Vol.16 No.1 August 2020 ₹ 100

Cooling India

India's foremost Monthly dedicated to the growth of HVACR Industry

ECO-FRIENDLY VARIANTS TO PROPEL REFRIGERANTS BAZAAR

A Chary Publication®

Publisher's Letter

Business Operations to 'New Normal'!

This pandemic is one big wave far from getting over. There is no question that it will permanently change all businesses going forward, as there is a lot of economic uncertainty. Just to cite, most of our office staff works from home now, because of safety concerns of coming in contact with other people or on way to office. The focus on the health and safety of employees will continue to be the priority in our publication house as usual.

Though familiar routines of our daily life tossed out of window, one good thing that happened positive towards environment is - levels of air pollutants and warming gases over some cities and regions are showing significant drops as coronavirus scare impacted industries function and travel. Emissions of the planet-heating gas CO_2 have also fallen sharply. In my opinion, refrigeration industry also needs to ensure that HVACR systems being designed for effectiveness and efficiency must include the latest technologies from a hygienic and safety point of view.

At the outset, we thank all the authors for contributing articles to your own publication bringing knowledge of refrigeration and HVAC industry for our readers. Also, we at Chary Publications are attending webinars, other online and networking sessions, thus providing the industry with latest content. This July-August 2020 issue presents its readers with broad coverage on air purifier, cold chain, refrigerants in the changing environment and other interresting topics.

The COVID-19 pandemic shut down many 'non-essential' businesses for several months, but this did not include supermarkets and other food retailers, most of which were busier than ever. Now life is getting back to normal, or rather, a 'new normal', as the pandemic teaching has forever changed the ways how businesses will operate, adapting to healthy and safety precautions, new processes and regulations. To put simply, now it's becoming obligatory to adopt digital competence and healthier physical distancing, as the distant looks uncertain and market players need to redesign their strategies.

Please do write to me with your inputs to serve you in the best possible ways at pravita@charypublications.in

Pravita Iyer
Publisher & Director

Directors
Mahadevan Iyer
Pravita Iyer

Publisher
Pravita Iyer
pravita@charypublications.in

Editor-in-Chief
Mahadevan Iyer
miyer@charypublications.in

Editor
Gopal Krishna Anand
gopal@charypublications.in

Commercial Director
Pravita Iyer
pravita@charypublications.in

Sales and Marketing Executive
Smit Kubadia
advt@coolingindia.in

Editorial Assistant
Abegail D'mello
abegail@charypublications.in

Design
Sachin Parbalkar
Jebas Thangadurai

Design Concept
Abegail D'mello

Accounts
Dattakumar Barge
accounts@charypublications.in

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

Chary Publications Pvt. Ltd.
906, The Corporate Park, Plot 14 & 15,
Sector - 18, Vashi, Navi Mumbai - 400 703.
Phone: 022 27777170 / 71

coolingindiamagazine
coolingindia
coolingmagazine

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.

Editor: Mahadevan Iyer

ENCON

Manufacturers & Exporters of Energy Saving E-Glass Epoxy FRP Fans & High Efficiency Cooling Tower

- Cooling Towers
- AHU
- Air Fin Coolers
- Radiators
- Man Coolers
- Man Coolers
- Exhaust Systems
- HT Motor Coolers
- Air Cooled Condensers
- Mines Ventilation
- Withering Trough
- Kiln Shell
- P&V Systems
- Humidification Towers
- Transformer Coolers

✓ **Mfg. Range:**
2' to 63' dia

✓ **Guaranteed Energy Savings:**
Minimum 15% to 30%

Head Office:
2&3, Ashirwad,
N. C. Kelkar Road, Dadar (West),
Mumbai 400 028. India.
Tel.: 91 22 2437 2949 / 2430 6578
Fax: 91 22 2431 0992 / 2432 1929
Email: enconindia@vsnl.com
encon@encongroup.in
Website: www.encongroup.in
www.recondoctpl.com

EDITOR'S NOTE

Anything Can Happen In Believing …

A fresh culture and a naïve paradigm are emerging during long-lasting pandemic wave, albeit on an optimistic note. The virus, compatible with all weather conditions is a shared- challenge globally, pushing the humanity into isolation and insecurity.

People are embracing new behaviour model as social distancing, virtual over physical, remote access, webs and online engagements as future tool for interaction and activity. Digitalisation - now a need has enveloped us. Potentially, the downturn in country's economic and manufacturing sectors demands a new definition of 'adaptability' to be creative and resilient in the face of new situations.

A whole new concept is coming into being as the market is changing. The mobility has taken a hit, production graphs have declined and people prefer online purchases. The things are getting expensive but marketing competitiveness, surging with new wave stands to grow. Work force inculcates a new habit; becoming conscious about more hygienic ways, washing hands every two hours, on the lighter side of it! What do we have to look forward clearly!

The current situation stresses the importance of having good, effective ventilation in a building that is paramount to dilute the concentration of airborne contaminants, if any. Simply, R&D focus inclines to new ideas as retrofits, creating energy efficient products as cooling devices are crucial to human health. In calling for a switch to energy- efficient cooling, the government in consultation with BEE, mandated a default temperature of 24°C instead of the standard 20-21°C, for all brands and types of AC units made or sold from the start of this year. The measures specify new set of thermal control technology.

Primarily, opportunity lies on intervention of technology in ways of doing; safety and comfort to meet changing times post 'unlockdown'. The lockdown has shown that people can do anything for sustained living, if they have to believe in happenings. To meet that reality, the HVACR industry needs to explore manifold options such as what kind of demand is convincing, to provide new insights, carve out innovative strategies etc., with an objective lending to bustling activity in a gradual unlocking phase leading to 'new normal'. Perceptibly, market is perpetuating to a new order.

Do feel to write us on industry insights and inputs you think will enhance industry knowledge.

Write me at gopal@charypublications.in

Gopal Krishna Anand
Editor

DISTRICT HEATING AND HEAT INTERFACE UNIT

HIUs evolved technologically and trend is in line with development of the concept of 5th generation DTH unit

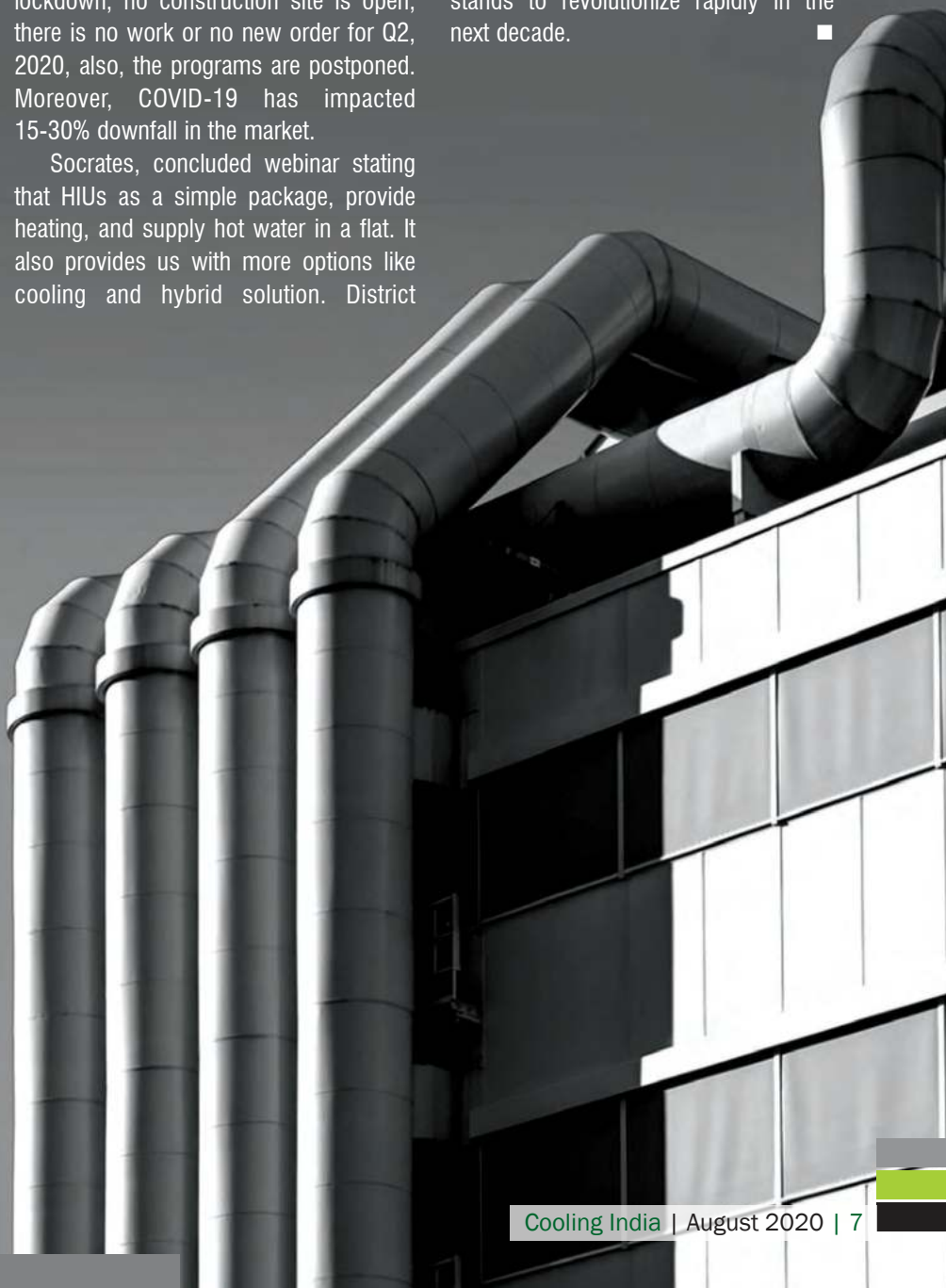
Just in July, a webinar was organised by BSRIA on "District Heating and Heat Interface Unit Review." The webinar opened with introduction by **Socrates Christidis, BSRIA Research Manager, Heating & Renewables**, being the panel spokesperson highlighting the key ingredients about HIU history, market status, and size saying: European HIUs market reached some 300 thousand units in 2019. The discussion revolved upon District Heating and Cooling (DHC) networks; fifth generation of DTH unit (dekatherm), and the ramification as to how COVID-19 affected the HIU market.

Socrates Christidis gave details about the emerging challenges like, climate crisis, urbanisation, green gas emission, poorly insulated existing homes, banning of domestic boiler, increased demand and COVID-19, etc. He emphasised upon changes that need to happen and lot of tough decisions to be made for our future. Christidis explained, HIU is a packaged set of components necessary to connect a consumer's heating and cooling unit or hot water system to the heat network. It links in to a district or communal heat network in place of boiler, which is suitable for future of low carbon buildings.

Speaking on benefits, he said, HIUs are usually installed with heat meters, giving both flat owners and occupiers the advantage of being able to control their heating use and to have precise information about the amount of heat used, hence the right billing. Today Heat Interface Units (HIUs) are sold in many European countries. They offer advantages over individual gas boilers as they do not require annual gas inspections. They can be installed with any source of heating, including renewable heating sources.

He highlighted, HIU types available are cooling only, heating and cooling and hybrid. District heating and cooling is one of the three pathways for decarbonisation of heating viz., electrification, green gas, DHC. Also, there is no fix definition for 5th generation DTH. However, demand driven and low temperatures are two main pointers. He observed, because of the lockdown, no construction site is open; there is no work or no new order for Q2, 2020, also, the programs are postponed. Moreover, COVID-19 has impacted 15-30% downfall in the market.

Socrates, concluded webinar stating that HIUs as a simple package, provide heating, and supply hot water in a flat. It also provides us with more options like cooling and hybrid solution. District heating and cooling is growing and developing but conventional source will still be in use for high temperature networks. He opined COVID-19 is a short term threat. The diversification of product offering will keep HIUs as relevant, as heating and cooling market stands to revolutionize rapidly in the next decade. ■



Contents

Vol. 16 No. 01 | August 2020

INSIDE

SECTIONS

Carrier Midea names Sanjay Mahajan as MD

Sanjay Mahajan, Chief operating officer, Carrier Midea takes over from Krishan Sachdev, who had been Managing Director since the company's establishment. Sachdev will continue as chairman and is expected to take a key role in growing Carrier's global residential consumer HVAC business.

