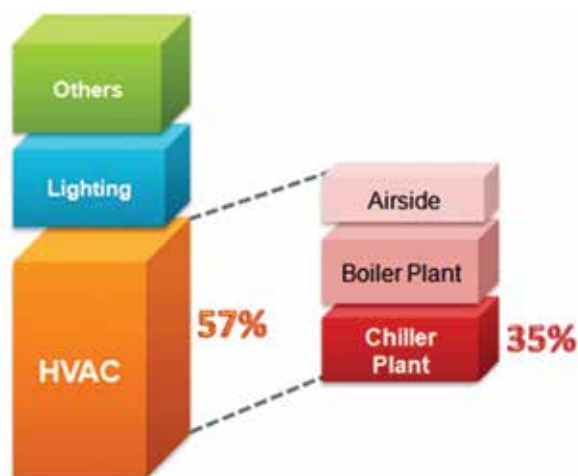
Origins of the circular economy concept

The notion of circularity has deep historical and philosophical origins. The idea of feedback, of cycles in real-world systems, is ancient and has echoes in various schools of philosophy. It enjoyed a revival in industrialised countries after World War II when the advent of computer-based studies of non-linear systems unambiguously revealed the complex, interrelated, and therefore unpredictable nature of the world we live in – more akin to a metabolism than a machine. With current advances, digital technology has the power to support the transition to a circular economy by radically increasing virtualisation, de-materialisation, transparency, and feedback-driven intelligence.

Circular economy schools of thought

The circular economy model synthesises several major schools of





Scenario	System	Fuel	Efficiency	Primary Energy Factor
1	Heating	Gas	0.812	1.05
	Cooling	Electricity	2.790	2.90
	DHW	Gas	0.794	1.05
	Production	Electricity (PV)	0.960 (inverter)	2.90
2	Heating	Oil*	0.812	1.10
	Cooling	Electricity*	2.790	2.90
	DHW	Oil*	0.794	1.10
	Production	Electricity (PV)	0.960 (inverter)	2.90
3	Heating	Electricity	2.980	2.90
	Cooling	Electricity	2.790	2.90
	DHW	Electricity	0.980	2.90
	Production	Electricity (PV)	0.960 (inverter)	2.90

*Systems and efficiency of the case study reference building

thought. They include the functional service economy (performance economy) of Walter Stahel; the Cradle to Cradle design philosophy of William McDonough and Michael Braungart; biomimicry as articulated by Janine Benyus; the industrial ecology of Reid Lifset and Thomas Graedel; natural capitalism by Amory and Hunter Lovins and Paul Hawken; and the blue economy systems approach described by Gunter Pauli.

Let us consider the example of “Grundfos”:

Grundfos, a pump supplier for heating, air conditioning, irrigation and water treatment, is branching out with a “circular economy takeback experiment” that’s worth following as an example of how to engage with consumers, Pigosso said.

The company, which has a global presence, had to solve a logistical challenge when it piloted a take-back program for circulation pumps.

Grundfos had to provide incentives

and means for take-back. The program, spread over many houses, meant the company needed to encourage many customers to participate.

“They got back the pumps and developed a tracking system to understand the health of the pumps,” Pigosso said.

Pigosso listed some challenges facing the take-back program: “After we take back the products, what is the best circular economy strategy to implement? Is it to remanufacture? Reuse? Recycle some of the materials?”

With persistence, Grundfos eventually found success with the take-back program. It provides information about how each product is disassembled and recycled on its website.

Big Data in HVAC: The case of chillers

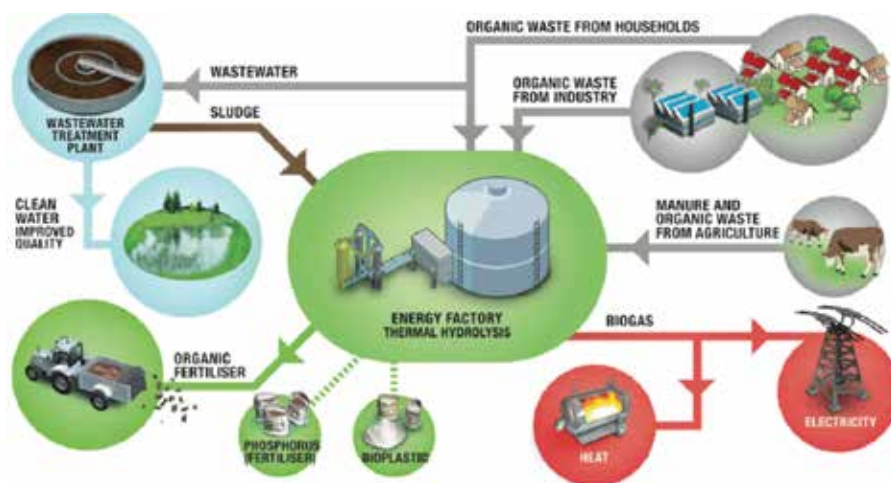
In a building, the heating ventilation and air conditioning (HVAC) system typically consumes about 60 per cent of

the building’s total energy requirement. Of this, chiller plants consume 35 per cent — translating to 20 per cent, or one-fifth of the total building energy use.

So, chiller plants must be one of the first logical starting points for any building energy-efficiency initiative. On the average, about 30 operating parameters of a chiller can be monitored. If these parameters are captured and recorded every 15 minutes, it translates into more than 1 million records a year for a single chiller. For a medium-sized building, normally about 600 HVAC equipment and system data points are captured using building automation systems (BAS). If the information is captured every 15 minutes and stored for each building, there will be over 21 million records every year. For 5,000 similar buildings, over 105 billion records will be captured annually, translating into over 4.2 terabytes of data storage.

Building owners and operators can leverage Big Data and Analytics in many ways to create tangible value:

- Advanced analytics: It can help with better understanding of building and equipment performance. It allows historical trending, pattern recognition and correlation between cause and effect of issues and events occurring in the various building and HVAC subsystems.
- Intelligent insights: It enables benchmarking of a building’s HVAC system performance against industry standards or benchmarks. Owners and operators can cross check what their



energy usage is in HVAC systems and how they stack up against peers.

- **Preventive maintenance:** Through proper analytics on past performance data and issue trends, future potential maintenance issues can be identified through simulation and predictive technologies. Such actions will help extend equipment life, reduce operating costs and minimise disruption.
- **Informed decisions:** Leveraging Big Data and Analytics, building managers also can model their future energy requirements and simulate their future operating budgets.
- **Value asset:** Monetise raw data for parties interested in sustainability such as educational institutes, research bodies and policy groups.
- **Connected communities:** At a fundamental level, virtualization of building subsystems allows harnessing dispersed experts by creation of a connected community of advisors to enhance performance of buildings.

“Bringing the building to subject matter experts” is now possible through organised Big Data and the Internet.

Big Data and Analytics brings much additional value for HVAC systems manufacturers and service providers:

- Improve future design by understanding how their equipment and systems are used by customers, facilitating the alignment between product development and customer needs.
- Anticipate future repair and replacement needs, thus, improving service quality and planning
- Increase service productivity with more accurate targeting of current and future issues identified by analytics on Big Data
- Differentiate their relationship and service offerings from organizations that are not leveraging Big Data and Analytics, thereby creating new economic models

Big Data and Analytics helps to understand what is going on with buildings

and the HVAC systems in them, the implications of that and what kind of actions are recommended to improve building performance. This is achieved as we progress on the dimensions of understanding the data and putting it in the context in which the data is created. As we get better in moving from data to analytics, we move from more descriptive analytics to predictive analytics.

Conclusions

The circular economy cannot be defined by a singular course of action. Rather, it is a multi-faceted approach to waste and materials management. At a product level, goods are increasingly being designed to become a part of this system, employing materials that can be reused and recycled. ■

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Air pollution is the fourth greatest cause of death worldwide, with 92 per cent of the world's population breathing air deemed unsafe by the World Health Organisation. But while outside air pollution grabs most of the headlines, the air we breathe inside can be much more harmful. The level of air pollution indoors can be between two and five times the pollution found outdoors. And as we spend around 90 per cent of our time indoors, those places we feel safest may not be as healthy as they seem. Germany based filtration specialist MANN+HUMMEL has designed OurAir to transform those spaces into the clean and healthy environments that they should be. The Group has recently announced the launch of its OurAir brand in the Indian market.

Joelle Chen, Director, Global Partnerships & Marketing, MANN+HUMMEL Filter Technology (S.E.A.) Pte Ltd speaks to **Subhajit Roy** and explains the company's India strategy. Edited excerpts:

MANN+HUMMEL bullish on Indian market

MANN+HUMMEL is a 4 billion Euro company having presence across 80 countries worldwide. Could you take us through your journey in Indian market?

MANN+HUMMEL Group is a leading global filtration specialist and a well-known brand in India, in the automotive sector. We have been in business since 1941 and in India over the last 13 years. In recent years, we made a number of

acquisitions in life science and environment space, including HVAC filters. In 2018, MANN+HUMMEL acquired Tri-Dim Filter Corporation, a USA-based air filtration company. We are actively growing our business in this area as we are committed to filtering out harmful pollutants in the environment, whether it is from automotive perspective or from an indoor air perspective. In this context, the company launched the

'OurAir' brand in the Indian market in September 2018.

