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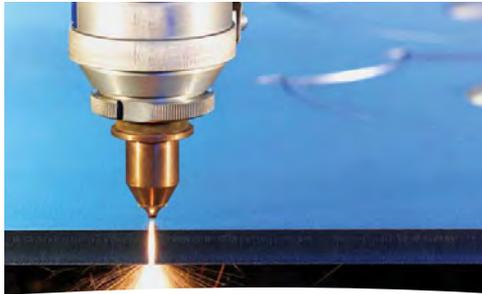
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Publisher's Letter

Hello and welcome once again to *Cooling India*.

Onions have left customers teary-eyed as its prices continue to soar across the country. On 10th December, Minister of Consumer Affairs, Food and Public Distribution Ram Vilas Paswan informed Lok Sabha that the prices of onion have increased by 400 per cent after March as the average retail price of onion on December 3, 2019 was recorded to be Rs 81.9 per kg as compared to Rs 15.87 per kg in March 2019. However, not just onions but prices of 20 other essential food items including rice, wheat, flour, pulses, oil, tea, sugar, jaggery, vegetables, milk, potato and tomato have also witnessed a gradual increase.

In India, onion is a widely consumed vegetable across the country throughout the year. Notably, though the country produces much more onion than it consumes, around 30-40 per cent of the crop gets lost during the storage. As onion harvested during the rabi season accounts for more than 60 per cent of total production, it becomes essential to successfully store rabi onion in order to maintain its supply in the markets. Otherwise, the instability in supply due to lack of storage will continue to create market distress that will eventually cause a steep rise in the onion price.

It has to be noted that India currently has a total cold storage capacity of 226.7 lakh tonnes as against the required capacity of 350 lakh tonnes. According to Agriculture Ministry, as many as 208 cold chain and value addition infrastructure facilities with 5.3 lakh tonnes capacity are built till October 31 this year under Pradhan Mantri Kisan Sampada Yojana (PMKSY) managed by the Ministry of Food Processing Industries. Since 2015, a total of 1,303 cold storages with total capacity of over 45 lakh MT established in country under the schemes under Ministry of Food Processing Industries and Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW).

Therefore, it is pivotal to create adequate storage facilities which will help in checking the supply volatility and steep rise in crop prices.

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




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AHRI heads campaign for HFC refrigerant phase down

The US air conditioning and refrigeration association, AHRI, is behind a six-figure media campaign urging senators to support newly introduced legislation to reduce HFC refrigerants. With support from the alliance for Responsible Atmospheric Policy the campaign supports the American Innovation and Manufacturing (AIM) Act introduced in October by Senators John Kennedy and Tom Carper.

Faced by a Trump administration seemingly reluctant to ratify the Kigali Amendment, the legislation seeks to establish a national framework for the phase down of HFC refrigerants, while in the process promoting US technology and creating thousands of new jobs. The legislation currently has 22 total bipartisan co-sponsors from 16 states.

"Globally, markets are already starting to move away from HFCs," said AHRI President and CEO Stephen Yurek. "A federal HFC phase down keeps US manufacturers in the driver's seat during this transition, creating jobs here at home, expanding market share abroad, and stimulating significant investment in the US economy."

The digital campaign started on Monday (December 2) and runs through to December 8 on the energy pages of POLITICO, CQ/Roll Call, and The Hill. Bill advocates will also sponsor a food truck that will visit Capitol Hill on Thursday, December 5.

"We are pleased with the strong and growing bipartisan support for the AIM Act, building momentum for claiming the jobs and trade benefits that a uniform Federal HFC phase down policy makes possible," said Kevin Fay, executive director of the Alliance for Responsible Atmospheric Policy.

A recent industry economic study is said to have shown that a phase down of HFCs would create 33,000 new US manufacturing jobs, add \$12.5bn per year to the US economy, and expand US exports in this sector by 25 per cent. ■

Panasonic to acquire Kauko Oy's air conditioning business

Kauko Oy, part of Aspo Group, and the multi-national electronics corporation Panasonic announced that Kauko's heat pump business unit will be acquired by Panasonic from 1 January, 2020. All Kauko employees of the heat pump business unit will join Panasonic, and in addition to sales, all aftermarket operations such as after-sales service and repairs are transferred to Panasonic.

Kauko has been Panasonic's exclusive distributor of heat pumps in Finland since 1988. Elsewhere in Europe Panasonic has distributed these solutions through its own organisation, and after the acquisition announced this approach is now in use throughout the continent.

"We are pleased about the arrangement announced today and confident that it will



be in the best interests of our customers in the heat pump market, our retailers, Kauko employees and Panasonic. This makes sense also for Aspo as the owner, and Kauko can now continue focusing on its core business," says Aki Ojanen, Chairman of Kauko Oy and the CEO of Aspo Group. The over 50 years of partnership between the companies will continue, however, as Kauko will remain the exclusive distributor of other Panasonic b-to-b products and solutions in Finland. ■

ASHRAE & American Chemistry Council sign MoU for sustainability in building sector

ASHRAE and the American Chemistry Council (ACC) have signed a Memorandum of Understanding (MoU) formalising the organizations' relationship.

The MoU was signed by 2019-20 ASHRAE President Darryl K. Boyce, P.Eng. and ACC President & CEO Chris Jahn on November 19 in Atlanta. The agreement defines parameters on how the two organisations will collaborate more closely to continue promoting the advancements of a more sustainable built environment.

The organisations have committed to work together on the following shared objectives:

- Engaging in projects and activities whose purpose is to help improve the health, safety, and welfare of communities through the built environment.
- Supporting the development, adoption, and enforcement of building codes standards that support those improvement goals.