Sanjay Mahajan joined Carrier as a director of its parts business Totaline, progressing to director of residential and light commercial sales. He joined the Carrier Midea India joint venture as vice-president of sales and marketing on its foundation. The Carrier Midea India joint venture operates from a 14,000m2 plant in Bawal, Haryana, about 60km from Gurgaon. ■

CSE says, country needs to focus on energy efficient cooling

Delhi based think-tank, Centre for Science and Environment, has been advocating for sustainable building and cities in India. The country must design its buildings and cities for thermal comfort and work to minimise the use of mechanical cooling systems, according to CSE. The production of room ACs grew by 13 per cent every year since 2010, with demand expected to grow at 11 to 15% per year between 2017 and 2027, according to the Union Ministry of Power.

Since January, Union government has mandated 24°C as the default temperature for ACs. This mandate is part of new energy performance standards. India's Bureau of Energy Efficiency, needs to revisit, revive and expand its star rating system for all designated consumers, especially buildings. Air conditioning sector growth also is responsible for increasing its contribution to greenhouse gas emissions, further warming planet. Moreover, energy-efficient cooling can help avoid equivalent to 460 billion tonnes of greenhouse gases added to the atmosphere. ■

Grundfos India in collaboration with 'Hand in Hand India' restores a pond in Chennai

Photo by Armando Ixcoy on Unsplash

Grundfos India completed restoration of the Injambakkam pond in Chennai. The pond is situated off the ECR road and is spread across 2.5 acres of land. Realizing the importance of renewing local water sources, Grundfos India has been working on restoring this pond since 2018 in a phased manner along with local NGOs and the community. In the third phase of restoration, the company has collaborated with 'Hand in Hand India', a leading nonprofit organization to clear the pond's bed, strengthen the bund and build fences and plantation around the water body.

Saravanan Paneer Selvam, General Manager, Grundfos India, said, "Water is at the core of everything we do at Grundfos. Through such initiatives, we hope to revive water bodies in the city and empower local communities to be involved. Our employees have also been closely involved in this initiative through their volunteering efforts."

Dr. Kalpana Sankar, Chairperson and Managing Trustee - Hand in Hand India, added, "We at 'Hand In Hand India' are happy to have partnered with Grundfos India, a company that clearly understands water. 1000 people live in and around this pond and they will be positively impacted by the restoration. Besides establishing a committee to maintain the pond, Grundfos India along with 'Hand In Hand India' has created a three-year plan to work closely with the community members to create a self-sustaining pond through the creation of herbal, vegetable garden and fishery." ■

DriExpress and Empire Holdings assets acquired by Resolute Industrial

Resolute Industrial Holdings, LLC, announced to have acquired the assets of DriExpress, LLC and Empire Holdings, LLC, two specialty HVAC&R equipment rental and logistical support businesses primarily serving the emergency and restoration services market. Resolute is a portfolio company of AE Industrial Partners, LP, a private equity firm specializing in Aerospace, Defense & Government Services, Power Generation, and Specialty Industrial markets.

Mike McGraw, CEO, Resolute said, "DriExpress and Empire strongly complement our growing rental fleet and service offerings, allowing us to better serve our customers. With this acquisition of over 5,000 assets, we have expanded our rental division to include Mobile DRI – Disaster Resource Solutions, while increasing our geographic coverage and specific expertise in a fragmented and rapidly evolving restoration services industry. We welcome William and his team, who are incredible additions to our Company."

William Leo, Owner, Empire Holdings said, "Joining Resolute is an exciting next step for our customers and employees. With access to Resolute's financial and operational resources and support, we look forward to continuing our track record of growth and customer excellence. We are pleased to share a bright future with our new team."

Pete Miko, Owner, DriExpress said, "We're proud to become part of Resolute, a longstanding industry leader in temporary climate control and power solutions, and we look forward to enhancing Resolute's offerings with our team's experience in disaster restoration and storm work support."

Daikin on expansion mode; planning a third factory in India

Photo by Kyle Williams on Unsplash

Daikin plans for a third factory in India to support its existing plants in Neemrana, Rajasthan. Reports of the additional plant have now resurfaced following news of Daikin's plans to expand its business in Africa.

Daikin is said to be ready to take advantage of Indian government manufacturing incentives to set up a third manufacturing plant in South India, the exact location of which is expected to be revealed shortly. The Japanese manufacturer established an office in Nairobi, Kenya, at the end of last year and recently revealed details of plans to enter the market in Tanzania in a collaboration deal with fellow Japanese IoT company, Wassha.

In addition to supplying the African markets, the new Indian factory will also provide additional capacity for the domestic market. ■

US Customs clamps down import of HFC refrigerants from India

Photo by Mick Haupt on Unsplash

The US Department of Commerce has announced an affirmative preliminary anti-dumping duty circumvention ruling involving exports of the refrigerant blends R404A, R407A, R407C, R410A, R507A from China, that is processed in India using both Chinese and Indian components, and then it is exported to the United States. This action circumvents the anti-dumping order imposed in 2016 on imports of HFC blends from China. The Department of Commerce also announced an affirmative preliminary anti-dumping duty circumvention ruling involving exports of R32, R125, R143a from China for further processing into blends in the United States.

US Customs and Border Protection has been instructed to suspend liquidation and to require a cash deposit of estimated duties on unliquidated entries of HFC blends from India which contain components from China and on unliquidated entries of HFC components R32, R125, and R143a from China.

This means that duty payments may be back-dated to recent shipments. Duties paid at the time of entry into the US are referred to as "deposits" because they are not considered customs' final assessment of duties owed. Generally, the shipment remains "unliquidated" for 314 days after the date of entry.

The applicable cash deposit rate for HFC blends from India, blended with Chinese HFC components will be 216.37%. For HFC components from China, the Department of Commerce says, it will instruct customs to collect cash deposits under those rates prevailing at the time of entry, depending upon the exporter in question. ■

Blue Star raises Rs. 350 Cr through unsecured Non-Convertible Debentures issue

Photo by Jason Briscoe on Unsplash

Blue Star Limited, India's premier air conditioning and commercial refrigeration player have raised Rs. 350 crores through a private placement of Non-onvertible Debentures (NCDs). The NCDs will be listed on the Wholesale Debt Market of National Stock Exchange of India Limited (NSE). NCDs are unsecured and carry a coupon rate of 7.65% with a tenure of three years along with a call option at the end of two years with the company stake for half of the NCD amount. The proceeds from the issue shall be primarily utilised for financing working capital, and for repayment of existing short term borrowings and business liabilities.

Vir S. Advani, Vice Chairman & Managing Director, Blue Star said,"The business environment has been quite challenging and we are thankful to the NCD investors for reposing trust and confidence in Blue Star despite unpredictable times. The NCD funds will infuse sufficient liquidity into the company and will also provide resilience and necessary financial strength to our balance sheet in the long-term. We expect that as the Government permits economic activities to resume, consumer demand will revive in due course. It is therefore important for us to remain prepared with adequate funding to execute our growth strategy." ■

KNF launches a series of pumps for industrial applications

The KNFs, new N 630 diaphragm vacuum and compressor pump series provides durability with cost-efficiency and delivers on high pressure and gas tightness. Four versions are available for use in industrial coolant systems, gas recycling, gas and emissions measurement/analysis, and leak detection across a wide variety of industries, from chemical processing and energy to physics research. The company's new N 630 diaphragm vacuum/compressor pump series with long service life, vacuum down to 0.74 inHg (25 mbar abs), positive pressure up to 174 psig (12 bar rel), and a flow rate up to 2.4 CFM (68 L/min), in the N 630 series offers - impressive, highly versatile performance. The cost-efficient and reliable diaphragm gas pumps are available in four variants: either one- or two-headed and connected in series or parallel, as a vacuum pump, or as a compressor. All models come with long-lasting EPDM or chemically resistant PTFE-coated diaphragms for exceptional durability and service life.

The N 630 series handles temperatures down to 41 °F (5 °C), and headwater cooling systems make them suitable for use at ambient temperatures up to 140 °F (60 °C). The N 630 pump series is particularly well-suited for applications in helium cooling, valuable gas recovery/recycling, measurement and transfer of explosive gases, and pressure boosting for biogas/natural gas engines. Other applications include emissions measurement and flue gas analysis, LNG QC, and gas leak detection. ■

SPX Cooling Technologies introduces Marley BasinGard Filter for Cooling Towers

Photo by Álvaro Bernal on Unsplash

SPX Cooling Technologies Inc., in designing and manufacture of evaporative cooling towers and air-cooled heat exchangers, introduces the 'Marley BasinGard Filter' as part of its 'MarleyGard Water Management' and 'Tower Protection Tools', for new and existing factory-assembled, crossflow cooling towers. The 'BasinGard Filter' maintains the cooling tower's hot water basin flow by capturing mineral scale, pipe rust, fibers and debris.

Using a stainless steel grid to provide stability and hold the filter into place, the patent-pending nylon 'BasinGard Filter' is infused with silver-based biocide, offering antimicrobial benefits to help maintain cooling tower hygiene. Because it ensures a free flow of water to the nozzles – even with up to 75% heavy debris blockage – the 'BasinGard Filter' reduces the risk of basin overflow, guards against premature component replacement and helps maintain cooling tower performance. It also provides twice the clog resistance of a hot water basin without a 'BasinGard Filter'.

The 'BasinGard Filter' captures debris #4 mesh or larger and withstands harsh cooling tower environments. To help sustain microbial properties, the 'BasinGard Filter' is replaceable. It is also easy to install and reduces maintenance and cleaning costs, as the filter helps prevent debris from reaching other components downstream, including cooling tower fill, pump impellers and heat exchangers. ■

LG appears in US EPA's Top 30 list of green power users

LG Electronics, USA, has been nominated to the U.S. Environmental Protection Agency's Top 30 list of the largest green power users among technology and telecommunications partners within the EPA's Green Power Partnership. LG appears on the Top 30 Tech and Telecom list, following the company's purchase of 17,000 megawatt-hours of renewable electricity in 2019 – representing 80% of the electricity for U.S office, laboratory and warehouse operations. Renewable energy was an important carbon reduction tool for the company, in meeting its 2020 goal, to reduce greenhouse gas emissions by 50%, a year. **James Critchfield, Program Manager, EPA's Green Power Partnership**, said,"EPA applauds LG for its commitment to using green power and for taking a leadership position on the environment. LG is helping to reduce greenhouse gas emissions and providing an excellent example for other businesses to invest in environmental progress."

LG now has set its sight on the next-generation goal to achieve carbon neutrality by 2030. The company will strive to reach net-zero emissions through measures such as highly energy-efficient buildings, renewable energy, fleet electrification, and carbon offset projects that encourage the development and adoption of a low-carbon lifestyle. ■

Carel intends healthy environment; launches a brand new healthcare Website

Carel draws focus to Indoor Air Quality (IAQ) and launches a new website devoted to healthcare. **Stefano Ruzzon, Group Head of Sales, HVAC Projects and Dealers**, said, "Our goal is to help spread awareness on the positive relationship between relative humidity control and people's health. Through this new website, we intend to disseminate knowledge that contributes to the creation of healthy environments, to prevent infections, increasing productivity and ensuring the comfort of patients and staff." Ruzzon added, the healthcare website is designed primarily for consultants who need a reliable educational tool before identifying solutions for healthcare facilities, that are highly efficient and easy to install and maintain. At the same time, however, we hope that this site can also be a useful tool for end-users, a source of valuable information regarding the impact of relative humidity on how healthy their work environment is! ■

New England Fuel Institute renamed as National Energy & Fuels Institute

NEFI, the trade association formerly known as New England Fuel Institute, has changed its name to the National Energy & Fuels Institute. The new name will reflect the services and essential products provided in Washington as well as the organization's mission and the leadership role, the company said via a press release. **Sean Cota, President and CEO, NEFI**, said,"NEFI has served these mostly small main street family businesses since it was founded in 1942, and that will never change. What has changed is the essential role they play in the clean-energy economy; and their need for a single, unified national voice to promote their interests."