We consider Asia, particularly India and China as focus markets, because in emerging economies where the growth rates are so high, air quality and health are often sacrificed in the face of rapid urban development.

What are the solutions you offer under 'OurAir' brand?

OurAir offers an IoT-enabled, end-to-end indoor air quality solution, where air quality monitors, filters, purification and ventilation systems, integrate seamlessly with the OurAir digital platform. With OurAir solutions, building owners, facility managers and tenants can "know, improve and manage" the air quality in commercial and industrial buildings.

How much environment business segment contributes to the Group's turnover?

Our Europe and US business, has been established in the last few years, and strengthened with new acquisitions such as Tri-Dim; however, Asia business is still growing. We are looking at growing this business aggressively over the next 5 years, through organic and inorganic growth.

With the launch of OurAir brand in India, what sort of opportunities you look at?

Globally, indoor air quality has become a trending topic. People have been talking about sustainable and energy efficient buildings for the last 10-15 years. Of late, the conversation has evolved and started to focus more on the benefits to the end users, which includes health and well-being, and indoor air quality is an important component of what a sustainable building means.

Sustainable building is not just about sustainability for environment but also sustainability for people, and one of the

most impactful ways to address health and wellbeing within the building is through air quality.

When you talk about Indian and Chinese markets, what will be your key focus areas?

Growth would come in different areas.

The requirement for commercial space is still very low in India and China. However, people are becoming more aware in China thanks to different policies in place, especially after China's "Airpocalypse" in 2015 and have announced environmental policies to stop industries from polluting the environment, particularly small and medium-sized companies in industrial sectors. In India, there still needs to be a lot of education. From the commercial building sector, through education and awareness raising, we are helping tenants and occupiers be more aware of the pollutants within the indoor environment. Particularly when there is poor filtration between indoor and outdoor, we generally

Globally, indoor air quality has become a trending topic. People have been talking about sustainable and energy efficient buildings for the last 10-15 years.

see PM2.5, PM 10 levels elevated.

However, if the building operator tries to reduce fresh air to limit contaminants, there will be a built up of carbon dioxide, which hampers cognitive function and affects employee productivity.

Considering economic growth in China and India, where do you see the growth is going to come from for your business?

Our solution adds intelligence in the filtration process. In China, the building market is fairly sophisticated and tenants are generally more aware and conscious about the indoor air, and are finding ways to obtain credible data about the indoor air quality. Indian building market, in terms of understanding and corporate response indoor air quality, is still at

infancy stage, which corresponds with the lack of industrial and corporate action against the state of air quality today in India. The growth will come from where clean air is an economic necessity, for instance, in sensitive manufacturing and facilities such as pharmaceutical, semi-conductor plants, data centres, hospitals. Growth would also come from grade-A offices where talent retention is a priority, and companies are willing to invest in protecting their people.

What is going to be your sales strategy?

Ours is a B2B business model and we are building strategic partnerships in our target segments. For instance, in the building markets, we are working with consultants to help educate the developers and building owners, as our solutions can be implemented at any point of a building's lifecycle, whether it's a new construction, retrofit project or even building in operations.

Do you wish to collaborate with any Indian manufacturer?

We are still in the midst of discovering the market and looking forward to establish a lot of partnerships. We are targeting around 20 OEMs in Indian market.

Any particular category of OEMs you are looking at?

In terms of applications, we are targeting commercial buildings, pharmaceutical and semi-conductor industries.

What sort of investment are you putting in India?

We are reviewing the market opportunities at the moment, and exploring manufacturing in India – we are cognizant that 'Make in India' is important for Indian market. ■



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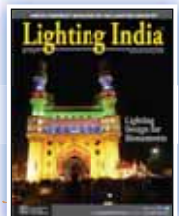
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Do air conditioners help clean up indoor air pollution?

Air conditioners, equipped with Lossnay Ventilation, give protection against PM 2.5.

The rise of PM 2.5 and other air pollutants is a big concern for the inhabitants of various cities in India. Extreme weather, pollution, and poor air quality are the primary factors of many air-borne diseases across the country. The necessity of ventilation can be analysed with rising unhealthy indoor air, which carries thousands of contaminants, including moisture, CO₂, Formaldehyde, Nitrogen Dioxide, odours, solvents (discharged from materials), aerosols (airborne particles), and VOCs (volatile

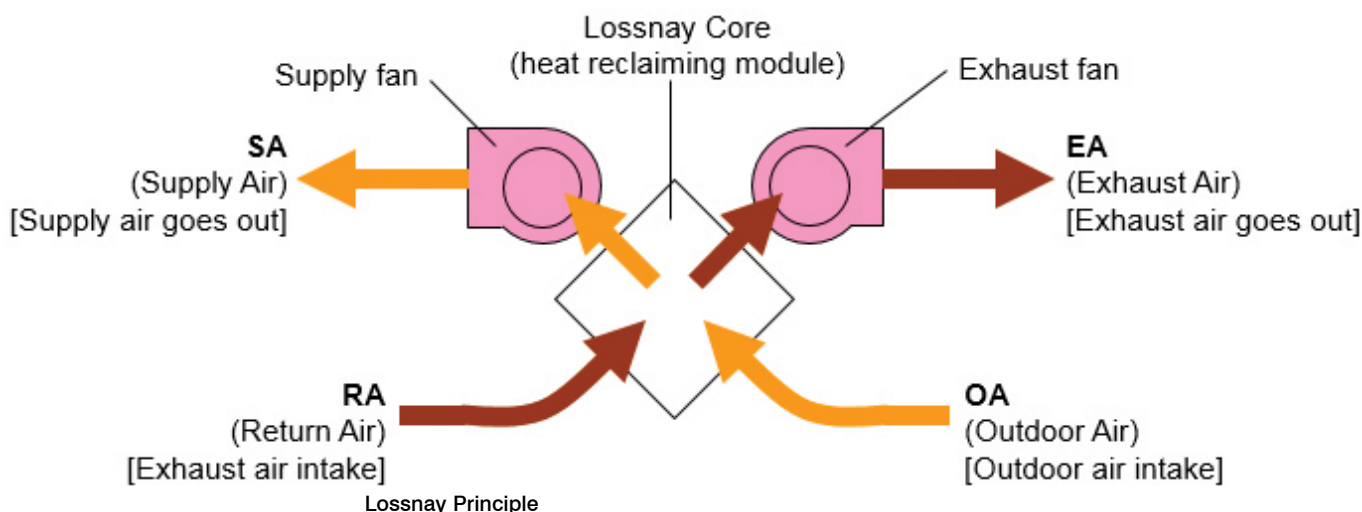
organic compounds) and chemicals. These contaminations provide a breeding ground to many airborne microorganisms, primarily responsible for many types of allergies and, of course, cold and flu and causes structural damages as well. Thus, the objective of providing proper ventilation alongside air conditioning in residential and commercial buildings is critical, so that people can live and work in a comfortable environment.

To safeguard people from extreme temperature and pollution, and to enhance

air quality, Mitsubishi Electric has introduced Lossnay Ventilation System in its air conditioner series. Developed and refined over the past 30 years, the Lossnay system has perfected the recovery of waste energy. The units reduce overall energy costs by extracting stale air, recovering the heating or cooling power and hence converting them into either warm or cool fresh incoming air. Lossnay system works on a basic principle: "The remarkable technology that permits the intake of fresh air with minimal loss to indoor temperature is known as the Lossnay Core". The cross-flow, plate-fin structure of the energy-recovery unit along with a specially processed diaphragm keep supply and exhaust air separate, ensuring that only fresh air is introduced to the indoor environment, while also allowing for the efficient transfer of heat. By utilising this energy, the Lossnay system can save up to 30 per cent on initial capital costs of heating and cooling plant. It helps to eliminate the problem of hot and cold air, adding to the expense of operating system with original energy-recovery technology.



Lossnay Ventilation System



This further uses the heat of the stale indoor air to be expelled to either heat or cool the incoming fresh air to a temperature much closer to the existing indoor air. This process reduces the load on the air conditioning system without cutting off the supply of fresh air.