- Promoting the use of sound science in the development and assessment of building standards and codes.
- Enhancing building performance by fostering improvements in energy efficiency, resiliency, indoor air quality, and the health, well-being, and productivity of building occupants.
- Increasing communication between professionals of the building, design and construction industry and chemistry industry to promote innovation and sustainability.

"We are pleased to collaborate with ACC as we work towards our shared goal of achieving optimal building performance," said Boyce. "ASHRAE and ACC are on the forefront of developing innovative technologies that are significantly impacting the building industry. This partnership signifies our commitment to broadening industry knowledge of energy efficient and sustainable building solutions to support the health and well-being of building occupants everywhere." ■



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Blue Star launches new room ACs with in-built air purifiers

Air conditioning and commercial refrigeration major Blue Star announced the launch of a new and innovative model of a room air conditioner with in-built air purifier, which cools and purifies the air in the room at the same time.

Pollution levels in India are rising with indoor air pollution getting worse than the outdoor pollution in many cases due to the closed environment of spaces such as a home or office, and the lack of fresh air. Pollutants get trapped and micro-organisms flourish in the stale environment.

What better way to tackle the situation than by using an AC which not only cools room but also purifies the indoor air at the same time through a single machine 5 Star Inverter AC with in-built air purifier Blue Star's new 5 Star inverter AC with in-built air purifier not only delivers powerful cooling during summers, but also simultaneously purifies the indoor air. It has the capability to function as a standalone air purifier during winters, and that too without switching on the machine's compressor, thereby, ensuring low electricity consumption. Powered by the unique Contact Microbiocidal Anti PM 2.5 Technology, this AC is proven to remove harmful pollutant particulate matters such as PM 2.5 with a reduction efficacy of 99.39 per cent. With a unique Double Stage Fortified Filtration mechanism, it can efficiently tackle micro-organisms such as bacteria and fungi floating in the indoor air environment, with an efficacy of 99.999 per cent. The SensAir Technology used in this air purifier continuously senses the indoor air quality and speeds up the air purification process automatically when required.

The company's air conditioners are well known for quality, reliability and durability, and have earned the trust of millions of customers. Making Blue Star one of the significant players in the industry with a market share of around 12.5 per cent. ■

Bitzer launches overhauled refrigerant ruler

The specialist for refrigeration and air conditioning technology BITZER has revised its free refrigerant reference tool for smartphones: the BITZER Refrigerant Ruler.

The completely renewed BITZER Refrigerant Ruler app enables users to easily and quickly assess refrigerant data. BITZER previously upgraded the application, which was launched in 2010, in 2016 in terms of its look and feel. Designed specifically for iOS and Android smartphones and tablets, it contains data on all common refrigerants, including key fluid properties, safety group information, global warming potential (GWP), ozone depletion potential (ODP) and information on choice of oil type for the compressor.

The tool provides an intuitive user interface for easy and accurate temperature-to-pressure conversion while allowing easy preselection and switching between different metric (SI) and imperial (IP) units.



The main functions include several parallel slide controls for setting pressure and temperature values, search filters and favourites, as well as the possibility to adjust all relevant parameters in the settings menu. In addition, supplementary information on refrigerants and links to relevant online documents are available.

The app contains information on more than 100 natural and synthetic refrigerants, which can also be preselected via filters. For comparison purposes and for practical use in the service and operation of older existing systems, BITZER also provides data on previously used refrigerants which may have been affected by usage restrictions. ■

Johnson Controls acquires EasyIO Building & Energy Management System

Johnson Controls closed an agreement to purchase the EasyIO Building and Energy Management System (BEMS) product line. Based in Kuala Lumpur, Malaysia, EasyIO has operations in Asia, Australia, Europe and North America.

The acquisition will create significant growth opportunities as Johnson Controls leverages the EasyIO products and team in the Americas, Europe, Middle East and APAC building automation markets, as well as the global HVAC and refrigeration markets.

"EasyIO provides a valuable addition to our already robust building automation system portfolio, which includes brands such as Metasys, Facility Explorer, Verasys and BCPro," said James Burke, VP & GM BAS at Johnson Controls. "We look forward to bringing our collective

customers new building automation products and services that create sustainable solutions."

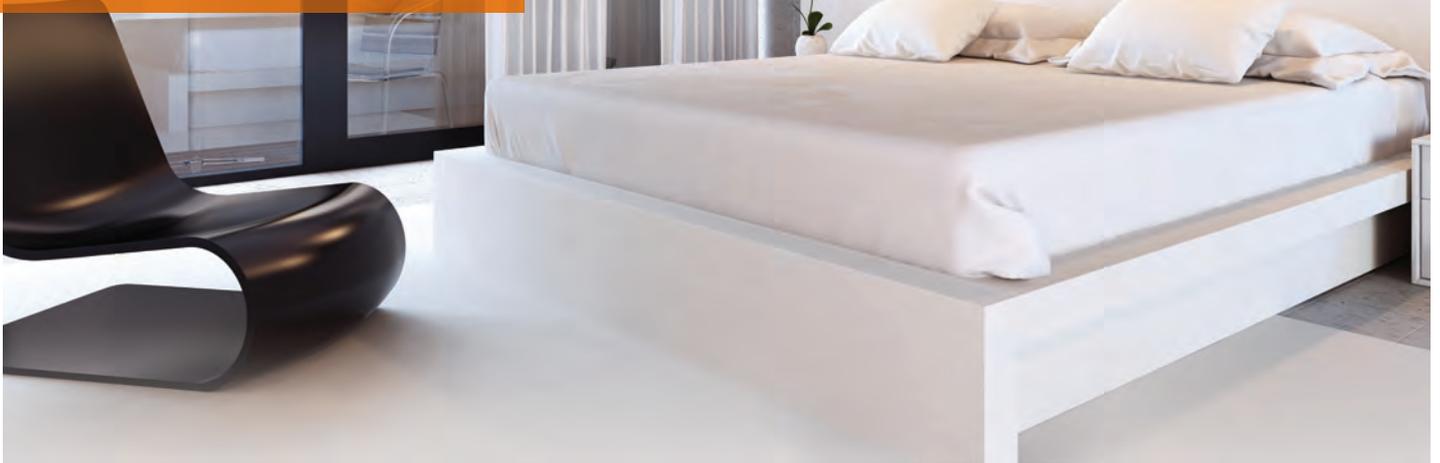
"EasyIO provides a valuable addition to our already robust building automation system portfolio, which includes brands such as Metasys, Facility Explorer, Verasys and BCPro." – James Burke, VP & GM BAS at Johnson Controls