At a summit organized by NEFI last September in Providence, Rhode Island, more than 300 industry stakeholders from across the Northeast unanimously adopted a resolution to dramatically reduce the industry's greenhouse gas emissions. The 'Providence Resolution' promises to cut greenhouse gas emissions by 40% from heating oil by 2030 and deliver net-zero liquid heating fuel to consumers by 2050. The resolution has been adopted by every state and local heating oil association in the Northeast. ■

Chillventa eSpecial goes virtual from 13 to 15 October 2020!

For the first time in the form of a virtual event, between 13 and 15 October this year, Chillventa eSpecial will be held. It will offer the international refrigeration, air-conditioning, ventilation and heat pump community, three days of industry knowledge, dialogue and innovation. As the world's leading exhibition for refrigeration technology, it will carry the spirit and drive of the event over to the digital world. As usual, participants at the Chillventa eSpecial will be able to establish contacts, cultivate their networks, share knowledge, and discuss new products, projects and developments in the sector. Here, too, the focus will be on the theme of "Chillventa Connecting Experts". ■

Bradford White launches new feature in eF120 series water heaters

Bradford White Water Heaters, manufacturer of commercial, residential and industrial water heating and storage applications, announces launch of a new feature within the American-made line of eF120 series commercial gas water heaters. The eF120 product line now incorporates BMS and modulation technology for remote monitoring capability and increased fuel efficiency.

Louise Prader, Senior Director-Product Management, Bradford White said,"We developed the new eF120 series in response to the changing market for commercial water heaters. Modulation and BMS are quickly becoming the standard. For industries that have a high demand for hot water, from manufacturing and construction to education, hospitality and healthcare, the efficiency and improved fuel utilization provided by modulation can make a big difference in a small amount of time. And the option to connect Bradford White products into a building-wide network of mechanical and electrical systems improves efficiency, reduces response times and limits the risk of equipment failure."

The eF120 series' modulation technology allows users to match burner output to variations in heating demand. Using sensors, electronic controls, variable speed blowers and algorithms, the heater maintains a higher constant temperature in order to respond quickly and efficiently to water draw. This modulation uses less energy and reduces mechanical wear compared to traditional heating tank systems.

BMS capability allows users to integrate a water heater into an automated system that controls and monitors electrical, communications, security and other systems. Within a BMS network, building and facilities teams can remotely monitor essential functions and more efficiently manage maintenance and repairs. ■

VaCom Technologies to provide expert insights to customers directly

VaCom sees a high demand for energy-saving industrial refrigeration and growth potential in India. Hence, VaCom will provide its expertise directly to customers in the large subcontinent.

Participants from India, Germany and USA attended the virtual opening ceremony.
Standing left side of screen: Gianni Parlanti, BITZER Chief Sales and Marketing Officer and Member of the Executive Board.
Upper row (L to R): Harvinder Bhatia, Managing Director BITZER and VaCom India; Pranav Godbole, Head of Energy Efficiency Projects VaCom India and Matt Lish, Managing Director VaCom Technologies.
Lower row (L to R): Doug Scott, President VaCom Technologies; Paul Conlon, President BITZER US and Trevor Bellon, Energy Modeling and Consulting Department Manager VaCom.
Standing right side of screen: Rainer Große-Kracht, BITZER Chief Technology Officer and Member of the Executive Board.

VaCom Technologies, a member of the BITZER Group, specialises in the complete development, financial analysis, performance and energy monitoring for industrial refrigeration control systems within the food and beverage and cold chain logistics markets. It has delivered more energy efficiency incentives (more than USD 92M to over 600 facilities) than any other industrial refrigeration control systems company in North America.

Gianni Parlanti, Chief Sales and Marketing Officer and Member of the Executive Board, BITZER stated, "At BITZER, it is our steady aim to strengthen the energy efficiency of our customers' systems and to support the use of low-GWP refrigerants. It is beyond doubt that the Indian market is rapidly evolving in this respect. This is where VaCom comes in with their proven expertise in industrial refrigeration controls and energy efficiency solutions."

Matt Lish, Managing Director, VaCom Technologies underlines, "The need for energy efficiency is growing in parallel with India's burgeoning cold chain and refrigerated food production industries. We are excited to bring our industry-leading, energy-efficient refrigeration control systems and Energy Dashboard Performance Monitoring services to the Indian market. With the formation of this new local company, we are looking forward to offering equivalent, unparalleled support to both North American as well as Indian cold storage and food processing companies as they too expand their operations across both markets."

Harvinder Bhatia, Managing Director, BITZER and VaCom India said, "The Indian market will be shaped by energy-efficient solutions in the future, seeing that the costs for high-GWP refrigerants are rising. VaCom's approaches are ideal for a populous country like India, where the transition to sustainable, intelligent technologies is a high priority due to the significant environmental impact. We look forward to supporting the Indian food processing and cold storage markets improve energy efficiency, performance and safety of their systems and operations." ■

Pandemic Intensifies Challenge

ECO-FRIENDLY VARIANTS TO PROPEL REFRIGERANTS BAZAAR

Economic slowdowns impelled by unrestrained global spread of pandemic, dealt a harsh blow, hampered growth and challenged production capacities in just about every business. Manufacturers got on facing issues associated with refrigerant raw materials supply and climate change. The switching demands reflected in pricing and availability influencing refrigerants market.

-Content presented by Gopal Anand, Editor.

Things are getting a bit furry in such times! The climate change concerns and environmental regulations; ozone layer challenges and GWP values, are containing global refrigerants market growth. The growing concern pertains to ecology dangers caused by HCFC refrigerants, which triggers their phasing out the world over. This intensifies the opportunity for alternative refrigerant blends and variants growth. Market players are becoming more attentive to climate friendly atmosphere. Consequently, the regulations to go 'Green' accelerate market demand for natural refrigerants. More likely, energy efficiency, cost factor and eco-friendly nature of hydrocarbons will influence all-inclusive refrigerants' demand in the near future. Presently, with easing lockdown, refrigerant market will continue its moderate growth in the post-lockdown 'New Normal' times.

Trends driving refrigerants market growth

In essence, emergence of energy-efficient systems, consumer electronics growth, rising demand for domestic air conditioning and demand for energy-efficient technology as well, are among few trends driving the refrigerants global market. All the more, global warming awareness is boosting demand for eco-friendly variants.

The enormity of refrigeration market trend lies in expansions of cold chain network. The increase in requirement of deep freezers and refrigerators by cold chain market also augments demand for refrigerants in the food and beverage industry. Air conditioning industry, automotive air conditioning, split ACs, as well as increasing use of VRF systems are the latest trends contributing to the growth of this market. Featuring in COVID-19 times - food retail chains, online markets coupled with rise in consumption of packaged and frozen foods etc., are other upcoming trends boosting refrigerants demand. The surge in manufacturing activity and demand for improved maintenance of industrial equipment factors will further enlarge the market.

Countries phasing out HCFCs are concreting opportunity to create demand for HFCs. The chief advantage of HFCs over chlorofluorocarbons is - they are non-reactive with environment even upon direct exposure; are non-flammable, recyclable, energy efficient, less toxic, and chemically stable. Halocarbons, specifically fluorocarbon refrigerants commercialised as 'Freons', so far dominated the market followed by hydrocarbons. The inorganic refrigerant and HFOs occupied lesser volume by percentage. Nonetheless, increasing demand for 'bio-based refrigerants' seems plausible for market growth in the future.

Eco-friendly refrigerants

So to say, the refrigerant usage should have safety, health and protection standards for living beings. Eco-friendly refrigerants such as low GWP HFOs R-1234yf, ammonia, R-1234ze, and hydrocarbons are replacing chlorofluorocarbon applications. OE car manufacturers moving to R-1234yf with GWP four value refrigerant in their vehicle AC systems. When designing a refrigeration system, ammonia, hydrocarbons, carbon dioxide, air (as in air-conditioning of aircraft), and even water (in applications above freezing point) are emerging among the several refrigerants from which to choose from. The safe use of hydrocarbons rests in system that requires smaller charge. For instance it's the dominant refrigerant for refrigerators, ice and vending machines. Hydrocarbons, like isobutane (R600a) and propane (R290) are a few of the eco-friendly refrigerants with zero ODP, low GWP benefits and stated to be highly efficient. "Earth friendly refrigerants, increased efficiency and reliability of refrigeration systems and equipment through the length and breadth of the cold chain network must continue to be a priority among the technical community. Energy efficient systems will benefit the world by reducing the amount of CO_2 produced, which reduces the potential for climate change and the amount of energy consumed – thereby positively impacting both the environmental and economic costs associated with the refrigeration industry," comments, **Ravichandran Purushothaman, President, Danfoss India** on 'World Refrigeration Day'.

Demand of refrigerants in emerging economies

Today, eco-friendly refrigerants are used across the world penetrating Asia-Pacific, Europe, Latin America, Middle East & Africa and North America regions. Asia Pacific is serving most of the demand of refrigerants for this region's rapidly growing construction, infrastructure, automotive industries, rising population and disposable income. The market for refrigerants during forecast 2020-2025 is expected to grow at a **CAGR of > 3%** as per **Mordor Intelligence report**. The global 'natural refrigerants' market is projected to reach **USD 2.88 billion by 2027** according to **Reports and Data** research agency. The market is estimated to be powered by the increasing demand for natural refrigerants concerning the adverse effects on environment created by the flux of HCFC and HFC based refrigerants. However, owing to unsettling pandemic, hurly-burly international trade, and unfavourable geopolitical affairs, the growth rate may slow down or speed up considering improved conditions in the future.

These days, the consumer's changing preference has put focus on health and hygienic food products, including organics foods that require cold storages. Packaged frozen foods are also becoming popular. And, the refrigeration appliances are becoming household necessities because of usage of ready-to-eat packed food, thus lending to market growth. Digital emergence and industrialization in economies such as India, China and Japan have led to the establishment of a large number of data centers fuelling demand for refrigerants in this region consistently.

Manufacturers operating in market

As known, global refrigerants market is consolidated. The top five major players accounting for a decent share in the market comprise, **Honeywell International Inc., The Chemours Company, Mexichem SAB de CV, Arkema Group and The Linde Group**. Other key players include Daikin Industries Ltd, Sinochem Group Co. Ltd, Messer Group, and Navin Fluorine International Limited, among others in the highly fragmented market. Many of these players are engaged in extensive R&D and developing innovative refrigerants, as regulations & compliances set by governing bodies around the world obligates the discontinuation of many harmful refrigerants.

Prioritizing the natural refrigerants will benefit the direct emissions saving and is the best way forward. The norms require vendors working on mixtures of gases to focus upon energy efficiency, climate change and health of general public worldwide as the prime most concern in post-pandemic times.

"As the world faces a reset moment from the COVID-19 pandemic, it's clear that cooling for all is necessary to recover better. We must accelerate access to energy-efficient cooling solutions that will protect people against the immediate public health and safety concerns caused by the pandemic, as well as support long-term economic recovery,"says **Damilola Ogunbiyi, CEO and Special Representative of UN Secretary General for Sustainable Energy for All and Co-Chair of UN-Energy.**

Furthermore, UNIDO also is currently developing a modelling tool that allows manufacturers to estimate the cooling and energy efficiency of refrigeration systems in different setups during the design phase, for the domestic and commercial refrigerator manufacturing sector as an environmental initiative.