Lossnay Ventilation System assures the most effective ventilation process. The history of Lossnay is fascinating; a MELNAK engineer was playing with his granddaughter when he noticed that the piece of paper by which they were playing was releasing heat energy. And in 1970, for the very first time, paper was used for effective heat exchange mechanism in air conditioners, and the technology called Lossnay. Besides keeping the room fresh with continuous ventilation mechanism, which results in 0.35–0.50 ach, the additional intermittent ventilation feature in Lossnay blows away the high concentration pollutants at the rate of 8–15 ach whenever required. These high concentration

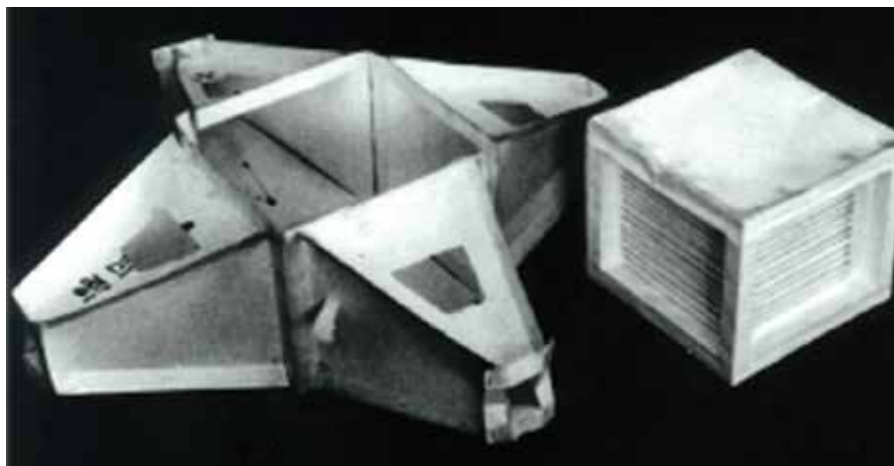
pollutants usually emanate from bathroom and kitchen areas.

Lossnay offers optional filters, PZ-RFP-E-Series for LGH-RX5 and GUF-Series and VL-100U5-E, which are designed to remove approximately 95 per cent of airborne particulates which are $2.0\mu\text{m}$ or larger. The air volume level can be set hourly (max 8 times) and weekly. One can pre-set air volume according to the predictable requirement so that Lossnay can automatically operate at only necessary air-speed at the specified period, which saves power consumption while maintaining the indoor air quality. Also, once the weekly timer has been set, no switching on-off is required.

Lossnay's automatic damper open/close function, open/close control via external devices is useful in delivering a "By-pass" ventilation system that is suitable to the installed environment. In addition to the conventional Extra High, High, and Low modes, an Extra Low mode

is added to provide a more dynamic range of air volume settings and versatility in a variety of installation environments, yielding much better energy conservation. Using a simplified timer function, it switches to extra low operation when the operation stop button is activated, and it is accordingly possible to implement 24-hour energy conservation ventilation. Lossnay also provides an option to connect ducts in two different directions (Outdoor Air, East Airside). Besides, energy conservation performance has been improved not only by reducing the air conditioning load associated with ventilation, but also by facilitating humidity penetration through the omission of both high and low concentration contaminant. It offers the industry's best total heat exchange efficiency.

Solutions catered by Lossnay Ventilation System for enhanced air quality: Best for smog and pollution-afflicted cities of India such as Delhi, Agra, Faridabad, Gurgaon, Kanpur, Lucknow, and Varanasi. Filtering the outside air before bringing it into your home or office is a solution to reduce your exposure to air pollution. In Lossnay, the superior heat-transfer and moisture permeability of the special paper assure highly effective total heat exchange (temperature and humidity). ■

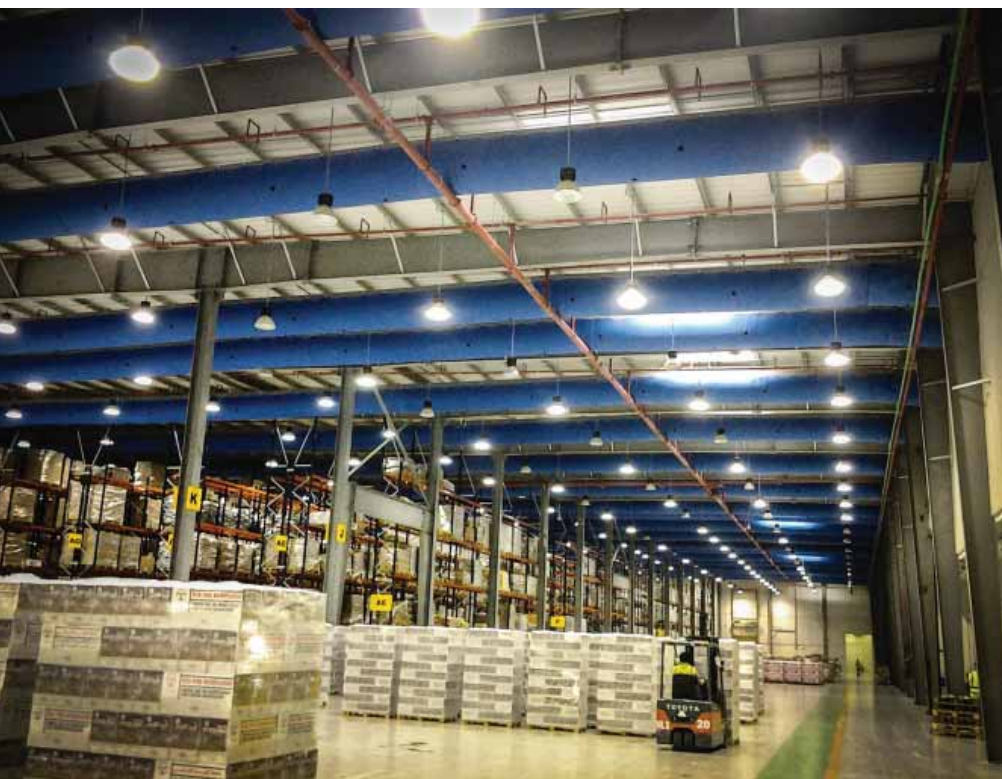


Yozo Ito
Director and Business Unit Head,
Air Conditioners
Mitsubishi Electric India Pvt. Ltd.



HVAC in Warehouse

HVAC is critical for the warehouses because a lot of products are sensitive to temperature or humidity and dust and no consumer likes to get damaged or defective products.



Typical e-commerce warehouse layout

While most of the space in a warehouse is dedicated to the storage racks, there are other functional aspects that a warehouse must cover. Figure 1 shows a typical layout of a warehouse servicing the e-commerce sector. The main areas, from a HVAC design requirement standpoint are:

The shipping and receiving bays:

These are where the delivery trucks get offloaded or loaded with consignments and material. These bays must have the flexibility to allow free movement of the material from inside of the warehouse to the trucks as well as prevent or minimise the untreated and unconditioned air from the outside environment from entering the stowage area.

Stowage areas:

This is the main function of a warehouse and is where all the action happens. The stowage racks can vary in height from 3 meter to as high as 10 – 12 meters, with multiple layers of stowage which is accessed by robotic systems. With advances in automation, the height of the stowage racks as well as the warehouse is increasing which poses a challenge for the HVAC designers as they must cater for the right amount of flow rates for such heights. The stowage areas are segregated as per the material and products that are stored. With same day delivery also seeing a lot of demand (Big Basket, Amazon pantry etc.), the warehouse operator looks to maximise the space available and combine the grocery section with the white goods or materials section. This means that the HVAC requirements for these sections will be

The e-commerce boom in India does not seem to be slowing down – all the big retailers are putting in more money into the business and are expanding their network. With such a large market, majority of which is in the rural sector and untapped, the growth opportunities are immense. The current revenues from the sector are USD 37 billion which is expected to go up to USD 120 billion by 2020. One of the key elements in the e-commerce process chain is the warehouse or 'fulfilment center' where products are supplied by manufactures and then distributed to the consumers. These can range from small sheds in crowded markets to large, 1 -2 million square feet warehouse that have multiple levels of

stocking and various zones for the multitude of products that are shipped every day.

Warehouses are simple to build and do not have much in terms of complexity by way of machinery, equipment's etc. and hence one may assume that the HVAC systems of a warehouse are also not very complicated to design and then maintain. If compared to commercial building HVAC systems, warehouses are relatively simpler, but a warehouse brings with its own set of challenges as any design or structure would. HVAC is critical for the warehouses because a lot of products are sensitive to temperature or humidity and dust and no consumer likes to get damaged or defective products.

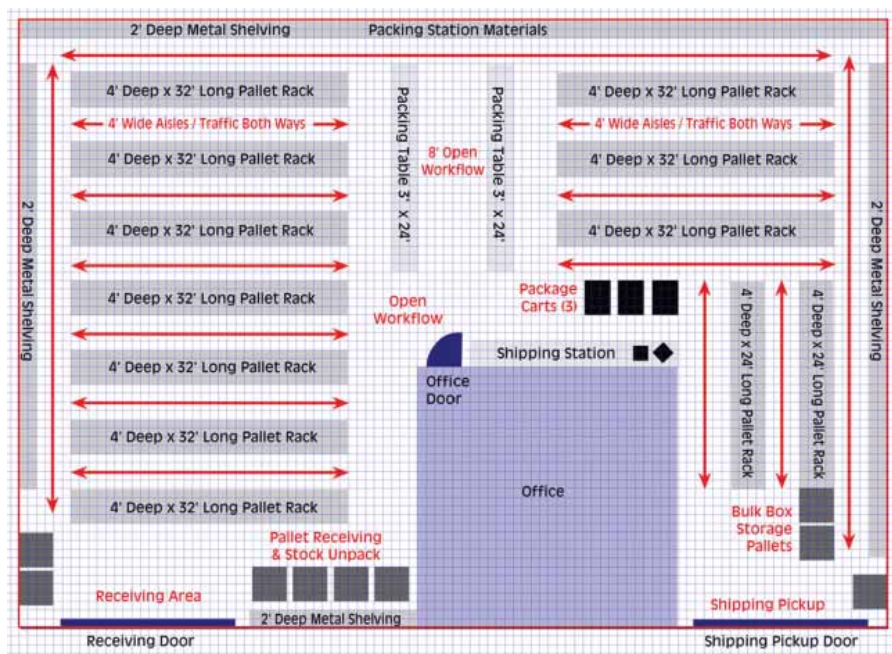


Figure 1: Typical Warehouse Layout

very different and the design will have to cater for such needs.