"This is an exciting move for us," said Mike Marston, Co-Owner, EasyIO. "With access to Johnson Controls resources, EasyIO will continue to bring to market even more new, innovative products."

Johnson Controls has more than 30 years of industry-leading expertise in building automation systems and has driven HVAC controls innovation for more than 130 years. The company provides building automation solutions for complex and light-commercial buildings. ■

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Chemours claims AGC infringed R1234yf patents

Refrigerant manufacturer Chemours has filed a patent infringement lawsuit in Japan against Japanese chemical manufacturer AGC over the HFO refrigerant R1234yf. The lawsuit alleges infringement of Chemours' patents covering HFO1234yf product compositions and usage in automotive air conditioning and stationary refrigeration applications in Japan.

Chemours and Honeywell hold most or all of the patents issued for HFO-1234yf, although some of these have been disputed and remain the subject of court actions. Honeywell has also taken a number of patent infringement actions in the past year in Europe relating to R1234yf.

In a statement, Chemours says the action reaffirms its commitment to "vigorously defend" its investment in its Opteon brand low GWP refrigerants "and builds on its on-going efforts to stop the unlicensed manufacture, marketing, and sales of Opteon HFO1234yf (R1234yf) refrigerant by all legal means wherever that activity occurs around the world."

"Innovation and product development are at the core of who we are at Chemours," said Diego Boeri, Vice President of Chemours Fluorochemicals. "By protecting our innovation, we are also ensuring our customers have access to the safe and high-quality refrigerants that they have come to rely on from Chemours and the Opteon brand," he added.

Based in Tokyo, AGC, formerly Asahi Glass Co, is a global glass manufacturing company with additional interests in electronics, chemicals, and ceramics. ■

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Carrier adds smart valves to i-Vu building automation system

Carrier has added new i-Vu Smart Valves to the suite of components available for the i-Vu building automation system, making it even easier to maintain occupant comfort, optimise energy usage and resolve problems faster. The Smart Valves provide operators access to valve performance data from anywhere at any time, as well as quick error detection with integrated fault detection and diagnostics.

The new i-Vu Smart Valves were designed in collaboration with Belimo, a leader in the development and production of actuator solutions. They integrate seamlessly with the i-Vu building automation system, which automatically notifies operators if a valve has failed, becomes stuck, or is cycling or leaking.

"We are excited to add Smart Valves to our i-Vu building automation system," said Mark Jones, business manager, Carrier Controls. "Through our relationship with Belimo, we are able to add this cutting-edge valve technology to our i-Vu system; as such, customers will benefit from a



single point of access into all of their building assets, from HVAC equipment and controls, to sensors and valves. This real-time visibility will help them improve operational efficiency and keep occupants comfortable."

The i-Vu Smart Valves are available for both pressure dependent and pressure independent applications. They feature a compact design for easy installation and the valve bodies snap directly to the actuator. This allows operators and technicians to install Valves quickly, easily, and without the use of tools, helping to reduce labour costs, and it also makes retrofitting traditional Valves a snap. The valve actuator is capable of providing fail open, fail close, or fail in the last position to meet project requirements. ■

AAF opens new regional office in Electronic City

American Air Filter(AAF), a Daikin group company, the world's largest clean air solution provider has opened a new regional office in the IT hub, Electronic City. This regional office is the centre of excellence for EEMEA (Easter Europe, Middle East and Africa), CIS and SAARC countries.

The existing office cum manufacturing plant in Jigani, Bengaluru will function for India. The new branch will incorporate our firm's ever-expanding business support departments - marketing, IT, finance and customer support team. These teams will serve EEMEA, CIS and SAARC countries from India.

Rahul Uppal, COO – AAF-Daikin, EEMEA, CIS & SAARC said, "AAF has served clean air for nearly 100 years now. People and government are increasingly

becoming aware of the hazardous effects of pollution on health and the environment. Incidences of respiratory related diseases are also rising. Indoor air pollution is as dangerous as outdoor air pollution. We are expanding our business to provide clean air globally."

He continued and said, "We are delighted to announce the expansion of our business with the launch of our regional office at Electronic city. Our new space will be exclusively for regional team which will be focused on global marketing, IT, finance and customer service support for AAF EEMEA, CIS & SAARC countries. We are hiring people in a large scale to make Bengaluru as a centre of excellence for global business. Our expansion in India will help us better serve our global customers." ■

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Galyen is AHRI Chairman



John Galyen, President, of Danfoss North America, is the new Chairman of the Air-Conditioning, Heating, and Refrigeration Institute (AHRI). Galyen, who was elected at the AHRI's recent leadership forum in Puerto Rico, has been Danfoss' North America President since 2001. He has been a member of AHRI's executive board since 2015 and also serves on the board of the National Electrical Manufacturers' Association (NEMA).