Reduction of GHG emissions

Comprehensively, selection of suitable refrigerant has become one of the most important concerns as chemical refrigerants are potent greenhouse gases that contribute to climate change. Refrigerant discharge always happens: be it during maintenance, accidents or leakages. EU has enacted legislation evolving with the climate and energy strategy, also known as the '20-20-20 targets' which includes a 20% reduction in greenhouse gas emissions by the year 2020. Desire to reduce GHG emissions has prompted development and application of alternative system designs, which employ secondary refrigerants as well as natural refrigerants such as CO2, ammonia and hydrocarbons. Underwriters Laboratories (UL) test protocols establish safety standards in the unlikely event of a refrigerant leak and most likely, it would not certify a refrigerant they deemed dangerous.

A new ITU standard- L.1470 highlights, that compliance with 'Paris Agreement' will require Information and Communication Technology (ICT) industry to reduce GHG emissions by 45% from 2020 to 2030, to meet the UNFCCC Paris Agreement's goal - of limiting global warming to 1.5^{0}C above pre-industrial levels. Signatories to 'Kigali Amendment', including India, have agreed to reduce the production and use of climate-warming refrigerant gases which have potential to avoid as much as 0.4^{0}C of global warming by 2100 through this step alone.

Conclusively, the outlook concerns that bad effects of specific refrigerants to the environment is severe. Hence, it seems that growing awareness among manufacturers will fall for developing energy-efficient cooling systems, coursing the growth of eco-friendly refrigerants. The digital technologies such as IoTs, machine learning and autonomous mobile robots continue to advance in the refrigeration systems for monitoring and control, generating data and graphs for better analysis, and customising refrigerant variants, suitable to refrigeration systems. Clearly, the cleaner future majorly belongs to hydrocarbon systems.

Inclusive of energy efficient approach, eco-friendly variant happens to be a major factor driving growth of global refrigerants bazaar, continuing its moderate growth with easing lockdown.Amid, all said above and beyond, the emergence from pandemic indulgence together with climate friendly focus should lead to a different and better new normal world to propel growth all around. ■

Global cold chain monitoring market forecasts – an upward trend

The cold chain monitoring market size is expected to grow from USD 4.6 billion in 2020 to USD 8.2 billion by 2025 at a CAGR of 12.5% during forecast period 2020 to 2025 according to report by MarketsandMarkets. Increasing demand for temperature-sensitive drugs, rising demand for better food quality, intensifying need to reduce food wastage, growing demand for generic drugs owing to higher accessibility, and surging government focus on increasing the supply chain efficiency of the fast-growing pharmaceuticals sector in Europe and North America, are some of the major factors driving the growth of the cold chain monitoring market.

Cold chain monitoring market for software to grow at a higher CAGR during forecast period

The market for software is expected to grow at a higher CAGR during the forecast period. Recently, the demand for cold chain monitoring software solutions, such as reporting, data analytics, and tracking software, has increased considerably. Software provides the ability to uninterruptedly monitor the performance of cold chains in real time and ensures adherence to guidelines set by regulatory agencies, such as the Food & Drug Administration (FDA) and the World Health Organization (WHO).

Food & beverages applications to register high CAGR

The market for food & beverages applications is expected to capture the highest CAGR during the forecast period. This growth is driven mainly by the growing demand for high-quality food products on a global scale. Additionally, with rapid urbanization in many parts of the world, there has been an increase in the number of fast-food chains, where food quality and the timely delivery of resources are of paramount importance. Furthermore, rising awareness regarding the importance of food quality, safety, and the nutritional value of food is driving growth of the cold chain monitoring market for the food & beverages application.

APAC to be fastest-growing market for cold chain monitoring solutions

APAC is expected to be the fastest-growing market for cold chain monitoring solutions. The growth of the market in APAC is driven by rising demand for high-quality food products and growing initiatives of the governments in emerging economies to bring maximum people under the modern healthcare umbrella. Additionally, increasing government funding towards logistics infrastructure development, and penetration of warehouses management systems are other major factors, which will favor growth of the market during the forecast period.

However, decline in trade and industrial activities across APAC due to the COVID-19 pandemic is likely to affect the cold chain monitoring market. This is happening on account of shutdown of the manufacturing activities in China, South Korea, and India. ■

Source: www.marketsandmarkets.com

Mitsubishi Electric offers diverse range in Heating, Cooling, ventilation & Hygiene products in India. In an exclusive e-interview with Cooling india (CI), Neeraj Gupta, Senior Sales Manager, Mitshubishi Electric, replies the questions sent by Gopal Anand, Editor, CI, sharing views that e-Commerce emerges as a challenge during pandemic creating an impending market shift towards modified approach. Excerpts ...

"WE BELIEVE IN CUSTOMIZED PRODUCT DEVELOPMENT ..."

What is your perspective about the HVAC market in India and Mitsubishi Electric's contribution to this sector?

HVAC systems are the major pillars to build the modern infrastructure. They have been formed to become the major requirement for any industrial, commercial and residential use. The rapid urbanization is the main factor for the rising HVAC market in India. The demand for the HVAC will only rise in the upcoming years as growth in retail, hospitality and commercial sectors is significantly boosting the sector with ease of installation and less space consumption.

Mitsubishi Electric's commercial and residential air-conditioning systems have earned a global reputation for a higher standard of performance, uncompromising reliability and cost-saving energy efficiency. At the leading-edge of air conditioner innovation, we provide greater comfort to customers while minimizing environmental impact. Our USP is offering Integrated Air Conditioning solutions to control indoor air conditions at a diverse range of facilities. We believe in customized product development to meet various clients across the globe.

Could you detail the diverse product range available in cooling and heating segment as well as the company's market penetration?

Mitsubishi Electric offer diverse range in heating, cooling, ventilation & hygiene products in India, like Splits (Both Heating & Cooling Type & also Inverter and Fix speed type), inverter & fix speed products in cassettes, ceiling concealed & floor standing type, City-Multi VRF Systems, Lossnay ventilation systems, Air Curtain & Jet Towels.

Mitsubishi Electric comes with an energy efficient Inverter Heat Pump range of air conditioner "MSZ-HP" series known best for the hottest summer day and the coldest winter nights. These ACs, unlike the normal ones, reverse the direction of refrigerant flow by using electrically operated Reverse valves/4way Valve. It makes the inside evaporator of the ACs hot, while keeping the outside condenser cold instead of hot, whenever the thermostat is set to heat. Heat pump type of splits under MSZ-HP Series comes with 5 Star BEE Rating. Another advantage of MSZ-HP AC is that it will provide you with floor space, which is restricted in case of heating equipment, thereby, giving you multiple options to use that free space.

Because of its high quality, superior technology & maintaining global standards in installation & after sales service, Mitsubishi Electric is always counted as top-notch premium AC brand in India. We are one of the youngest brands in the country with just 10 year history of direct operations, but able to make our presence felt across India with presence in all Tier-I & Tier-II cities and now expanding in remote locations through distribution network. We currently operate through 20 offices, 25 resident operations, 5 Training Centre, 26 Warehouses & over 2500 POS.

Most of the consumers who invest in Mitsubishi Electric ACs are the ones, who have already experienced air conditioners from at least one other brand & are looking for improved product & service experience.

What are the features of your new Warranty scheme on Air Conditioners amidst Pandemic Lockdown?

The Air Conditioning Industry has witnessed a sudden downturn during the prevailing pandemic conditions. We are taking prominent measures to support our dealers, customers, service engineers, and trainers while keeping safety as our priority. The New Warranty Scheme is our approach to support our customers in such tough conditions and continue our relationship with trust and confidence in our product and services. Therefore, effective from 1st April 2020, we are offering a 10 Year compressor warranty scheme on the entire range of Inverter and non-inverter type of room air-conditioners (RAC only). Additionally, 5 (1+4) years Controller / PCB warranty on the entire range of inverter and non-inverter type of room air-conditioners (RAC only) with no hidden charges for customer.

What strategies your company is adopting to strengthen its foothold while dealing with COVID pandemic, which has dented businesses and production all around?

The lockdown was announced during the peak season for the AC industry. Thanks to our loyal customers, highly efficient & reliable products, good stock availability & efficient service, we could minimize the impact of lockdown & hopefully will recover soon in the coming months. We used the lockdown period to enhance skill-set through special online training to dealer staff on measures for installation work, technical, product-related issues under Covid-19 situations. Currently, our dealer network is executing new installations smoothly and efficiently. We were able to liquidate most of the inventories in record time and now, we are maintaining stock and product mix for the remaining season to fulfil any sudden demand from a customer. While accomplishing all these tasks, we made sure to gain customer trust with usage of PPE Kits, sanitizer, protection gears like a mask, gloves, headcover and shoe covers, to create topmost hygiene at customer place. We have a strong belief and categorize our customers and employee's health & safety as our top priority.

FY20-21 is a special year and needs extra care to surpass the adversity and grow stronger than before. Hence, we have placed our strategies in line with the market dynamics and believe that we will adequately manage the COVID-19 pandemic and come out stronger than before.

Do you perceive a market shift from the pre-pandemic scenario globally and conceiving a modified approach towards the products and services provided in terms of HVAC applications?

COVID-19 has created a lot of awareness among consumers and manufacturers, like, there are lots of unseen external environmental factors that need attention. We believe, there will be a market shift towards modified approach, as it is time of survival for the fittest. Due to lack of footfall, retail channel has been severely affected, as customer does not like to visit stores so often now. However, E- commerce has gained its charm, customers are ready to buy air conditioners through direct company portals to have trusted products, with installation and service are well taken care by trained dealer network. Mitsubishi Electric has also modified its website, now customer can easily get connected with our dealer network and dealer can provide optimum solution to customer requirement.

Pandemic has given a new dimension to the way we work at site & the focus is now on the health, safety & hygiene of not only the engineers & technical staff but even the work force doing installation job. I think it will be a major differentiator and manufacturers & dealers will take it very seriously from now onwards.

Could you elaborate on the need to optimize energy efficiency - a rising concern to conserve energy and protect the global environment through carbon-reduction measures?

India being a developing country, requires a lot of energy to build infrastructure. Generating power is always expensive, rather saving is cheaper. Mitsubishi Electric always keep efficiency among one of its top priority. Highly efficient products will save energy, which can be utilized in building infrastructure for present & future. We are always committed toward protecting the nature of the earth. Our AC product line-up in India are available with eco- friendly refrigerant only, i.e. R410 and R32. We have completely stopped using R-22, with high carbon contents from year 2015 onwards. ■

AIR PURIFIERS IN INDIA:

A Largely Untapped Opportunity

The article mentions that air purifier market has a low penetration and is focused on a few cities and high-income households.

Air pollution is the third-largest cause of deaths in India. According to a recent study by Greenpeace India, out of the 30 most polluted cities in the world, 22 cities are in India. Similarly, data from the World Health Organisation (WHO) indicated that 91 per cent of the world's population breathes air that is deemed unsafe.

With the rise in health issues owing to increased air pollution, significant attention was brought up on the quality of indoor air, which led to the creation of the air purifier segment in India. This market has seen unprecedented growth in the past five years with more than 30 players currently competing for market share.

Key Factors Pushing the Market

According to Frost & Sullivan analysis, the rising concern over increasing airborne diseases, improving the quality of life, technological advancement with multiple filtration technologies, and smart city projects are some of the key drivers influencing the air purifier market in India.

Air purifiers are effective in reducing or eliminating smoke, contaminants and other harmful particulates from the atmosphere and improving air quality to make

it breathable. Depending on the number of filters used in each stage, companies market air purifiers as 3/5/7 stage filtration. In the initial stage, the particulate pre-filter removes dust particles in the range of 75 microns; in the next stage, the carbon filter removes odours and harmful gases. In the final stage, with the help of various filters, particles up to 0.1 microns are removed.

There are five different types of filters currently used in air purifiers. The High-Efficiency Particulate Air (HEPA) filter is the most significant type, capable of filtering up to 0.3-0.1 microns at 99.97 per cent efficiency. It helps in filtering harmful particles such as PM 10 (particles less than 10 microns) and PM 2.5 (less than 2.5 microns). Other filters, such as electrostatic-charged plasma, ion ozone, UV, and activated carbon, are less effective and less preferred compared to the HEPA filters.