Office area: With a typical 1 million square feet sized warehouse having 500 – 600 staff working round the clock, which increase to 1000- 1200 during the peak holiday season, there is a need for an operations team to plan and manage the work flow. There will thus be a dedicated office space in most large warehouses and the HVAC requirements will be that of a typical office environment.

Staff Amenities: Unlike office environments, most staff in e-commerce warehouses are the blue collared workers. They need to be provided with canteen facilities, rest rooms and recreation spaces which will have their own HVAC requirements.

Warehouse Operations: To understand the HVAC requirements of an e-commerce warehouse, one needs to understand the operating cycle of a warehouse. All large warehouses operate 24x7, with the night operations sometimes being the most intensive due to movement of trucks at night. There are usually multiple receiving and dispatch bays which are open to the environment. A large part of the workforce is assigned in packaging the materials that are received, putting on the address labels, putting the items in the boxes and sealing the box before dispatch. There are many

machines that are used in a warehouse – Forklift trucks, robotic devices to collect items from the storage bays, cleaning machines, conveyer belts etc. These machines generate heat which needs to be removed by the HVAC system.

HVAC Systems for Warehouses

The key functions of a HVAC system in a warehouse are two-fold – maintaining the ambient air temperature or humidity to the desired levels for staff to work effectively and to maintain the Indoor Air Quality (IAQ) of the space to the acceptable standards. ASHRAE 62.1 2010 lays down the acceptable ventilation rates for

warehouses. It is typically 10 cfm/per person but will depend on other factors as well such as outside air quality, type of work etc.

The temperature that is typically maintained in warehouses is around 28 Degrees centigrade with a variance of 1 – 2 degrees. While no humidity standards are defined for warehouses specifically, the design aims for a humidity range of 55 – 65 per cent.

The warehouse HVAC requirements can be segregated to two areas – the stowage section and the non-stowage section. The non-stowage section will cover the office, rest rooms, recreational areas etc.

Stowage Area HVAC: Most warehouses are single storey, big box designs where the stowage racks are positioned. The racks may be 2 – 3-meter-high in smaller warehouses or be as high as 20 meter in large, automated a warehouse. If there are no grocery or perishable items in the warehouse, then the space is only ventilated and not air conditioned. There are three main approaches that designers take to provide ventilation for warehouses

Ceiling fans: The most basic approach is to install ceiling fans across the warehouse stacking zone. These fans circulate the air at a constant rate and help maintain an even temperature across the workspace. The cost of operation is low. However, the fans are not very effective in

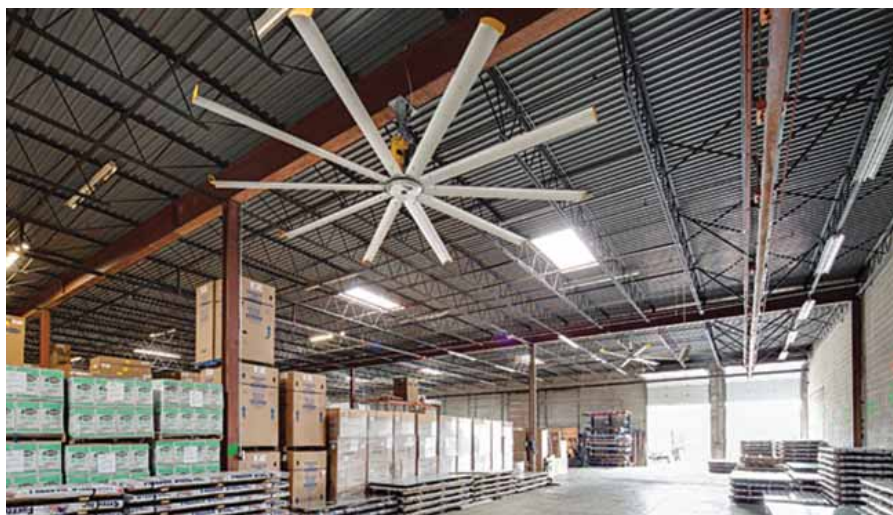


Figure 2: HVLS Fan

maintaining the humidity and do not provide enough comfort in peak summers where ambient temperatures are high in the northern plains where a large no of warehouses are set up. This arrangement is suitable for smaller warehouse set ups with low ceiling heights.

Exhaust fans: When the warehouse stores materials that give off fumes or have Volatile Organic Compounds (VOC), then a more effective way to provide good air quality inside the space is to use exhaust fans. These will pull out the indoor air and outside air will enter from the loading bays or other openings. A factor that needs to be considered is that the quality of outside air may not be good so filtration may be needed. Also, exhaust fans have a higher noise level which may impact the staff's productivity. Another difficulty with exhaust fans is that the air flows get restricted due to the stowage systems which results in hot and cold spots or in adequate ventilation in many areas. Roof mounted, wind turbines are quite popular in warehouses as they have low operating

costs and the noise levels are also low.

HVLS Fans: Where the warehouse floor plate is very large and there is enough height, High Volume, Low Speed (HVLS) fans are used. These fans have large radial diameters and provide a column of air downwards as well as outwards which helps circulate the air more effectively than ceiling mounted fans. These fans are also more energy efficient and hence operating costs are low.

Air Washers: Where the ambient temperatures are on the higher side and the products stowed in the warehouse are temperature sensitive, air washers are used. Outside air is passed over cooling pads and through evaporative cooling, the air temperature reduces.

Non-Stowage Area HVAC: The approach to provide HVAC to non-stowage areas in a warehouse is like that of office or recreational space design. Since the spaces are not very large as compared to the warehouse, the typical solution is use of smaller package units.

Conclusion

Ventilation of warehouses is important not only for maintaining desired air quality for the staff working there but also to prevent damage to the products that are stored. E-commerce supply chain relies heavily on good quality warehouses where products can be shipped, sorted for dispatch and stowed for future use. The staff working in warehouses are mostly blue collar but the whole distribution system relies heavily on this staff for stowage, retrieval and packaging of the products and hence, good ventilation of the space is essential. With the requirement of warehouses set to increase exponentially, the need for more advanced ventilation systems will arise and will further help in making the supply chain more effective. ■

Aneesh Kadyan

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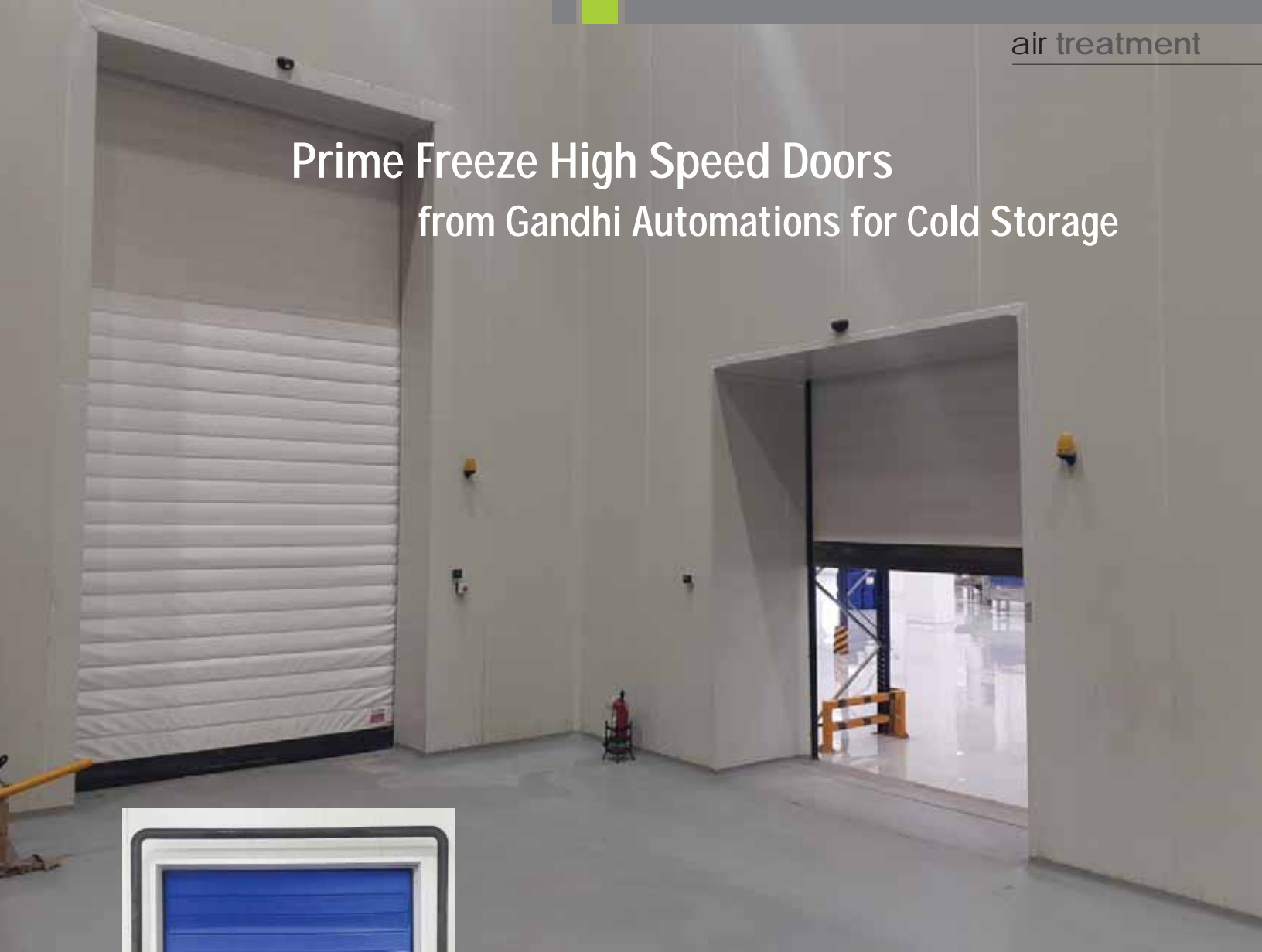
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Prime Freeze High Speed Doors