The officers and executive committee are as follows:

- Vice Chairman: Mike Schwartz, CEO, Daikin Applied
- Vice Chairman: Ron Duncan, President, Magic Aire
- Treasurer: Megan Fellingner, President and CEO, Morrison Products
- Past chairman: Bill Steel, president and CEO, Bard Manufacturing. ■

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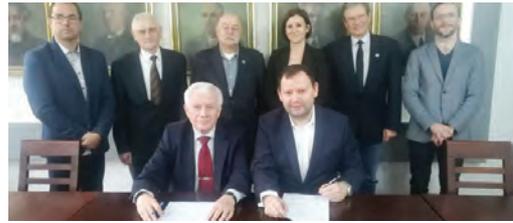
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Cooperation Agreement with Warsaw University of Technology

CAREL's Polish subsidiary Alfaco Polska signed an agreement with the Warsaw University of Technology for cooperation in research and development in the fields of refrigeration and air conditioning.



"The basis for this cooperation is the development of innovative technologies, scientific activities and the dissemination and improvement of knowledge among students at the Warsaw University of Technology in the field of refrigeration and automation systems, as well as IoT," commented Tomasz Andracki, CAREL Retail Business Development Manager - Poland and Baltics. "The refrigeration market is changing, and the Carel Group focuses on developments that respond to its needs. This cooperation not only involves development of technology, but also educational aspects. We see huge potential among students, which is why

we are happy to share our knowledge and experience." The partners expect that the joint venture, involving the design and construction of a research and teaching area at the Warsaw University of Technology, will be beneficial and respond to EU regulations regarding the reduction of high GWP refrigerants.

"During the next semester, we plan to build an educational water loop system using CAREL's Heos technology, a high energy efficiency solution for commercial refrigeration. This will then be available to the teaching staff in the new academic year", added Michał Grabowski, Project Manager Refrigeration at Alfaco CAREL. ■

Milan among the top 5 cities in Europe for LEED Green Building

According to Green Business Certification (GBCI) Europe, Milan has emerged as one of the top five cities in Europe for LEED green building. LEED, or Leadership in Energy and Environmental Design, was created by the US Green Building Council (USGBC). Milan has more than 80 LEED-certified buildings certification that are helping to reduce carbon emissions and provide healthier environments for people to live and work, and about 130 registered to pursue LEED certification.

"The way we design our buildings, cities and communities impacts our quality of life for generations to come," said Mahesh Ramanujam, President and CEO of GBCI and USGBC. "Milan's work with LEED is an example not just to Italy, but to the rest of the European region, and proves that high-performing, sustainable buildings are within our reach. By committing to practices that reduce our impact on the environment and prioritise our health, we can create a better living standard for each and every person."

"Urban development can no longer ignore the quality of the buildings in terms of sustainability, especially, now-a-days, when everybody can play a crucial role to face and tackle climate change," said the Deputy Major for Urban Planning Pierfrancesco Maran. "The recognition of GBCI is indeed a further incentive to do more and work through more performative measures towards this goal. With this perspective, the City Master Plan - recently approved by the City Council in Milan – introduces carbon neutrality for all new construction."

"The use of LEED across Milan is a signal of the city's commitment to creating a healthier, more sustainable future for residents and that is something every citizen deserves," said Kay Killmann, managing director, GBCI Europe. "Our partners are a vital part of advancing this work. Their work along with the work of countless building and design professionals will continue to shape the real estate landscape across the city." ■

Carel gets International Star at European Small & Mid-Cap Awards 2019

At the annual European Small and Mid-Cap Awards held on 12 November in Brussels, Carel Industries won the prize for the 'International Star' of the European market.

These awards were created in 2013 by the European Commission, to recognise the best small and medium-sized companies listed on Europe's stock markets. Divided into four categories (International Star, Rising Star, Star of Innovation and Star of 2019), the winning companies are chosen following a strict selection criterion that looks at results in terms of international sales, profits and growth in market share. A high-level independent jury, moderated by the European Commission and comprising representatives from academia, asset management, brokerage and the media, evaluated the nominations and chose Carel as the 'International Star' for 2019.

"For Carel, this is an important recognition, and one we



are very proud of," commented Group CEO Francesco Nalini. "In recent years, our group has seen a series of major evolutions, with the pinnacle being our stock exchange listing. The award recognises Carel as a company with a strong propensity for constant innovation, focused above all on environmental sustainability, and internationalisation, both of which are fundamental characteristics that have

underscored our company's history and will undoubtedly be at the centre of our future development."

Carel Industries was recognised as the company with the best performance internationally, in part due to its expansion into new markets as well as in existing ones. Its solid international development strategy, combined with the ability to grasp opportunities outside of the borders of its home country, were listed as the main reasons why the award went to the Padova-based company. ■

Daikin and Nikken Sekkei selected as finalist of The Global Cooling Prize

Daikin Airconditioning India, and Daikin Industries, are selected as a finalist of The Global Cooling Prize (GCP) together with Nikken Sekkei Ltd. This announcement was made in New Delhi, India.

The GCP is an international competition endorsed by the Indian Government, Mission Innovation, and the Rocky Mountain Institute to explore technologies that can significantly reduce the climate impact of room air conditioners compared to equipment currently on the market. For this initiative, Daikin and Nikken Sekkei teamed up to propose a new concept for room air conditioning.