In India, the use of air purifiers is dominant in the residential segment, predominantly, in metropolitan cities because of the high levels of pollution. Every year, the sale of air purifiers witnesses a spike around Diwali, due to the increased amount of smog created by firecrackers and stubble burning. Air purifier requirements in the commercial space, especially in the closed environment of high-rise office buildings, are on the rise, which is attributed to the rising awareness of employee health and productivity.

Due to variations in lifestyles across regions, there is non-uniform adoption of air purifiers in the country. According to Frost & Sullivan's study - Indian Air Purifiers Market, Forecast to FY23 - the northern region with 54 per cent market share is leading air purifier sales, followed by the western (25 per cent) and southern regions (17 per cent). The remaining 4 per cent is sales in the eastern region. Currently, the adoption of air purifiers is largely seen in metros such as Delhi, Bangalore, Mumbai, and Chennai, as branded participants initially target these markets and then expand to tier-II/III cities. However, there has been some traction in markets such as Kerala, North East, Lucknow and Kanpur, which are not the main target centers for market players.

Indoor air quality is a key parameter, which is directly linked to the health of the occupants of a building. There are international standards and guidelines prescribed by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) and OSHA (Occupational Safety and Health Administration), but India does not have any set standards for indoor air quality. If India sets standards for air quality maintenance, it could drive the demand for air purifiers.

Market Dynamics – Consumer Electronics Brands Entering the Space

The air purifier market is currently estimated at Rs. 580 crore, which is expected to grow at 27 per cent over the next five years as per Frost & Sullivan's study Indian Air Purifiers Market, Forecast to FY23. Philips, Sharp, Kent, Xiaomi, and Eureka Forbes are the key participants with a 65 per cent market revenue contribution. These prominent consumer electronics brands are entering the space to capitalise on the opportunity. Each player comes up with at least four different variants, which are modified and improved upon with new technologies year-on-year.

The increased volume may give rise to local manufacturing in the future. The reduction in the price of air purifiers due to the arrival of Chinese brands and multiple consumer-appliance brands is expected to further boost demand. Certain restraints have led to lower penetration in the market. Adoption of air purifiers is limited to urban centers due to lack of consumer awareness and the preconception that it is still a luxury, not a necessity. Similarly, the filter of the air purifier needs to be changed frequently, incurring high maintenance costs. Some air purifiers are noisy, especially when the fan is kept at a high speed, which makes it uncomfortable to use while sleeping. Many sub-standard products are still sold due to the lack of regulations.

According to Frost & Sullivan's study on Indian Air Purifiers Market, currently, more than 70 per cent of the sales distribution is through retail stores. All of the current key players have a retailer network for a larger reach. Also, distributors have a working relationship with builders, building administrators, and government bodies for project sales. E-commerce, which contributes about 30 per cent, is a fast-growing segment and is expected to boost air purifier sales in the future as consumers shift to online shopping.

Air Purifiers to Gain Prominence

The air purifier market is a largely untapped opportunity, which currently has a low penetration focused on a few cities and high-income households. Air purifier devices in the future are expected to provide multiple smart functions such as operating on Wi-Fi, Bluetooth, and automatic on/off by sensing the quality of air or the number of people in a room. The players must offer additional innovative features to differentiate their products in the market and to garner a larger market share.

Some leading international players emphasise aesthetics and position air purifiers in the luxury segment while other players are concentrating on targeting the masses with economical pricing. With the growing preference for health and lifestyle products and increasing adoption across households, air purifiers are expected to gradually transition from being a seasonal product to an essential household appliance. ■

Manu Tiwari,
Program Manager, Frost & Sullivan.

Arushi Thakur Upadhyay,
Associate Director, Industrial Practice, Frost & Sullivan.

Importance of Refrigeration

Cold Chain and Food Supply Chain Industry

Refrigeration plays an important role is preservation, reduction in losses by means of storage in the required temperature, processing, packaging, transportation, supply & distribution, wholesale and retail sales. However, refrigeration is also vital to ensure food safety which is paramount, and is required to maintain the right temperature.

Photo by Markus Spiske on Unsplash

Refrigeration and cold chain are inter-linked and directly related, whereby refrigeration plays an important and vital role in the food industry as a whole, especially keeping in mind the relevant issues such as food safety, food hygiene, health and environment as well.

Refrigeration is a part of cold chain and pivotal to food industry, so to say, is part of "Farm to Table" phenomena and is very much necessary for storage, preservation, transportation and distribution of frozen, chilled or food grade materials with ambient temperature, which is also a must in order to control and avoid decomposition, decay and contamination right from the time of produce, storage, transportation, distribution and consumption, as it is directly related to health whereby, it is directly

Image by RENE RAUSCHENBERGER from Pixabay

Image by RiomarBruno from Pixabay

Kiran M.B,
Consultant, Cold Chain, Food Distribution and Supply Chain Transportation Equipment & Refrigeration Systems.

linked to one of the most important aspects of food safety and food hygiene, which is paramount.

The possibility of storing various foods or food related materials depends on the requirement of specified temperatures. If stored under normal internal room temperature conditions without refrigeration; based on the external temperatures, food produce would begin to decompose and decay, depending on the nature of product in question, and its shelf- life would potentially be lost and wasted. Moreover, if not properly stored under the required conditions & temperatures; with the rise in temperature within the storage area, the product, if used for human consumption will cause food poisoning or will have an adverse effect and significant influence on health related issues such as salmonella and so on, which will lead to severe health hazards, so to say, the necessity of cold chain in the food industry is as much necessary for health, as is the refrigeration.

Hence, without proper refrigeration system in place, abundance in production during the time of harvest and processing of foods, and if not stored under required temperature conditions, would render the produce unfit for distribution and human consumption and will end up being dumped in the wastage bins or garbage dumps. This generally happens in the developing or under developed countries where the food wastage and losses are huge, in the absence of required infrastructure such as, temperature controlled warehouses and cold storages with frozen and chilled temperatures systems for meat products, dairy products and fresh vegetables and fruits respectively, complimented and supported by Refrigerated Transport Systems and Structured Logistical Systems in place. Refrigeration and controlled temperatures are a must for food processing companies, such as tinning & canning Industries involved in processing of vegetables, juices, pulps, meat and fishing industry.

Refrigeration is widely applicable and used in food supply chain such as packaging, processing, storage, transportation, waste management, distribution of perishable products that requires further refrigeration during storage and transportation to prevent deterioration of product quality and losses. Hence, the extensive use of refrigerated cold rooms and refrigerated transport systems is widely used in the cold chain and food chain supply industry, where refrigeration plays a pivotal role.

Refrigeration technology has an important role to play in the cold chain and food industry. The technology needs catering to longer shelf-life of the farm fresh dairy products and fresh agricultural products which requires constant specified temperature conditions to be maintained, from time of storage of goods and until the products are transported and delivered to their final destinations.

Refrigeration in the cold chain, food storage, warehousing, supply & distribution industry and most importantly, in the refrigerated transport industry, plays a very significant and an important role in the cold chain industry, in reducing losses of especially perishable foods. Basically, the foods such as fresh vegetables & dairy products from farms are temperature sensitive and are perishable; hence require refrigeration in order to extend their shelf-life and to reduce the risk of food borne Illnesses & diseases, especially in fresh green leafy vegetables. Cold storage is the way forward, wherein refrigeration is a part of it, for safe storage and distribution thereafter, which is also an important means for prevention methodology used to avoid losses and wastage of various food items, for which refrigeration by way of specified and controlled temperatures is a prerequisite.

Conclusively, refrigeration is necessary in order to prevent the formation of mildew, growth of fungus and microbes. It helps extend especially the shelf-life of farm fresh vegetables and fruits, dairy product, poultry and meat products. At the same time, it helps maintain freshness and quality as well. ■

"Focused in developing solutions to address market demands ..."

Embraco has technology for the complete domestic and commercial cold chain with portfolio for special applications also. In an exclusive interaction with Cooling India, he remarks, Covid-19 has temporarily slowed down the industry activity though it has accelerated important trends, such as the digital transformation and the initiatives for a more sustainable future

Esequias Pereira Junior, Senior Sales Manager at Nidec Global Appliance, deals with Embraco brand portfolio for Asia Pacific region.

Could you provide a brief assessment on the Cooling sector in India? What is the market demand like for various cooling solutions? What is the market growth trajectory for the cooling and HVAC&R sector?

Market researches show that the refrigeration market in India has been growing around 13% annually for the last few years. It is a high and rapid growth, that is necessary to provide better infrastructure to the various links of the country's cold chain and, thus, avoid food waste. India is among the world's largest producers of fruits, vegetables, milk, meat, and seafood, but according to numerous sources, 40% of it is lost. One of the reasons for this is the limited cold chain infrastructure. For future, the estimates maintain this perspective of high levels of growth.

In the beginning of 2020, Indian cold chain market was expected to grow at a CAGR of around 15% during 2020-2025, according to the market research agency Report Ocean. We do not know for sure, how these numbers are going to evolve during the Covid-19 pandemic, but as soon as the recovery starts, those are the expectations of growth for the refrigeration sector in India.

Nidec Global Appliance, provides the Indian market our Embraco portfolio of cooling solutions for the whole Indian cold chain, which means solutions for commercial and residential refrigerators, including a big participation in the market of cooling solutions for merchandisers. From our experience with the Indian market, the growth trajectory of the refrigeration sector is driven towards quality, adaptability to voltage fluctuations, competitiveness, sustainability and energy efficiency.

It is a market with a great potential for solutions, and for commercial refrigeration equipment running on natural refrigerant R290, which fits perfectly with our Embraco brand portfolio, because it is a brand that has been a pioneer in developing solutions with natural refrigerants for over 25 years. To better serve the Indian market, we have a local Technical Support and Sales team, partnerships with local laboratories as well as training sessions to customers, about our products and innovations.

Assessing market for refrigerants in India, how do you fare when compared to international market? What is the kind of market demand for refrigerants and solutions?

Considering the international market, so far 98 parties (among them the European Union) have signed the Kigali Amendment, an international agreement established in 2016 to gradually reduce the consumption and production of hydrofluorocarbons (HFCs), which have been widely used as refrigerants in refrigeration during the 1990s and 2000s but have been found to be powerful greenhouse gases.

So, globally, regarding refrigerants the market demand is for alternative options with low global warming potential. In this search for alternatives, natural refrigerants have been considered the best way forward, for a combination of environmental and economic gains. Natural refrigerants have GWP very close to zero and can add around 10% to 15% benefit in energy efficiency, according to the application. Among the natural refrigerants options, hydrocarbons (HCs) R600a and R290 are the main ones for domestic refrigerators and light commercial refrigeration equipment, respectively. India has not signed the Kigali Amendment yet, but the Indian government has been encouraging the refrigeration industry to develop more sustainable solutions, with lower global warming potential (GWP), so we see a great potential for solutions with natural refrigerants in the Indian market.

Additionally, the large global food and beverage brands have already transitioned a big portion, if not all of their refrigeration cabinets to HC (hydrocarbon) refrigerants as a path to reduce their carbon footprint. And, India being a relevant industrial hub has already adjusted to these global needs, opening the door for this kind of solution to the local market. Our portfolio of Embraco cooling solutions for India has a complete range of options in R290 and R600a for the various types of applications in commercial and domestic refrigeration. In addition to this, Embraco is still one of the leaders of the R134a market, delivering reliable and robust solutions, including wide-voltage range compressors. In the long term point of view, we believe that natural refrigerants are the most compliant way to fulfil society's and customer's interests. ■

Part 2 will be continued in next issue of Cooling India.

Image by Steve Buissinne from Pixabay

"INDUSTRY IS NOW MOVING TOWARDS NEW GENERATION REFRIGERANTS ..."

While providing in-depth understanding of refrigerants, Venkatesh B, SBU Head - Absorption Cooling and Heating Business, Thermax Ltd., assesses the HVAC&R sector in India, in comparison to the international market and technological advancement that can help improve energy-efficiency.