from Gandhi Automations for Cold Storage



Gandhi Automations is one of the leading diversified suppliers to the cold chain logistics and cold storage sector, serving customers pan India in more

than 23 cities.

Prime Freeze High Speed Doors are a perfect solution where cold storage with negative temperatures to as low as – 30 deg Celsius is required. The curtain is made up of reinforced PVC vinyl with heated side guides. Optionally, a special and innovative insulated flexible curtain is also available. High Speed Freezer Doors are the solution when temperature control is critical and where forklift traffic is high.

"If a cooler door is down, that could be detrimental to our operation," says warehouse manager who notes that a single inoperable door could cost 30 per cent of shipping capacity. "We cannot afford to lose an opening. We are hard on things, and

that's why we need durable doors."

High-Speed Freezer Doors not only helps to maintain temperature but also to provide human safety. High-Speed Freezer Doors have a revolutionary soft bottom edge and sensor combine to ensure operator safety at all times. High-Speed Freezer Duo doors curated by Gandhi Automations are sturdy, dependable and an ideal fit for maintaining temperature control. To prevent ice formation during intensive cooling, the high-speed freezer duo doors have a functionality of partial and full opening. Its intelligent dual curtain technology - simultaneous open-and-close operation has blower or dryer to maintain temperature balance.

Fast door speed also reduces the likelihood of panel collisions with tall-mast forklifts. In the event of a collision, the self-repairing system automatically resets the panel back into its guide without human intervention.

To avoid accidental contact with door panels, an LED safety light system along the door columns warns employees when the door is about to close and when it is actually closing. two photo eyes, (cells) a dual-pneumatic reversing edge and threshold warning lights will reverse the descending door panel if an employee is in the doorway. ■

Indoor Air Quality in Hospitals

Hospitals are the backbone of healthcare delivery system in India. Hence, it is important to maintain a healthy IAQ and demands immediate attention of hospital authorities towards taking the necessary measures to maintain a sound and healthy atmosphere.

Indoor Air Quality (IAQ) of a healthcare facility by definition involves a variety of factors such as thermal (temperature and relative humidity) conditions, presence of chemical components and contaminants as well the outdoor air quality. IAQ is vital in relation to environment inside hospitals, nursing homes and other healthcare facilities.

Poor hospital IAQ may cause outbreaks

of building-related illness such as headaches, fatigue, eye, and skin irritations, and other symptoms. The pre-requisite for any hospital facility is to provide for and ensure a good IAQ to safeguard patients, nursing staff and visitors from the hazards of occupational diseases and nosocomial or hospital-acquired infections (HAI).

According to the World Health

Organisation (WHO), at any given time over 1.4 million people across the globe suffer from a nosocomial or HAI. HAIs account for 2 million cases and about 80,000 deaths a year. Understanding the wellbeing of its patients and workers and safeguarding their health is a matter of utmost importance to healthcare facilities. Nosocomial infections are a major threat to the patients' safety in any healthcare facility. However,



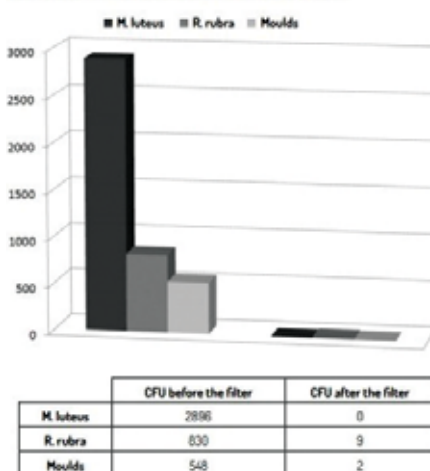
the prevalence is higher in the Intensive Care Units (ICUs) than other areas of the hospital. This increased prevalence of nosocomial infection not only influences the mortality and morbidity pattern of ICU but also poses a significant financial burden to the patient and the society.

Further to this a 2008 study by the International Society of the Built Environment of indoor and outdoor air quality in hospitals in India revealed the counts of bacteria higher in ICUs and wards namely the orthopaedic ward, neonatal ward, dialysis ward and post-operative ward beyond the recommended levels. The mere presence of fungi in hospital air was a matter of great concern as many spores can be released leading to an incidence of HAIs and occupational infections. Noteworthy is the finding that the high counts were influenced by the activity of ventilation provided.

Sick Building Syndrome (SBS)

The issue of improving air quality in buildings has previously been mainly related to SBS. It is a situation in which

Measurement of bacterial load in the air before and after installation of PureAir system



occupants of a building experience linked to time spent in the building with no specific illness. Symptoms of SBS are acute discomfort, headaches, dizziness, eye, nose, throat irritation, dry cough, itchy skin, nausea etc. Recently many researchers have worked on SBS issue and its effect on office workers and noticed that SBS is not linked to the type of ventilation or air conditioning system used but it is more likely to be a function of how well system are installed, managed and operated. Therefore Operation & Maintenance of HVAC systems in hospitals are more critical than other buildings.

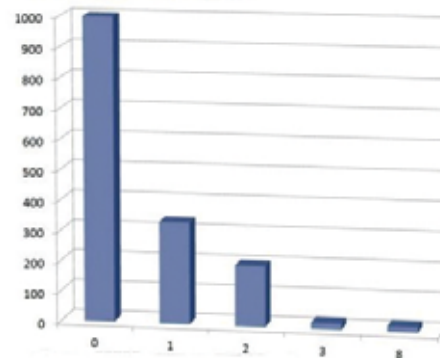
Active Ionisation technology to improve IAQ

Active Ionisation technology has an elevated anti-bacterial power and is proven to be active on pollen, fine dust, toner, mould, smog, viruses, bacteria and tobacco smoke. These contaminants, according to their size, can enter the body and damage certain organs. Among the most dangerous airborne substances we find Legionella, a very topical problem that causes millions of deaths every year. With Evergen's Active Ionisation air cleaners, this problem is eliminated as pollen, dust mites, fungus and other contaminants are captured and inactivated.

The technology is extremely efficient and is proven at removing 98-99 per cent of:

- Airborne bacteria, such as *Micrococcus luteus*;

Reduction of moulds inside an environment cleaned by PureAir System



Operating hours of the PureAir System

Operating hours of the PureAir System	0	1	2	3	5
CFU Moulds	1000	335	200	20	18

- Yeast, such as *Rhodotorula rubra*;
- *Bacillus Anthracis*;
- Moulds and germs present in the natural spectrum of air.
- Maintaining the Humidity Levels

The heating, ventilation and air conditioning systems of buildings and their components, as well as sanitary equipment, can nurture and amplify the diffusion of airborne substances. Among these, *Staphylococcus Aureus* and *Legionella* are seen as particularly dangerous. The first cases of legionellosis were in fact attributed to airborne substances containing bacteria from cooling towers, evaporative condensers or humidification sections of the air handling units of AC systems. Infections are also caused by contamination of water supply networks, sanitary appliances, oxygen therapy equipment, fountains and ultrasonic humidifiers.