This new concept employs a technology which can achieve comfort and energy savings – and at the same time – ensure consistent room temperature and humidity by adequately controlling multiple indoor units in one room.

Another new concept is that it utilises the vaporisation heat of water to further increase the energy efficiency of the equipment. The proposed equipment uses HFO-1234ze(E) refrigerant.

Daikin adopted an out of the box approach by controlling multiple units in one room and by choosing the refrigerant HFO-1234ze(E) which has a low GWP. However, this causes other environmental challenges such as the increased use of raw materials as a result of the larger equipment size.

Daikin's overall refrigerant policy is to support a diversity of refrigerants. Daikin believes that R32 is the most balanced refrigerant for many applications in terms of safety, energy efficiency, economy and the environment, and that it will be the standard for the mid- to long-term horizon. R32 based equipment is an established technology, being sold in more than 70 countries including India. ■

Mike Creamer voted IoR President-elect

Mike Creamer, MD and founder of Business Edge, has been elected President-elect of the Institute of Refrigeration. The announcement saw the gender revolution continue with Juliet Loisel, publisher of ACR Journal and Lisa-Jayne Cook of J&E Hall being elected to the Institute's board of trustees.

A fellow of the Institute, Mike Creamer formed Business Edge Ltd in 1990 to provide technical consultancy, air conditioning or refrigeration training and certification. His varied career includes work as toolmaker, design draughtsman and mechanical design engineer, chief applications engineer, marketing manager, sales



Mike Creamer

director, compressor quality director and managing director.

He will take over from current President Kevin Glass next autumn. The addition of Juliet Loisel and Lisa-Jayne Cook to the board of ten trustees, which already includes Jacinta Caden, means female representation on the Institute's governing body is at its highest ever. The move follows the realisation of the need to attract more women into the industry and the creation of the IoR's Women in RACHP group in

2016. Although there are still only 85 female members of the Institute, it is a far cry from as recently as the 1970s when it was still frowned upon for women to even attend the annual dinner. ■

Johnson Controls appoints Michael Ellis as EVP and Chief Customer & Digital Officer

Johnson Controls International has named Michael Ellis, Executive Vice President and Chief Customer and Digital Officer effective from October 14. In this newly created role, Ellis will serve as an officer of the company and oversee Johnson Controls digital strategy, innovation and execution, working closely with customers to drive new growth and value opportunities across the globe.

Ellis most recently served as global managing director of Accenture where he advised Fortune 1000 CEOs in developing digital strategy and innovation for new transformative revenue opportunities and industry leadership. Prior to joining, Accenture as an executive in 2018, Ellis was President, Chairman and CEO of ForgeRock, a global digital security software company.



Michael Ellis

Earlier in his career, Ellis served in leadership roles at SAP, Oracle, i2 Technologies and Apple Inc.

"Mike brings to Johnson Controls a wealth of experience in helping companies navigate the intersection of digital innovation and giving customers the products and solutions, they need to succeed," said George Oliver, Chairman and CEO, Johnson Controls. "Recognising digital is core to our growth strategy, I'm excited Mike will help drive this innovation and focus throughout our company."

Ellis received two bachelor's degrees from the University of Minnesota and has participated in executive programs at the Kellogg School of Business at Northwestern University and the Tuck School of Business at Dartmouth College. ■

Honeywell names Scott Zhang as President of Honeywell China

Honeywell announced that Scott Zhang has been appointed as President of Honeywell China, effective from November 1. He will be responsible for executing Honeywell's business objectives in the company's single largest country market outside the US.

Zhang has a long track record of highly effective leadership at Honeywell. He served as President of Honeywell Technology Solutions (HTS) for the past four years. He drove an internal innovation process along with external ecosystem partnerships to strengthen Honeywell's technological leadership as a competitive advantage. He also leveraged the organisation's diverse talent to enable global business



Scott Zhang

growth and productivity, and he led the establishment of HTS Mexico to enable growth in Latin America.

Zhang succeeds William Yu, who will take an exciting global leadership role within Honeywell.

"We have long history of development in China, and strong commitment to better serve China market. Scott has been instrumental in creating our success story in China. His unique experience and proven track record will be a definite asset as we continue our success in this important market," said Shane Tedjarati, President of Honeywell global High Growth Regions, "I also would like to thank William for his great contributions in leading China market, which we believe this is the place for long-term growth." ■

Global Cold Chain Equipment Market to earn profits with USD 118 bn by 2025



The main products available in the cold chain equipment market are storage equipment and transport equipment. Among these two, the demand for storage equipment is relatively higher and the trend is anticipated to remain so over the next few years, notes the research report.

With the presence of a large pool of participants, the global cold chain equipment market is displaying a highly competitive business landscape, finds a new research report by Zion Market Research (ZMR). Cloverleaf Cold Storage, AmeriCold Logistics, A B Oxford Cold Storage, Burris Logistics, and Lineage Logistics, are some of the key vendors of cold chain equipment across the world. These players across cold chain equipment market are focusing aggressively on innovation, as well as on including advanced technologies in their existing products. Over the coming years, they are also expected to take up partnerships and mergers and acquisitions as their key growth strategy across cold chain equipment market, states the market study.

Reportedly, in January 2018, the President of Westfalia Technologies advised its consumers to manually pre-pick up orders from the cold storage equipment and delivers them before the trucks arrive for picking up the products. It is speculated that the decision to store the products in the cold storage is aimed to help it avoid getting spoiled. Analysts predict that such initiatives are likely to provoke the growth of cold chain equipment market over the years to come.