Provide a brief assessment of the Cooling sector in India? What is the market growth trajectory for the cooling and HVAC&R sector?

The cooling sector in India was growing rapidly before COVID-19 struck the world. India was among the fastest-growing HVAC markets globally. However, the scene is going to remain subdued owing to reduced demand and issues with supply. Capital availability for new projects is going to be a challenge, many projects are being put on hold owing to unfavourable market scenario. This year would be challenging, even if the investments pick up in the latter part of the year.

Assess the market for refrigerants in India, how do we fare when compared to the international market?

India is yet to mature as a market as far as refrigerants go. EU stands tall among all others in terms of adoption of newer refrigerants. In India, there are no policies or incentives in place for usage of new generation refrigerants or green/natural refrigerants. Such incentives can speed up the adoption and prove win-win for both society and industry.

What are the updates within the industry concerning the refrigeration sector in India?

Awareness of green refrigerants and lower GWP refrigerants is improving. The industry is now moving towards the new generation refrigerants due to the regulations. Cleaner and greener solutions such as absorption chillers and heat pumps are gaining more visibility owing to the drive around waste heat recovery and lowering carbon footprint. Customers are willing to invest in low-grade heat recovery

Photo Designed by macrovector on Freepik

based cooling solutions than five years ago and newer forms of waste heat, which were earlier looked down upon are gaining interest.

Elaborate on technological advancement and the call for energy-efficient solutions, how big is this demand?

The demand for an energy-efficient solution is high, a large portion of the market values this. However, the adoption of energy-efficient solutions is at times hindered by the delta one needs to pay over conventional solutions. Wherever the gap is marginal, customers are opting for energy-efficient solutions. The market is not matured enough to pay a premium for energy-efficient solutions. Many corporates and MNCs do adopt them as they have the policy to reduce carbon footprint and sustainability.

What are the updates concerning policy and regulation around refrigeration? What role can the government play for the future?

India has a golden chance, now that the natural gas price is at a very low level. It presents an opportunity to shift from polluting coal to cleaner natural gas-based power generation. The government should aim at getting into long term purchase agreements, which can help in offering clean energy at an affordable price. Industry stands to gain from this, it will also spur some demand for making this fuel shift. We have in the last decade widened the gas piping network, but the adoption of gas is not widespread owing to price. This can also increase demand for trigeneration, gas-based absorption heat pumps for industrial heating and gas-based cooling using absorption chillers. ■

SUBSCRIPTION RATES

PERIOD	No. of Issues	Print			Digital	Print+Digital	
		By Normal Post	By Registered Parcel	By Courier	By E-mail	By Registered Parcel	By Courier
ELECTRICAL INDIA							
1 YEAR	12	1000.00	1600.00	1800.00	1000.00	2100.00	2300.00
2 YEARS	24	1750.00	2950.00	3350.00	1750.00	3825.00	4225.00
3 YEARS	36	2500.00	4300.00	4900.00	2500.00	5550.00	6150.00
5 YEARS	60	4000.00	7000.00	8000.00	4000.00	9000.00	10000.00
COOLING INDIA							
1 YEAR	12	1000.00	1600.00	1800.00	1000.00	2100.00	2300.00
2 YEARS	24	1750.00	2950.00	3350.00	1750.00	3825.00	4225.00
3 YEARS	36	2500.00	4300.00	4900.00	2500.00	5550.00	6150.00
5 YEARS	60	4000.00	7000.00	8000.00	4000.00	9000.00	10000.00
LIGHTING INDIA							
1 YEAR	6	750.00	1050.00	1250.00	750.00	1425.00	1625.00
2 YEARS	12	1350.00	1950.00	2350.00	1350.00	2625.00	3025.00
3 YEARS	18	2000.00	2900.00	3500.00	2000.00	3900.00	4500.00
5 YEARS	30	3000.00	4500.00	5500.00	3000.00	6000.00	7000.00
MEDICAL EQUIPMENT & AUTOMATION							
1 YEAR	6	750.00	1050.00	1250.00	750.00	1425.00	1625.00
2 YEARS	12	1350.00	1950.00	2350.00	1350.00	2625.00	3025.00
3 YEARS	18	2000.00	2900.00	3500.00	2000.00	3900.00	4500.00
5 YEARS	30	3000.00	4500.00	5500.00	3000.00	6000.00	7000.00
AUTOMATION & ROBOTICS WORLD							
1 YEAR	6	1200.00	1500.00	1700.00	1200.00	1875.00	2075.00
2 YEARS	12	2160.00	2760.00	3160.00	2160.00	3435.00	3835.00
3 YEARS	18	3200.00	4100.00	4700.00	3200.00	5100.00	5700.00
5 YEARS	30	4800.00	6300.00	7300.00	4800.00	7800.00	8800.00

Chary Publications Pvt. Ltd. To Subscribe, visit: www.charypublications.in

Subscription Form

Yes, I would like to subscribe **ELECTRICAL INDIA / COOLING INDIA / LIGHTING INDIA / MEDICAL EQUIPMENT & AUTOMATION / AUTOMATION & ROBOTICS WORLD** for _____ years at Rs. _____. Payment needs to be in favour of "**CHARY PUBLICATIONS PVT LTD**"

Cheque/DD.No	Dated	Drawn On

Preferred mode will be NEFT/RTGS for which the details are as under :-

Account Name: Chary Publications Pvt.Ltd	Account Type : Cash Credit
Account Number : 000930110000085	IFSC Code: BKID0000009
Bank : Bank of India	Branch: Chembur, Mumbai-400071

Name:_____ Designation : _____

Company : _____

Address : _____

City : _____ Pin Code : _____

Email : _____Tel.No._____ Mob.No. _____

Signature : Stamp :

Chary Publications Pvt. Ltd.
905-906, The Corporate Park, Plot No. 14 & 15, Sector 18, Opp. Sanpada Railway Station, Vashi, Navi Mumbai - 400 703
Email: sub@charypublications.in • Contact : 022 27777170 / 171 • Website: www.charypublications.in

FUTURE REFRIGERANT OPTIONS

AN OUTLOOK

This article presents an overview of future refrigerant options in RACHP systems, wherein halogenated refrigerants have been dominating due to their good thermodynamic and thermo physical properties but they have negative environmental impacts. International protocols have restricted their use in existing RACHP systems. Hence, usage of energy efficient and environment friendly natural refrigerants is essential to meet the growing demand.

Most of the small and medium capacity RACHP (refrigeration, air conditioning and heat pump) systems are working on compression refrigeration cycles. The halogenated refrigerants have been widely used in RACHP systems. The environmental impacts due to indirect green house gas emissions because of combustion of fossil fuel for power generation and the direct green house gas emissions due to leakage of refrigerants from vapor compression based RACHP systems, contribute significantly to global warming. Hence, it is essential to identify a long term sustainable replacement to meet the system performance requirements, chemical compatibility, safety and service requirements. The developed countries have already reduced the production and consumption of halogenated refrigerants thus inducing demands for sustainable alternatives. The natural refrigerants with zero ozone depletion potential and negligible global warming potential are considered as long term alternatives. The hydrocarbon refrigerants have flammability issues, which restrict the usage in existing systems. Moreover, the carbon-dioxide is having high operating pressure and low critical temperature, and so has limitations for use in existing RACHP systems. In addition, the refrigerant mixtures provide flexibility in searching environment friendly alternatives to match the required thermodynamic, thermo-physical and chemical properties with existing halogenated refrigerants.

Refrigerant history

The historical transition of refrigerants during last 100 years is shown in Figure 1. During the year 1930, the chlorine based refrigerants such as CFC and HCFC refrigerants were introduced for the use in refrigeration, air conditioning and heat pump applications due to their good thermodynamic and thermo-physical properties. In 1974, Rowland and Molina have identified that the presence of chlorine in CFC and HCFC refrigerants are responsible for ozone depletion and global warming. Montreal protocol 1987 restricts the use of chlorine based refrigerant in RACHP systems. During the year 1990, the hydro-fluro-carbon (HFC) refrigerants such as, R134a, R152a, R404A, R407C, R410A, R507 have been introduced for the use in RACHP systems. The Kyoto protocol 1997 identified six green house gases, which includes HFCs being used as refrigerants. During the year 2010, the hydro-fluoro-olefins (HFO refrigerants) (unsaturated HFC refrigerants) have been introduced, which has very low global warming potential. The HFO refrigerant has low global warming potential due to its short atmospheric life time. The HFO refrigerant gets decomposed and forms tri-fluro-acid, which is more harmful to the aquatic systems. Paris protocol 2016 restricts the use of refrigerants with significant global warming potential. The natural refrigerants are identified as the good alternative to phase-out the halogenated refrigerants in existing RACHP systems.

Properties of refrigerants

Thermodynamic properties such as, critical temperature, critical pressure, freezing point, boiling point and molecular weight of hydrocarbon refrigerants are found to be good compared to the existing halogenated refrigerants. Hence, the replacement of existing halogenated refrigerants with hydrocarbon refrigerants does not require major changes. Further, the thermo physical properties such as, saturation pressure, latent heat, liquid density, thermal conductivity and specific heat in both liquid and vapour phase of hydrocarbon refrigerants are superior than existing halogenated refrigerants. Hence, better performance will be expected with halogenated refrigerants.

The refrigerant compatibility with all the components of the system and with lubricant is essential during refrigerant retrofitting. The hydrocarbon refrigerants are compatible with all the components of the system and also with lubricant using compressors. The hydrocarbon refrigerants are flammable and it is essential to adopt required safety measures in the system while retrofitting. The toxicity of refrigerants are grouped into two levels as A and B, which are lower and higher levels. Similarly,

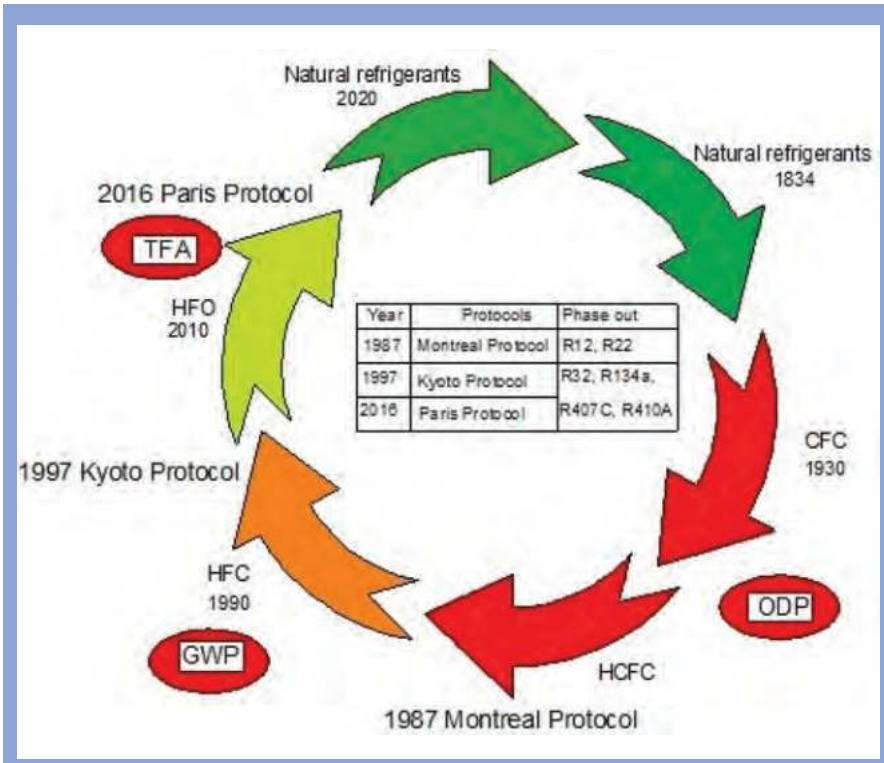


Figure 1: Transition cycle of refrigerants

flammability of refrigerants is categorized by numerical value in the range between 1 and 3. The flammable index of hydrocarbon refrigerants is categorized as A3. The flammable risks of hydrocarbon refrigerants are reduced by blending with HFC refrigerants. The refrigerant should contain extremely low level of impurities. Presence of impurities leads to formation of acids, which will damage the system. The moisture content in the system will freeze and clog the expansion device.