Conclusion

Hospitals are the backbone of healthcare delivery system in India; this again highlights that maintaining a healthy IAQ and demands immediate attention of hospital authorities towards taking the necessary measures to maintain a sound and healthy atmosphere for the patients, healthcare workers and others. ■

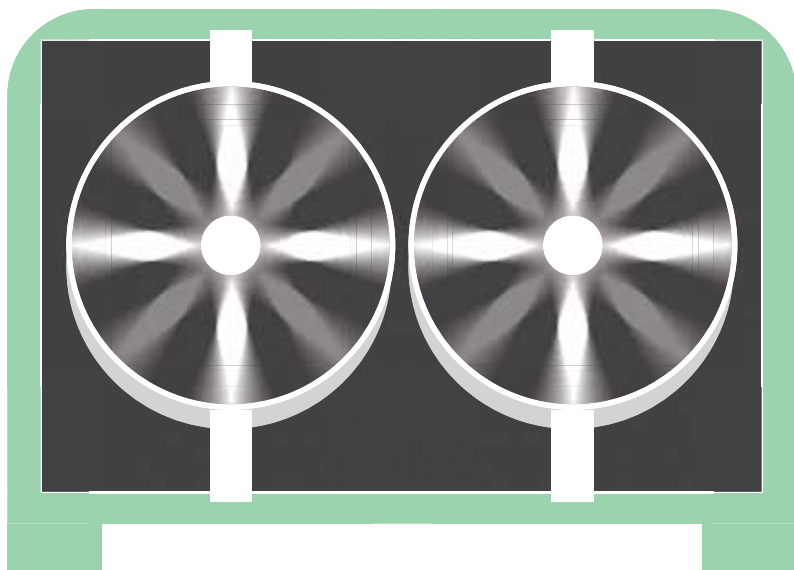
GBS Sodhi

Director & Country Head India,
Evergen Systems India Pvt. Ltd



Asia-Pacific (APAC) Chiller Market to Grow at CAGR of 5.4% by 2024

Application areas such as hospitals, small factories, retail stores, and hotels are registering the adoption of water-cooled screw chillers which are cost effective as well as environment friendly.



According to Prescient & Strategic (P&S) Intelligence Market report The Asia-Pacific (APAC) chiller market was estimated to value at USD 3.6 billion in 2018, and is predicted to register a CAGR of 5.4 per cent during 2019-2024. Growing popularity of absorption chiller in response to higher adoption of solar energy was one of the major trends being exhibited in the market.

Based on chiller type, the market is segmented into centrifugal, screw, scroll, absorption, and reciprocating; wherein screw chiller market was estimated to contribute to the largest revenue share in 2018. Application areas such as hospitals, small factories, retail stores, and hotels are registering the adoption of water-cooled screw chillers which are cost effective as well as environment friendly. In APAC, China registered the highest consumption of these chillers in 2018, where the government is focusing on cutting down HCFC refrigerants, to a more environment friendly HFC based refrigerant, R-134a. On account of this, several companies engaged in the production of chillers that are focusing on developing R-134a refrigerant based chillers.

APAC Screw Chiller Market

Based on end-user, the market is categorised into industrial, commercial, and residential; wherein commercial end-user category was estimated to hold the largest market share in 2018, buoyed by growing demand from transportation and hospitality sectors. Moreover, though residential application for chillers are extremely rare due to low TR

requirements of residential end-user application; however, during the forecast period, residential category is poised to register a growth rate of 6.2 per cent, buoyed by growth in district cooling, driven by collective demand for cooling from apartment buildings and luxury homes. During 2013-2017, China's residential construction industry recorded a growth rate of over 15%, underpinned by rising urbanisation.

Asia-Pacific Chiller Market Dynamics

Driver

Increasing infrastructure spending in APAC countries such as China and India is supporting the growth of Asia-Pacific chiller market. In India, there are several infrastructural projects such as metro rail, and airports that are in the pipeline. For instance, in 15 Indian cities, there are more metro rail projects that are under various stages of implementation. Further, in 2017, the Government of India is planning to construct around 100 new airports including expansions in the next 15 years; of these, 70 would be constructed at new locations in India.

In addition, aviation industry is registering rapid growth in China, year-over-year (YoY). According to the International Air Transport Association, China would be the world's largest aviation market by 2022. As per Civil Aviation Administration of China (CAAC), China built 27 new airports between 2014 to 2017. Further, in 2017, China is planning to construct 74 new civil airports by 2020. Chillers are installed at metro stations and airports to keep temperature cool.

Opportunity

Growing demand for energy efficient cooling systems, including chillers would create opportunities for market players in APAC region, during forecast period. The demand for these systems is expected to derive mainly from developing countries such as China and India, which are focusing on developing energy efficiency programs to conserve energy. For instance, in 2017, the Government of India, and Asian Development Bank signed a USD 200 million loan agreement aimed to expand the market for energy efficient technologies and reduce greenhouse gas emission.

APAC Commercial Chiller Market

Trend

Absorption chiller is trending in Asia-Pacific chiller market,

buoyed by increasing demand for cost effective cooling systems. In absorption chiller, as the cooling process is driven by the condensation and evaporation of water, it consumes less electricity. In this chiller type, energy comes from waste heat, such as steam from industrial processes or heat generated from solar panels. In addition, absorption chiller offers vibration free operation along with low operational and maintenance cost. Furthermore, as absorption chiller emits less pollutants, and toxic gases, it is also eco-friendly as compared to the other cooling systems.

Restraints

Alternative cooling technologies like variable refrigerant flow (VRF) is likely to hinder the growth of Asia-Pacific chiller market. VRF systems are capable of providing simultaneous heating and cooling during the same mode of operation. In addition, VRF systems are easy to install, and need fewer connections, thus, installation cost of VRF systems are low. Further, as VRF systems transfer energy from cooling zones to heating zones of the building, these systems are more energy efficient than systems that use air or water.

Value Chain Analysis

Asia-Pacific Chiller Market Competitive Landscape

There is high presence of competition in the Asia-Pacific chiller market; primarily due to the presence of large number of global and regional players. Daikin Industries, Johnson Controls International, United Technologies Corporation, Midea Group, and Ingersoll-Rand are the leading players in the market. Companies like Johnson Controls International PLC, is focusing on one of the fastest growing chiller categories that is centrifugal compressor. Recently in 2018, the company introduced YORK YZ magnetic bearing centrifugal chiller. The company claims it to be the most energy efficient low-global warming potential (GWP) line of centrifugal chillers with energy savings of up to 35 per cent annually. It operates at a minimum temperature of 40°F with condenser water.

Some of the major players in the Asia-Pacific chiller market includes Johnson Controls International, Ingersoll-Rand, United Technologies Corporation, Daikin Industries, Mitsubishi Electric Corporation, Smardt Chiller Group, Multistack LLC, Thermax Limited, Thermal Care, and Midea Group. ■

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Integrated Systems for Smart Healthcare

With lives often literally on the line, healthcare buildings demand the highest levels of HVAC customization and control.

Integrating the various hospital sub-systems like heating, ventilation and air-conditioning (HVAC), fire safety, air quality, security, nurse call system, hospital management system so that they work together offers many benefits. The benefits include reducing energy usage, improving hospital operations, complying with hospital building codes and process, improving patient comfort and safety, as well as saving lives.

Airflow regulation as an example

Take healthy airflow as another example. It is not just a reserve of the realms of comfort. Instead, it becomes crucial in ensuring both the safe and speedy recovery of patients, as well as minimising the risk of airborne contaminants spreading from patients to visitors and staff. Both rely on keeping pressure measurements to within a 0.01 degree of accuracy to ensure that rooms

are set up such that nothing can enter or escape unintentionally – no small engineering feat.

While investment in HVAC has always been a top priority in healthcare, major outbreaks not too long ago – including MERS, Zika and Ebola – have cast a spotlight on the industry's susceptibility to crises, and the need to improve facilities. On a day-to-day basis, surgical site infections still account for about 30 per cent of all healthcare acquired infections, costing hospitals and facilities huge losses every year.

As our awareness of the importance of airflow increases, our global standards for healthcare, quite rightly, get stricter. India's Ministry of Health and Family Welfare has outlined the Airborne Infection Isolation Precautions, a set of strict guidelines to reduce the risk of airborne transmission of infectious agents, including specific regulations for room set-ups.

More granular and precise control

In response, the industry has innovated and enhanced its technologies to allow for more nuanced and integrated control of airflow in a building, and faster speed of response. Johnson Control's Triatek healthcare systems, for instance, allows for hypersensitive and subtle control of air pressures within a healthcare building. This marks major progress from as recently as a decade ago, where the capabilities of systems in healthcare facilities were typically limited to differential controls. Today, we have since progressed to give critical environment building managers full control over spaces in a building, incorporating temperature, humidity and basic demand control with CO2 models.

Take for example a patient suffering from AIDS, who would be more susceptible to infection. In this case, more air has to



flow out of the room than in to ensure nothing enters the space. By contrast, in a room housing a tuberculosis patient, airflow has to be negative, with more air flowing in so that the illness doesn't escape into the facility. In laboratories, where there is a need to ensure that conditions are perfectly consistent throughout, a perfect balance of incoming and outgoing airflow has to be set up for the success of experiments. This involves careful control of temperature, humidity, and pressure. The array of customised settings extends to pharmacies, chemotherapy rooms, and even lavatories!

Untapped Potential

For many hospitals, the design usually starts from individual systems, which are built separately. There will be some interactions and coordination between systems, but there is usually no unified planning. Individual systems either are integrated or simply operate independently, and must be coordinated manually. Hence a unified, central design, is very important.