As estimated in this report, the global cold chain equipment market stood at USD 67 billion in 2014. Witnessing a tremendous rise during the period from 2014 to 2020, the revenue in this market is expected to reach USD 118 billion by the end of the forecast period. The main products available in the cold chain equipment market are storage equipment and transport equipment. Among these two, the demand for storage equipment is relatively higher and the trend is

anticipated to remain so over the next few years, notes the research report.

Increasing Need for Reducing Food Wastage Will Spur Market's Growth

"Growing requirement for increasing the shelf life of products such as chemicals, drugs, and vaccines along with ensuring their safety and quality is likely to enhance the cold chain equipment market demand," says the study. Apart from this, the escalating need for food storage and preservation along with humungous popularity of frozen food products is forecast to uplift cold chain equipment market growth over the coming years.

High deployment costs and strict government legislations, however, are predicted to impede the progress of cold chain equipment market. Nevertheless, mounting food requirement across developing economies is projected to result in greater demand for the product in the near future, normalising the impact of hindrances on the cold chain equipment market, reports the study.

Regionally, Asia Pacific has been leading the worldwide cold chain equipment market and is anticipated to continue on the dominant position in the years to come, states the market study. Increase in the installation of cold chain equipment in countries such as China and India is the main factor behind the dominance of the Asia Pacific cold chain equipment market. In addition to this, the rising trend of cold chain logistics in the developing countries is projected to contribute substantially towards the growth of cold chain equipment market in the region. ■



The industry stalwarts feel the need for high efficiency solutions that will certainly be an important trend in the cold chain industry.

Supriya A Oundhakar,
Associate Editor

Cold chain markets in India is gaining traction owing to the young working population, rising disposable incomes, growth of the consumers in various socio-economic strata, exposure to new cultures and cuisines, and change in eating habits of families.

Current scenario

CRISIL Research estimates India's cold chain industry grossed a cool Rs 30,000-35,000 crore in fiscal 2019. But the pie could be much bigger if more investment was incentivised to minimise the massive wastage in horticulture produce that happens even today.

Although India is a global leader in horticulture, post-harvest losses are 15-20 per cent of horticulture produce. CRISIL Research estimates that 70 per cent of this wastage stems from lack of end-to-end cold chain logistics.

The report further mentions that temperature-controlled warehouses (TCWs) comprise 85-90 per cent of the overall industry. Of the TCW pie, again, multi-purpose cold storages comprise a dominant 80 per cent. And as of fiscal 2019, over three-fourths of the multi-purpose cold storage volumes came from meat, seafood, dairy, and fruits and vegetables.



Technology innovation is required in energy efficient field - reasons being high operating cost and lower margins of the customer segments. Efficient Ammonia compressor with screw technology are preferred.

Soumen Mukherjee,
Senior Vice President,
Ice Make Refrigeration

Now a predominantly domestic unorganised trade in fruits and vegetables implies this segment incurs higher wastage compared with meat, seafood and dairy. In fact, over three-fourths of horticulture products moved across India is for domestic consumption; the balance is exported. Export of fruits and vegetables face minimal cold chain-related wastage owing to necessary compliance with mandated regulations for overseas movement.

Soumen Mukherjee, Senior Vice President, Ice Make Refrigeration observes that cold room and cold storage installation is a highly fragmented business and organised large players contribute to 40-50 per cent of the market share but lower half of the market is highly fragmented. Cold storage industry is estimated around 1 to 1.5 MMT.

“Installed capacity of cold storage in India is growing at approximately 3.7 per cent CAGR. The segment is plagued with many challenges. However, the government is taking necessary steps to boost the sector,” he adds.

Growth Drivers of Cold Chain

Owing to the rising need of the infrastructure and to reduce wastage, according to a market research report, the cold chain industry in India is forecast to grow at a CAGR of 19 per cent during the period of 2017-2022. Arvind Surange, Chairman-cum -Managing Director, ACR Project Consultants Pvt Ltd mentions the following drivers for growth of the industry:

- Changing demographics, lifestyle patterns and food consumption patterns in urban areas with nuclear family setup leading to increasing demand for processed, chilled, frozen food and beverages
- Rising need for the cold chain facilities to reduce the cold chain infrastructure gap as stated above
- Increasing government initiatives and financial support
- Increasing private sector investments of both domestic and foreign players
- Increasing demand for packaged or canned or frozen or ready-to-eat products
- Increasing interest in Indian food market and investments from international players like food chains and logistic players

Trends to watch in 2020

According to various marketing research reports, the Indian cold chain logistics market is estimated to be in continuous and rapid growth for the next few years. And in this scenario, it is necessary to preserve quality of goods during transformation and transport processes. Apart from that, it is necessary to keep a tab on total energy consumption in refrigeration. Therefore, the industry stalwarts feel the need for high efficiency solutions that will certainly be an important trend in the cold chain industry. Energy saving is always linked to operating cost, where it is easy to calculate the return on investment.

“Technology innovation is required in energy efficient field - reasons being high operating cost and lower margins of the customer segments. Efficient Ammonia

compressor with screw technology are preferred,” states Soumen Mukherjee from Ice Make Refrigeration.

Pack houses for enhancing value of agricultural produce

Vikram Murthy, President, ISHRAE opines that pack houses are the apt solution for enhancing the value to the farmers for their agricultural produce. A pack house performs the functions of large-scale sorting, cleaning and dressing, inspecting, packaging, temporary cold store preserving and planned despatching to locations where enhanced value can be realised and transferred directly to the seller. These packhouses are located close to a collective of farms and then freight operator cooperatives can run the cold chain transport by multi-modal transport to the point of sale. The whole link must be connected by a business that is well encouraged, monitored and regulated to perform efficiently and reliably.