The major environmental impact of halogenated refrigerants are ozone depletion potential and global warming potential. The chlorine atoms released from CFC and HCFC refrigerants act as a catalyst to destroy the stratospheric ozone layer which protects the earth from direct UV rays. More than 90% of the ozone exists in the stratosphere between 10 and 50 km above the earth surface. The RACHP system manufacturers have restricted the use of CFC refrigerants from the year 2000. However, the HCFC refrigerants are still being used in RACHP systems, which were banned from the year 2017. The global warming potential is caused due to release of halogenated refrigerants. The presence of halogenated substance in the atmosphere is capable of absorbing the reflected radiations from the earth surface, which heats up the earth and behaves like a black body radiating energy, which results in enhancement of global temperature.

Limited pure refrigerants have suitable properties and provide alternative to halogenated refrigerants. The refrigerant mixtures provide solutions to this problem. Three types of refrigerant mixtures were used as working fluids: azeotropes, near azeotropes and zeotropes. Azeotropic mixture of the substances is one, which cannot be separated into its components by simple distillation. An azeotrope evaporates and condenses as single substance with properties that are different from those of other constituents. Near azeotropes may alter their composition and properties under leakage conditions. Zetropic mixture does not behave like a single substance when it changes its state. Instead, it evaporates and condenses between two temperatures (temperature glide). Hydrocarbon blends are the zeotropic substances which have greater potential for improvements in energy efficiency and capacity modulation.

Future options

The future refrigerant options in major RACHP systems are presented in this section. The thermodynamic properties of various refrigerants are shown in Table 1.

- ***Domestic refrigeration***
  Presently, the domestic refrigerator manufacturers have shifted their production using R600a as the working fluid. The refrigerant R600a is having good thermodynamic and thermo-physical properties for the requirements in domestic refrigerators. However, the pure R600a is not possible as a drop-in substitute to R134a due to mismatch in operating pressure and volumetric

Table 1: Properties of pure refrigerants

Refrigerant	Molecular weight	Critical properties		Boiling point (°C)	ASHRAE code	ODP R11=1	GWP 100 yr
		Temperature (°C)	Pressure M Pa				
R12	120.9	112.0	4.14	-29.8	A1	0.82	10600
R22	86.47	96.2	4.99	-41.4	A1	0.034	1700
R23	70.01	25.9	4.84	-82.1	A1	0	12000
R32	52.02	78.2	5.8	-51.7	A1	0	550
R123	152.93	82.0	3.66	27.8	B1	0.012	120
R125	120.02	66.2	3.63	-54.6	A1	0	3400
R134a	102.03	101.1	4.06	-26.1	A1	0	1300
R152a	66.05	113.3	4.52	-24	A2	0	120
R290	44.1	96.7	4.25	-42.2	A3	0	20
R600a	58.12	134.7	3.64	-11.7	A3	0	20
R717	17.03	132.3	11.34	-33.3	B2	0	< 1
R744	44.01	31.1	7.38	-78.4	A1	0	1
R1234yf	114	94.7	3.38	-29.5	A2L	0	< 4
R1270	42.08	92.4	4.67	-47.7	A3	0	20
R404A	97.60	72.1	3.74	-46.6	A1	0	3800
R407C	86.2	87.3	4.63	-43.8	A1	0	1700
R410A	72.8	72.5	4.95	-51.6	A1	0	2000

cooling capacity. The hydrocarbon refrigerant mixtures composed of R290 and R600a is a probability to use as a drop-in substitute to replace R134a in small capacity refrigeration systems during its servicing to extend its life time.

- ***Commercial refrigeration***
  The commercial refrigeration units are using R134a and R404A for their good thermodynamic and thermo-physical requirements. The high global warming potential of R134a and R404A has restricted its usage in commercial refrigeration units. The commercial refrigeration system manufacturers have shifted their manufacturing to R290 considering its good thermodynamic and thermo-physical requirements to meet the low temperature refrigeration system requirements. The small capacity refrigeration units using R134a can be retrofitted with R290/R600a mixture as a drop-in replacement to extend its life.
- ***Industrial Refrigeration***
  The ammonia is the most widely used refrigerant in industrial refrigeration systems because of its good thermodynamic and thermo-physical requirements with zero ozone depletion potential and negligible global warming potential. However, the ammonia is more toxic and highly reactive with copper tubes. Hence, steel tubes are recommended for the use of ammonia. Moreover, the use of ammonia requires secondary refrigerant circuit to tackle the toxic nature of ammonia.
- ***Transport Refrigeration***
  The refrigerant R290 is a good option for transport refrigeration.
- ***Domestic Air Conditioning***
  Presently, R22, R32 and R410A are the three halogenated refrigerants dominating the residential air conditioning sector. The refrigerants R22 and R410A need to be phased out soon because of high global warming potential. The sustainable option for residential air conditioner is R290 due to its good thermodynamic and thermo-physical properties. The R290 can be used as a drop-in substitute to replace R22 in small capacity residential air conditioners. The R290 is not being taking-up in India due to lack of flammable standards for Indian climatic conditions. The R410A has high global warming potential of around 2000. The refrigerant R32 can be used as an alternative to phase-out R410A in residential air conditioners to reduce its environmental impact. The replacement of R32 with R744/R290 mixture is possible, to reduce the environmental impact of residential air conditioners using R410A. However, due to lack of commercial availability of R744/R290 mixture, it is not possible to use it as an alternative.
- ***Commercial and Industrial Chillers***
  The halogenated refrigerants such as, R22, R134a, R32, R410A are being used in industrial chillers. These refrigerants are having high global warming potential, that should be phase-out. The refrigerant R290 is recommended for industrial chillers. Plate heat exchangers are recommended in the chillers to reduce the refrigerant inventory.
- ***Automobile Air Conditioners***
  The refrigerant R134a is the most commonly used refrigerant in automobile air conditioners during last three decades. Paris protocol 2016 restricts the use of R134a in automobile air conditioners due to its high global warming potential of 1430. Presently, the automobile air conditioners have shifted to R1234yf due to its lower global warming potential. However, R1234yf is not a sustainable refrigerant option due to its short atmospheric life. The R1234yf gets decomposed and forms tri-fluoro-acidic acid, which are highly harmful to the aquatic systems. The refrigerant R152a is also possible to use as a possible alternative to R134a due to its similar performance. However, the R152a has higher compressor discharge temperature, which may affect compressor life. The R290 was successfully used in automobile air conditioners for both cooling and heating applications. The refrigerant R744 (caron-dioxide) is being used in automobile heat pump system operating under low ambient conditions. The use of R290 in automobile air conditioner requires secondary loop system to reduce the flammable risk.
- ***Heat Pumps Systems***
  The refrigerants such as, R22, R32, R134a, R407C and R410A are being commonly used in heat pump systems due to good thermodynamic and thermo-physical requirements. These refrigerants should be phased out soon as carrying high global warming potential. Presently, the R1234yf is recommended due to its low global warming potential. The hydrocarbon refrigerants such as R290 and R1270 are recommended for heat pump applications due to its good thermodynamic and thermo-physical properties to meet the requirements in heat pumps.

Conclusion

A lot of research and developments have been carried out identifying environment friendly alternatives to phase out the halogenated refrigerants. The outcome of the research confirmed that, the hydrocarbon refrigerants are found to be good option for replacing the halogenated refrigerants in refrigeration, air conditioning and heat pump systems. The use of natural refrigerants in RACHP applications plays a vital role in reducing the environmental impacts. ■

Dr. M. Mohanraj,
Consultant for Refrigerant, HVAC, Heat pump and Energy, is M.E. and Ph.D. in Heat pumps.

Photo by Gervyn Louis on Unsplash

The Air is Changing! Are you?

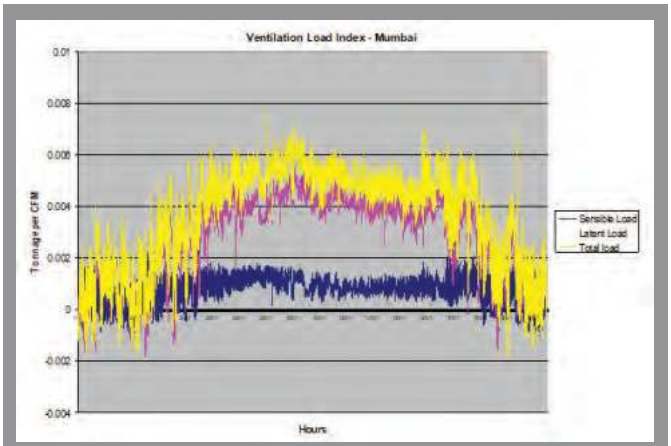
-Part 1

Today, as scientists are still struggling to confirm, whether Sars Cov – 2 virus is airborne or not, several concerns on running air conditioning systems in buildings are being raised.

With temperature rising and offices opening after lockdown, human comfort in occupied space is important as there is a direct correlation in human comfort and the immune system of our body. Hence, switching off air conditioning is seemingly not the right approach to address preventing virus spread, if any, through air conditioning.

Ventilation of conditioned spaces to dilute the indoor air pollutants in the space is becoming savior during this pandemic. Many International papers are now recommending increasing ventilation in occupied spaces and even suggesting 100% outdoor air systems.This increased amount of ventilation should definitely solve IAQ related problems. However, the inability to maintain the right humidity

by our HVAC systems may lead us to other problems. Mold & Mildew are serious dilemma in itself, which are caused by lack of humidity control. Also, the growth of viruses & bacteria can augment if proper humidity is not maintained in the conditioned spaces. The question is "Have we Traded one problem with the other".



Outside Air load- Mumbai.
Figure 1: Ventilation Load index Mumbai

City	Load per year		
Name	Ton-hours / SCFC		
	Sensible	Latest	Total
Ahmedabad	8.78	16.61	25.39
Amritsar	5.58	13.29	18.87
Bhopal	6.13	10.38	16.51
Chennai	8.6	30.14	38.74
Dibrugarh	3.48	19.55	23.03
Delhi	6.94	14.22	21.16
Guwahati	4.72	23.18	27.9
Hyderabad	7.01	14.58	21.16
Indore	5.74	9.25	14.99
Jaipur	7.49	11.62	19.11
Kolkata	6.85	27.62	34.47
Lucknow	6.42	17.36	23.78
Mangalore	6.64	26.6	33.24
Mumbai	7.38	25.26	32.64
Patna	6.78	20.48	27.26
Pune	4.64	14.84	19.48
Trivandrum	7.68	17.12	24.8
Vizar	7.78	30.72	38.5

Shown above is the load profile (refer Figure 1) of the outside air for the city of Mumbai. The curve defines the load of outside air in terms of the sensible and latent load in tonnes for the entire year. Clearly, one can see that latent load of the city is quite high and is around 78% of the cumulative fresh air load.

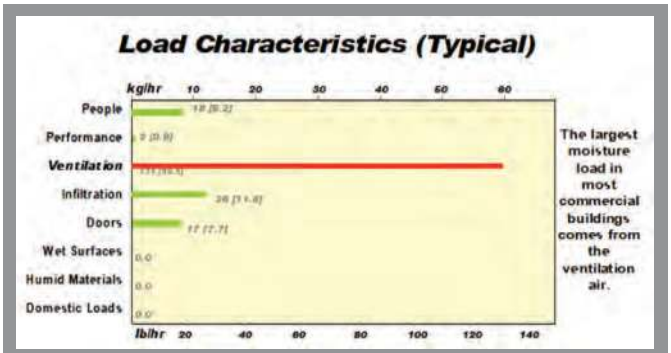
Similarly, if one studies the profile, the cumulative loads (i.e cooling & dehumidification only) for major cities of India, one can see that latent load component of the fresh air is quite high (ranges from 60% – 85 %) (refer Figure 2).