As a master system integrator,

Johnson Controls has helped many complex healthcare facilities globally improve operational and building efficiencies as well as patient outcomes through a unified, central design. There is certainly a lot of untapped potential in India for many reasons ranging from lack of awareness to lack of resources. The improvements can be tremendous with the technologies that are now available and advancing rapidly.

Data-driven analytics

Integrating cloud-based systems for data analysis is one area with tremendous potential. The collection of data from disparate institutions can be computed and analysed in a remote location, ultimately to inform decision making which improves energy and cost efficiencies.

Of course, as with any solution that requires data collection, cloud-enabled building management in healthcare facilities and critical environments remains in its infancy as we address safety and privacy concerns. However, as awareness of these issues grows, technology partners

can be expected to bring a fleet of products that are secure-by-design, as cybersecurity becomes a competitive advantage. While activities and operations such as localised controlling of actuators and sensors have to be strictly done at a local level, the potential of leveraging the cloud to identify cost savings is vast, and should not be ignored.

In an industry as tumultuous and unpredictable as healthcare, institutions have to proactively continue to invest in advancements that will improve the safety and well-being of the people within the institutions. At the same time, building solutions providers will have to channel more investments towards solutions catered to the healthcare sector, to stay competitive amidst rapid growth opportunities. ■

Prasun Talukdar
Director – Key Verticals and
Strategic Projects,
Johnson Controls





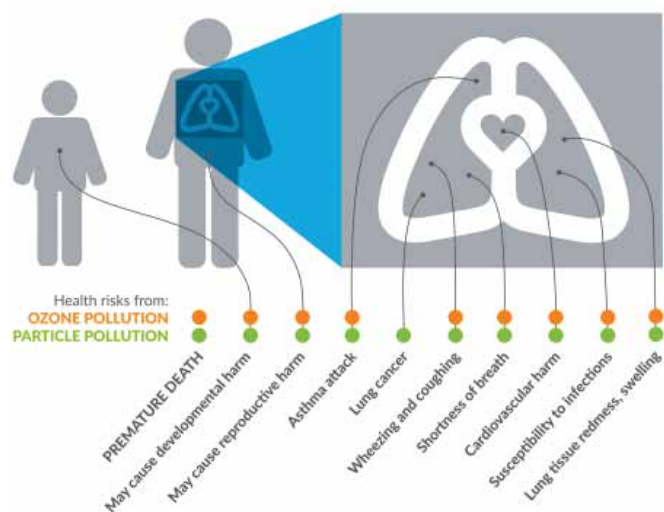
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Importance of maintaining IAQ in hospitals

Healthcare is the basic need which can be achieved from hospitals and clinics. This article shares about how to maintain IAQ in hospitals.

Hospitals play an important role in our society i.e. to ensure good health and vitality of the members of the community. The bad air quality in hospitals, however, can unexpectedly lead to new illnesses and poor health of the visitors and patients.

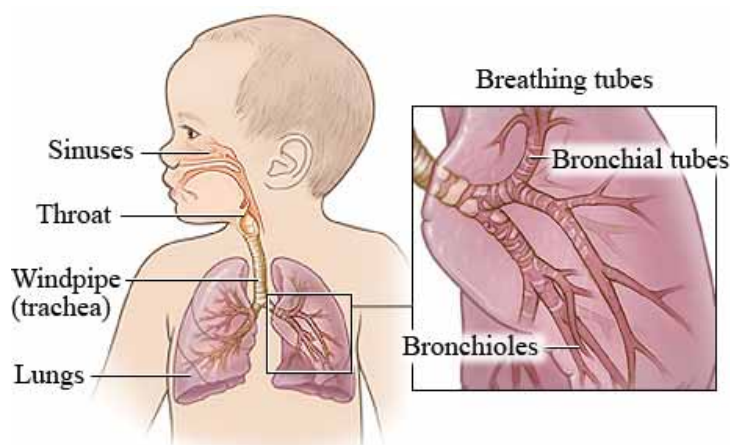
While air pollution is a serious problem in developing countries, it gains even more importance in healthcare settings. In **Air pollution remains a major danger to the health of children and adults.**



major Indian cities, such as Delhi, the air quality is quite pronounced and its effects disturbing. Everyone remembers the dreadful incident in November 2017, famously known as Great smog of Delhi, when the PM2.5 and PM10 hit 999 micrograms per cubic meter, more than 10 times over the safe limits. In hospitals, the repercussions of exposure to poor air quality are much more aggravated.

On top of the pollution load from the environment, hospitals generate a lot of airborne microbial pollution, so much so that 1.7 million people per year get an infection during their hospital visit. According to WHO, of every 100 hospitalised patients at any given time, seven in developed and ten in developing countries will acquire at least one health care-associated infection. Healthcare associated infections (HAIs) are a widely recognised bane and kill more people each year than breast and prostate cancer combined. Thus, it is imperative for hospitals to take appropriate measures to provide their visitors an environment that is safe and healthy.

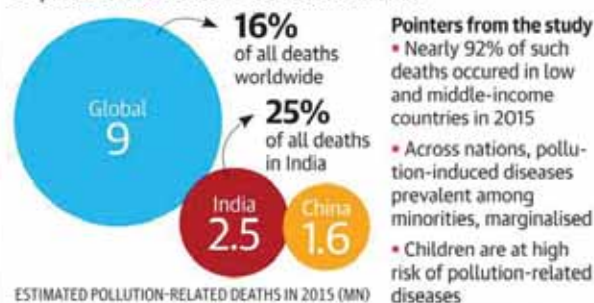
There are numerous steps that hospitals must take to maintain clean air in the facility, free from airborne infectious diseases and respiratory illness causing dust particles. First, the facility track the air quality in different locations, including the common waiting area, wards, ICU, ERs, etc. through the use of appropriate



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Every breath we take

Pollution is the biggest environmental cause of premature death according to a Lancet study. In absolute numbers, India surpassed all countries in such deaths in 2015

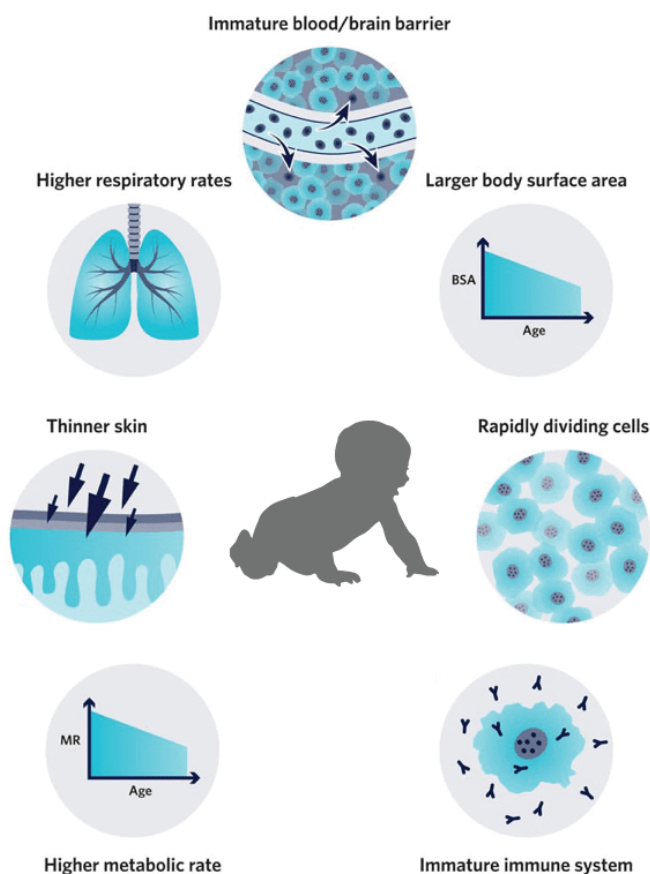


SOURCE: THE LANCET COMMISSION ON POLLUTION AND HEALTH

air quality sensors and conduct regular air quality tests. To protect the visitors and healthcare workers, the overall air distribution must be sanitised and purified, the fine particulate matter and the airborne microbials must be removed. Due to the massive size of typical facilities, standalone air purifiers cannot work and a central air cleaning approach needs to be taken. The challenge with traditional HEPA (High-Efficiency Particulate Absorber) or MERV filters is that although they capture dust effectively, they are in turn a secondary source of pollution. Since these filters only capture dust and bacteria, harmful microbials actually accumulate and proliferate on their surfaces, increasing the risk of these microbes being present in the air. Instead central air cleaning type (MCAC),

electromagnetic filters must be applied that not only capture tiny dust particles with high efficiency but also kill all microbials on the surface on the filters. These can have up to MERV 15 dust removal efficiency and proven kill rates of 99 per cent on E. Coli. UVGI (Ultraviolet Germicidal) and PCO (Photocatalytic Oxidation) are also known to deactivate and destroy bacteria and viruses upon exposure. Depending on certain critical applications for microbial control, these technologies can be applied. In operation theaters that have hazardous biological waste, HEPA filters must be used to stop the propagation of biomedical waste in the air stream. These extremely high efficiency filters must be applied and replaced frequently to ensure no diseases can spread to and from the OT room.