Renewable energy to gain traction

In order to reduce the carbon footprint, cold chain sector is exploring the use of renewable energy such as solar, biomass, and wind energy. “Even technologies emerging for food processing are such that function in hybridisation manner with cold chain involving minimal processing of its



These packhouses are located close to a collective of farms and then freight operator cooperatives can run the cold chain transport.

Vikram Murthy,
President, ISHRAE



Brushless DC (BLDC) technology with Electronic Expansion Valves (EEVs) could be one answer, as this combination can provide stable refrigerant flow to keep a reliable conservation temperature.

Eason Cheng,
Marketing Manager -
Refrigeration, APAC,
CAREL

constituents. Cryogenic technology has another dimension for F&B sector to prolong their life. Trends are changing even in case of regulatory standards and guidelines to facilitate cold chain growth vis-à-vis F&B,” informs Atul Khanna, India Representative, Global Cold Chain Alliance (GCCA).

Energy saving with variable speed compressors

According to Eason Cheng, CAREL Marketing Manager - Refrigeration, APAC, energy saving of 20-30 per cent by implementing ExVs and variable-speed compressors will be the first step involving well-known actions that can be introduced in cold chain industry. In addition to the implementation of individual components, coordinated management of high efficiency components to maximise efficiency could be another step to respond to this trend. Communication between the rack controller and cold room controller, integration of the air conditioning system and lighting system, combining the refrigeration system with the building

heat recovery system, or making the waterloop work with the refrigeration system to maximise overall Coefficient of Performance (COP).

While talking about maintaining stored products in a safe temperature range, he informs, “Recover cooling capacity will be a hot topic for the cold chain industry. Brushless DC (BLDC) technology with Electronic Expansion Valves (EEVs) could be one answer, as this combination can provide stable refrigerant flow to keep a reliable conservation temperature, and can also give a quick response to dynamic requests, so as to release full cooling capacity in a very short time and fulfil the instant request, such as recovering after a blackout. BLDC inverters can moreover stabilise the power supply to compressor, avoid compressor start up in critical condition, reduce maintenance and unexpected failures in the field.”

Use of natural refrigerants

Anuraga Chandra, Head – Cooling Sales, India Region, Danfoss Industries Pvt Ltd stresses on wide adoption of natural refrigerants in most applications. On this, he says, “This comes from a direct lack of knowledge and awareness on safety. There is still a sizeable number of market players that use chlorofluorocarbon (CFC), hydrofluorocarbon (HCF) and hydrochlorofluorocarbon (HCFC) as refrigerants. At Danfoss, we believe natural refrigerants are an environmentally safe alternative to the traditional refrigerants if used with the right safety standards. The evolution within the use of refrigerants within the cold chain and overall HVACR sector is definitely a trend for the year 2020.”

Rising demands of modern customers

Cold chain industry is under tremendous pressure to cater to the rising demands of modern consumers. Demand for fresh food is increasing while at the same time, cold chain from farm to fork has gone global. More and more products are introduced in the market which have shorter shelf life and require stricter

temperature control throughout the cold chain – from manufacturer, refrigerated warehousing, during transit and at the retail outlets too till the product falls in the hands of the consumers.

“Much focus is on maintaining quality of the product – its texture, its taste should be kept intact by not deviating from the recommended temperature limit values. Shipments are not accepted if the prescribed limit values of temperature are not adhered to in any of the given stages of cold chain. Stricter regulations are falling in place – all the more pressure on the cold chain logistics to adopt reliable measurement technology of temperature, humidity and even shock during transit,” informs Kalidas Bhangare, Managing Director, Testo India Pvt Ltd.

In pharmaceuticals too, product innovation is driving more and more temperature sensitive products and compounds into the cold chain. With this, cold chain operators are required to build stronger infrastructure and switch to latest technologies that will support the market demands. Building efficiency, sustainability and integrity will be the focus area for cold chain industry.

Testo’s transit data loggers testo 184 help in getting key information of



The evolution within the use of refrigerants within the cold chain and overall HVACR sector is definitely a trend for the year 2020.

Anuraga Chandra,
Head – Cooling Sales, India
Region, Danfoss Industries

temperature log straight as a PDF report without any software installation and simply by plugging it as a USB.

Positive trend for air curtain

Akriti Gupta, Vice President Sales, Mitzvah Air Curtains, one of the leading air curtains manufacturers in India, hopes a positive trend for air curtains. While talking about trends for 2020, he gives emphasis on awareness around the technical aspects of air curtains especially, concerning the kind of industrial air curtains that are used for certain requirements, and the most important its placement. "This all requires education around the subject. Companies who are serious about doubling their turnover for the coming year must consider this aspect as we believe that education and awareness will ramp up demand while also giving rise to new trends within the cold chain industry," states Gupta.

Energy Efficiency

Jegapriyan Govindarajan, Managing Director, Tecumseh Products Company, an American manufacturer of hermetic compressors for air conditioning and refrigeration products, envisages energy efficiency as a trend in commercial refrigeration as they have client base in commercial refrigeration and always



The Indian market is gaining awareness of the existence of green technology.

Jegapriyan Govindarajan,
Managing Director,
Tecumseh Products

demand for high energy efficiency products. "Another factor that we notice is that there are cost pressures, we see cheaper imports from China. Also, the Indian market is gaining awareness of the existence of green technology," informs Govindarajan.