With outside air bringing in high amount of latent energy, RH management becomes difficult. HVAC fraternity was first sounded the wake up call for IAQ & RH control, when the bacteria spread by a hotel air-conditioning system, had killed 34 people and ailed more than 200 people at American Region Convention, Philadelphia (US), around twenty years ago.

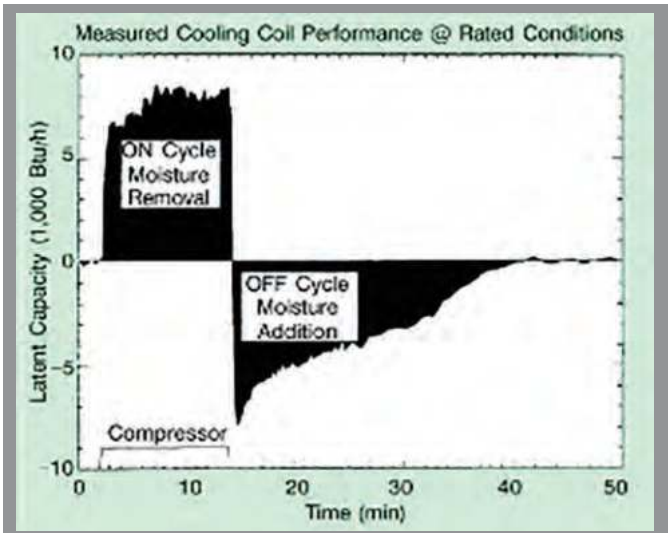
Lack of RH control leads to growth of Mold and Mildew which lead to various health related issues. Mold release tiny spores to reproduce. These spores then waft through the Indoor Air and start developing in damp areas. They can cause several problems like rashes, asthma, running nose, respiratory problems including serious diseases like hypersensitivity pneumonites, etc. (refer Figure 4).

Latent Loads

If RH control is so critical and important let us examine the latent load profiles in a building. Comparing the sources of the latent load, it is clear that the largest contribution to latent component is



Medium sized retail store in Atlanta during 0.4% dewpoint conditions.
Figure 3: Latent Load Characteristic
Source : Lewis Harriman



After the compressor shuts off, moisture condensed on the cooling coil re-evaporates.
Figure 4: An example of passive humidity moisture control in a 3 ton Unit.
Source: Dehumidification Equipment Advances by Lewis g Harriman III

the outside air. The chart (Figure 3) below clearly shows that the almost 50% - 70 % of internal latent load comes from Ventilation

Rh Control Challenge

Why is it so difficult to manage RH? The answer lies in the fact that the sensible and latent loads don't peak at the same time. Hence in moderate weather the sensible loads are reduced but latent remains high. With Ventilation bringing in the most of internal latent load one needs to study the ability of conventional cooling system to control RH during moderate weather conditions. A thermostat driven cooling coil will experience great difficulty in managing the RH in low sensible load periods. i.e. off peak periods of the day or monsoon weather in most of India. The problem is that in moderate weather, the outside temperature drops but the moisture level remains high. And, with the ambient temperature dropping, the sensible loads drop. Hence, the return air temperature is quickly achieved thereby triggering the thermostat to switch off the compressor in the constant volume DX cooling system, allowing them to operate only for short periods. As a result the moment the

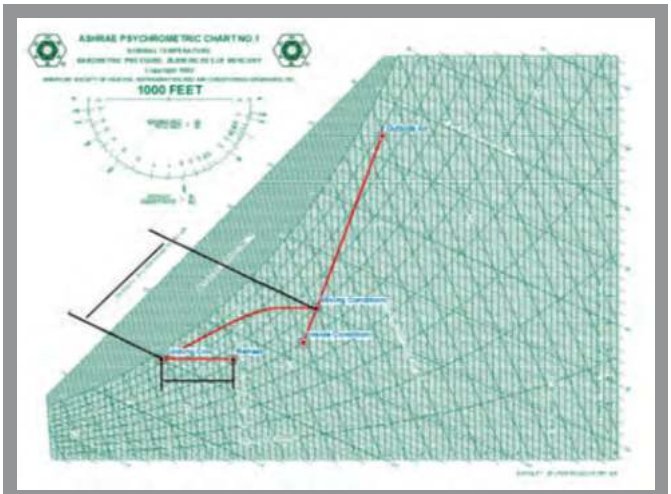


Figure 5: Baseline system with Reheat

compressor turns off, the coil stops dehumidifying and moisture remaining on its surface re-evaporates back into the supply air. (refer Figure 4).

Even in immaculately designed central plant system, where designing for very low ADP's and reheat, one faces difficulty in controlling RH during low sensible loads. Such systems do have better RH control, as compared to constant volume, DX cooling systems but are highly energy intensive (involve sub cooling and then reheat) and are increasingly getting banned in many countries.

With Moderate weather being a considerable part of season during Monsoons and throughout the year in many coastal cities, this problem needs some immediate attention. Consider the grain levels in the following data at the outside temperature of 75^{0}F (i.e moderate weather) one can see considerable number of hours) where the grain level is more than 65 gr/lb (moisture level generally maintained inside).

On studying the hourly data of outside air, one can see that RH control definitely is a problem in the moderate weather, which is almost 2500 hrs in a year for city like Atlanta in US.

Control Strategies

Traditionally, one would immediately talk about a system with low ADP. i.e., having low chilled water temperature, high row deeps (8 row or deeper) and reheat with active energy.

Such systems do help but are highly inefficient and drain lot of energy. Figure 5 illustrates the fact that one has to first sub-cool and then add active reheat wasting energy twice.

DOAS Approach

Constant Volume, mixed air, HVAC units are generally selected with sufficient cooling capacity to handle dry bulb design and are controlled by thermostat, which matches the sensible cooling capacity of the coil with the sensible cooling need of the space. But, when it is cool and rainy outside, latent cooling load can approach or even exceed sensible cooling load. To overcome this problem, one needs to divide the load into the two components i.e. 'Sensible' and 'Latent' and handle them separately. This approach commonly referred to as the "Divide and conquer" deals with both components separately.

As already identified, majority of the internal latent load is coming from the outside air. Hence, It is important that the latent load of this air be handled separately. The DOAS approach works on this principle only. It removes all the latent load being brought by the outside air at the source and processes the same to a very low dew point, thereby enabling it to take care of the rest of the internal latent load too.

The internal cooling devices are then limited to sensible cooling only. If one wants to draw an analogy its like making the "Naughtiest Boy" of the class as the "Class Monitor".

This approach now opens up a whole new world of innovative designing and helps the designer to maintain the right RH throughout the year irrespective of the weather pattern outside. The IAQ and RH management both get resolved and one is able to overcome all obstacles being seen by the conventional systems.

The designer can now increase the chilled water temperature (CHW) feeding the Internal Air Handling units (AHU's), reduce the row deeps (as ADP's can be increased) and can optimize between the air volume and ADP (by CHW temperature), as one now is not limited by Sensible Heat Factor (SHF) any longer, to get the maximum energy and space efficiency. ■

Part 2 of it will be continued in next issue of Cooling India.

Rahul Aeron,
Assistant Vice President, Sales,
DRI, Pahwa Group.

Grundfos SE1 pump with S-tube impeller

Grundfos India has introduced its innovative SE1 pump with an S-tube impeller catering to the wastewater treatment processes. Integrated with motors, hydraulics and seamless functionality, intelligent SE1 solutions are the most efficient wastewater pumps. Grundfos SE range of pumps with an S-tube impeller has also been able to significantly boost energy savings in wastewater operations, while simultaneously reducing the number of jamming related incidents.

S-tube unique proposition

- The front and backplate of the closed S-tube optimise the leak flow into the cavities between the rotating impeller and the stationary pump housing.
- The non-compromised inner diameter of the S-tube is uniform, reducing the chance of clogging, even with a relatively low volume of transportation fluid as found in modern-day wastewater.
- Consequent hydraulic efficiency gains drive down energy costs for the end-user.
- The lack of a leading-edge has the benefit of significantly lowering NPSH inside the centrifugal pump where the hydraulic system is most prone to cavitation.

Pump applications

- This cutting-edge solution is ideal for processes with a higher volume of water/liquid flow.
- They are used to handle wastewater, process water and unscreened water processes in municipalities, utility and industrial applications. ■

Energy-efficient ventilation fans range by Panasonic Life Solutions

The ventilation fans market expects to see a rise in the demand as people are getting aware and accustomed to the measures that help fight against the pandemic. In line with the current global situation, Panasonic Life Solutions India Pvt. Ltd., has introduced a new range of ventilation fans which can be for both, ceiling and wall-mounted category.

Unique properties

- The highlight of the fans is advanced blade design which incorporates the aerodynamic principle that minimizes any obstacles against airflow. It, therefore, makes a unique aspect in terms of removing 90% of the droplet nuclei from the room.
- Helps mitigate the chances of the virus from spreading.
- It also comes along with an insect screening net, which prevents small insects from entering the outside duct.

Design

- The wall mount ventilation fan has a slim & sturdy design which makes it compact and easy to install.
- Both the ventilation fans, come with the lowest power consumption (less than a LED bulb) along with an extraordinary silence feature, which typically, most of the ventilation fans imbibe. ■

INDEX TO ADVERTISERS

UPCOMING EVENTS

28-28 August 2020

INAGREENTECH 2020
Location: Indonesia
Contacts: +62 - 21 - 5435 8118

AQUATHERM ALMATY 2020
Location: Almaty (Kazakhstan)
Contacts: enquiry@ite-eurasian.com

08-10 September 2020

10-12 September 2020

HVAC/R DAVAO
Location: Philippines
Contacts: info@globallinkmp.com,
8 + 893-7973 /09955298672

ECOCASA ENERGY 2020
Location: Italy
Contacts: info@fierapordenone.it

12-14 September 2020

16-19 September 2020

ADANA IHS
Location: Turkey
Contacts: +90 222 700 00 82

CHILLVENTA ESPECIAL
Location: Virtual event
Theme Focus: Chillventa Connecting Experts

13-15 October 2020

WEBINAR

Company Name: Healthy Buildings Start at the Door
Date: 3rd September 2020
Time: 1:00 PM – 2:00 PM EDT
Organizer: Johnson Controls

Company Name: Mitsubishi Electric- Utility Incentives: Driving Tomorrow's Energy-Efficient Infrastructure
Date: 25th August 2020
Time: 2 p.m. ET
Organizer: ASHARE

Company Name: Belimo- How to Protect Your System and Save Money by Understanding the Effects of Glycol on HVAC Systems
Date: 10th September 2020
Time: 2 p.m. ET
Organizer: ASHARE

LOUVER TYPE MIST COOLING SYSTEM

For

CHILLERS

A Superior Alternative to Cooling Tower

▲ *Louver Type MCS*

Assured Approach of 1°C to WBT.
Guaranteed Power Saving with Small Foot Print...
Not a miracle, a reality!

Other Superior Features of LTMCS

- **NO FILLS / NO FINS, NO FANS**
- Zero Maintenance due to all Non-moving parts, Choke-less Nozzle design and Special non-corrosive MOC
- Exremely easy operation
- Life of more than 15 to 20 years

Over 300 installations

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**

MIST
imitating nature

Mist Ressonance Engineering Pvt. Ltd.

Regd Office : 'Anandi', 1304-1/7, Shukrawar Peth, Bajirao Road, Pune - 411 002. INDIA.
Tel : (+ 91 20) 2447 2726 / 2447 1184 ■ Fax : (+91 20) 2447 4972
E-mail : mistcreation@gmail.com ■ mistcool@vsnl.com ■ Website : www.mistcreation.com

COOLING TECHNOLOGY CTI INSTITUTE MEMBER

RNI No. MAHENG/2005/18432 • Published and Posted on 15th of every month at Vashi MDG SO, Navi Mumbai - 400 703.
Licence to post without prepayment WPP Licence No. NMR/Tech/WPP-16/NM/2020 • Postal Regd. No. NMB/184/2018-2020