Hospitals are locations that host people who are most susceptible to diseases. They have patients undergoing treatments and operations, pregnant women, newborn children, elderly seeking care – all who have a lowered immunity. A UNICEF study published recently found that 17 million babies suffer air six times more toxic than the guidelines. Considering this, it is essential for new and existing hospitals to take steps to maintain a good air quality in their premises based on sensing and monitoring. Adopting the recommended strategies, some hospitals and companies have already successfully combated air pollution. The central air cleaning solutions provided by Magneto Cleantech have been applied at scale at several national hospitals, including PGIMER, Chandigarh which has an air volume of 3,76,000 CFM with 68 air handling units. Magneto is also working with the Amrita Hospital in Faridabad with 2000 beds to provide a clean indoor environment 24x7. Since HAI is a massive global issue and India is the tuberculosis capital of the world, healthcare centers such as hospitals, clinics, and nursing homes across India must take appropriate steps to improve the air quality in their facilities, ensuring the sustained well-being of our society. ■



Himanshu Agarwal
CEO & Founder
Magneto CleanTech



Seawater Cools Copenhagen City



Two district cooling centrals in Copenhagen use seawater from Copenhagen Harbor for their cooling systems. For seven years, VLT drives controlling pumps and compressors have proven their worth, ensuring high efficiency and impressive security of supply.

Comfort, process cooling, and freezers

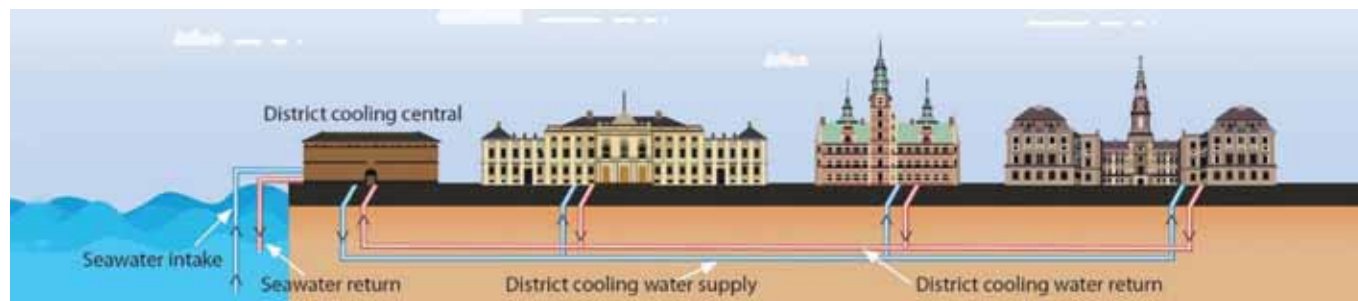
In chilly northern Europe, the need for cooling systems is not obvious to all. Nonetheless, there is a demand for cooling even in the frosty winter time. The Greater Copenhagen Utility (HOFOR) operates the seawater-based district cooling, which serves a wide variety of commercial customers. Business developer at HOFOR District Cooling, Admir Omeragic explains that 50 per cent of his customers use district cooling for comfort cooling, 40 per cent are using it for process cooling and 10 per cent for freezing facilities. This means that around half of the district cooling capacity is used to maintain a comfortable indoor climate in offices, shops and other places where many people share facilities. The 40% used for process cooling applies to server rooms, processing facilities or hospital equipment.

How seawater cools the city

The two district cooling centrals have a combined capacity of around 65 MW. During the winter, when seawater temperature is below 5.2 degree C, the system pumps sea water through a heat exchanger and the treated water on the output is sent out to customers as free cooling. During the warmer months of the year, the passive seawater cooling is combined with active compressor cooling. HOFOR pumps 6 degree C cooling water out to the end users and 6 degree C water is returned.

Customers save money, space and hassle

District cooling customers in Copenhagen enjoy multiple benefits – it costs less, it takes up less space and it makes no noise. “We are getting a lot of feedback from customers who are so happy to have got rid of their noisy roof-top chillers. And customers who have replaced their old air-conditioning facility with the much smaller receiver setup can now put the freed-up space to better use,” says Admir Omeragic, Business developer at HOFOR District Cooling.





Admir Omeragic Business developer at HOFOR District Cooling

The large numbers of VLT drives employed to control the pumps and compressors in the district cooling plant contribute to reducing CO2 emissions by more than 3000 tons per year.

Drives regulate pumps and compressors

An important contributor to the high efficiency of the district cooling system is the choice of high-power VLT drives to adjust the flow of all the main pumps to meet the changing cooling need.

The refrigeration compressor capacity is speed-controlled with high-power VLT drives and the HVAC system in the building uses some smaller Danfoss drives.



Contributing to high energy efficiency in HOFOR's district cooling facilities, VLT drives also ensure an impressively high security of supply of 9.9803 per cent.

"Right from the beginning we chose to go with quality products from Danfoss in our facilities and we have never regretted that. It was easier for us to get an overview over the specifications and, on all parameters, such as maintenance, standards, efficiency and running costs, they have turned out to be optimal. We have had no problems whatsoever, even during this extremely hot summer we've just had, where everything has been running at full power, everything has worked perfectly," says Admir Omeragic. ■



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World's first LEED Zero Building

A rooftop solar array and onsite constructed wetland have helped the Petinelli headquarters, housed in a converted warehouse, to achieve net-zero energy and water. Petinelli Platinum used to be the ultimate LEED rating but not anymore. A new program, LEED Zero, asks project teams to show a year's worth of data proving zero impact in at least one of four categories: energy, carbon, water, or waste. The U.S. Green Building Council (USGBC) has now awarded its first LEED Zero certification, for net-zero energy, to engineering and consulting firm Petinelli for its headquarters in the Brazilian city of Curitiba.



"We've been bugging USGBC about net-zero energy for a while now," commented Guido Petinelli, Managing Director at the firm. Petinelli immediately jumped at the chance to certify its headquarters, which has been net-positive energy for more than a year and also recently achieved Platinum under LEED v4 for Existing Buildings: Operations and Maintenance (O+M) using the Arc platform. The building itself is a converted two-story warehouse, roughly 4,700 feet, originally built in the 1980s. A 15kW rooftop solar array provides 25 per cent more energy than is needed to operate 25-person office space. ■

Italy's First Sustainable City in Europe

Savona was awarded LEED gold through the LEED for Cities program, according to the US Green Building Council (USGBC) and Green Business Certification Inc. (GBCI), the organisation that certifies LEED green building projects globally

"We are proud to be recognised as Europe's first LEED city," said Mayor Ilaria Caprioglio of Savona. "Our commitment is toward shaping a sustainable and resilient urban environment and a safe and equitable society. We believe that LEED for Cities is the instrument to grow awareness about cities' actual performance." LEED for Cities provides cities with a framework for measuring and managing



the performance of water consumption, energy use, human experience, waste and transportation. The University of Genoa Savona Campus developed a state-of-the-art smart polygeneration microgrid combined with a smart energy building. These strategies inspired city officials to set appropriate low-carbon initiatives that will be instrumental in driving the whole

city's transformation into a low-impact urban center. When it comes to human experience, the city seeks to guarantee the safety and health of its inhabitants through such tactics as high air-quality standards that reduce risky conditions for the most sensitive population groups and mitigate urban pollution. ■

Organic and Sustainable Winery in Marche

The Filodivino project began to take shape in 2014 with the production of Verdicchio dei Castelli di Jesi and Lacrima di Morro d'Alba grapes by four friends who shared a passion for the Marche region and its wine.

The goal of the members was immediately to enhance the beauty of the place without while respecting the environment and the ecosystem, that's why, in addition to following organic farming directives, the materials used for all the buildings are reclaimed or recycled. The materials have been sourced locally to further minimise the environmental impact and to enhance the territory in which



Filodivino is immersed.

It was, therefore, important to find a HVAC system that would be able to satisfy the actual needs of the winery while maintaining high efficiency. A Climaveneta branded bespoke solution comprised of 1 Integra NECS-CQ/B/S multi-purpose 4-pipe heat pump and 1 NECS-C/B chiller, was deemed ideal. Integra units can simultaneously provide cooling and heating demands based on

actual load requirement, where any type of hot and cold combination can be met. Since the demand for cooling is greater than that of heating, the NECS-C air cooled chiller, which is highly efficient at partial loads, was supplied to complete the HVAC system. ■

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Typical case study data of a 1200 TR Chiller

Sr. No.	Parameter	Cooling Tower (Induced Draft)	LTMCS
1	Wet Bulb Temperature	29°C	29°C
2	Chilled Water Temp in °C (Assumed)	5°C	5°C
3	Supply Temp. from CT / LTMCS	33°C	30°C
4	Approach to WBT	4°C	1°C
5	ΔT for Chiller	28°C	25°C
6	Chilled Water Compressor Motor Kw for 1200 TR	720	643
7	Energy Saved in %	-	10.7%
8	Energy Saved in Kw	-	77 Kw/Hr
9	Total Running Hours per Annum	8640	8640
10	TOTAL POWER SAVED PER ANNUM	-	6,65,280 Kw



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