Integration of IoT

Cold chains traditionally relied on drivers, warehouse managers and transporters to confirm that temperature of goods transported by them is maintained at optimal temperature during the course of entire chain. "As an improvement, post-delivery, a data logger was then used to download data and verify the temperature reading in warehouses and during journey. However, in recent times, with the advent of IoT and strict requirements of the shippers, all participants are more focused on getting real-time visibility of temperature data. But the use of IoT is not adopted in an integrated manner and it is used for corrective measures rather than preventive measures. In other words, use of analytics to improve operations and business decisions is largely absent, informs Rohit Chaturvedi, CEO, Transport Hub.

The next stage of IoT evolution is towards integration of IoT with analytics tools such as machine Learning. The analytics can be used not only by the operations team but also by the management to improve business metrics on real-time basis.

The supervisory system, whether in the field or remote, and the trend towards IoT will also be important for the cold chain industry. Remote alarms and data logs help address issues occurring in the field, while centralised cloud-based systems can be used to analyse showcase or cold room performance and benchmark store-to-store performance, helping the cold chain management team improve store management. In the near future, IoT service based on machine learning will be able to provide diagnostics and pre-maintenance to the cold chain industry, another certain trend.



Stricter regulations are falling in place – all the more putting pressure on the cold chain logistics to adopt reliable measurement technology of temperature, humidity and even shock during transit.

Kalidas Bhangare,
Managing Director,
Testo India

"Automation and cold storage go hand in hand as the industries work together to secure the cold chain. Presently the market demand is steady, and as an automation company, we are constantly in the pursuit to innovate with technology and our products. We study market trends and requirements; cold storage is an industry which is likely to see growth and we try and innovate so that our solutions fit the individual requirement of the customer," states Dimpi Barot, Gandhi Automations Pvt Ltd.

Carsten Dahlgaard Senior Director of Sales, Industrial Refrigeration, Danfoss A/S. Denmark, informs, "Within the scope of industrial refrigeration and cold storage, the trend is that globally we are seeing that safety and total cost of ownership are the drivers within the industry. Today the five points that are important to the cold chain and the industrial refrigeration sector are energy, the total cost of ownership, reliability and also safety and standards."

"Investment in the right technology and adherence to the regulations will be the contributing success factors in 2020," concludes Bhangare. ■

Temperature and ventilation are very important parameters to be perpetuated during the processing as well as storage of the various drug substances and drug products, which ultimately influence their standard.

HVAC Cold Supply Chain in **Pharma Industry**

The pharmaceutical industry building adopts the centralised air-conditioning system with the characteristics of complicated structure, numerous equipment, relatively concentrated, high level of energy consumption, flexibility larger. The energy consumption and energy efficiency was been argument. It was a very good solution for the pharmaceutical companies. So, the heating, ventilation and air system encompass heating, ventilation and air-conditioning (HVAC) which is integral component of pharmaceutical facility functionality. The system is needed for maintenance of a suitable temperature, for continuous flow of air, which ultimately prevents cross contamination and accumulation of air and to ensure the cooling of air in the premises. The three core facets of HVAC system validation comprise of installation qualification (IQ), operational qualification (OQ), and performance qualification (PQ). Validation of HVAC system is an essential subject to provide documented evidence about the accuracy of results produced by it. The validation of HVAC system involves systemised and assembled documents of functional specifications and design. The various parameters to be evaluated for the validation of HVAC system include air flow pattern, air flow velocity, air changes per hour, filter leak test,

particle count, viable monitoring, filter integrity test, pressure difference, recovery test for temperature and humidity, temperature and humidity uniformity, and fresh air determination.

Introduction

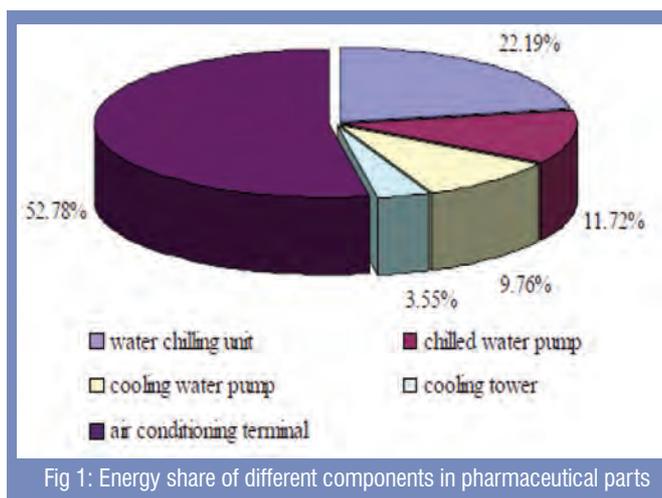
Validation is a very vast topic in the field of pharmaceutical sciences. It ensures about the accuracy of results being produced by any system. Maintenance of quality of products is of great importance, especially in the field of pharmacy as this field deals with drugs which directly affect the human body. The HVAC system is an extremely vital concern, which aids to enhance and maintain the quality of drug products. It assists in achieving an adequate temperature, ventilation, and air-conditioning in the premises. The HVAC system design has an immense impact on the prevention and control of cross contamination and for the achievement of a hygienic condition at the work place. Temperature and ventilation are very important parameters to be perpetuated during the processing as well as storage of the various drug substances and drug products, which ultimately influence their standard. Air-conditioning not only mean cooling of air but also embrace temperature, moisture in the air (humidity), supply of outside



air for ventilation, filtration of airborne particles, and air movement in the occupied space.

HVAC systems are of great importance to architectural design efforts for four main reasons. Firstly, these systems often require substantial floor space and/or building volume for equipment and distribution elements that must be accommodated during the design process. Secondly, HVAC systems constitute a major budget item for numerous common building types. Thirdly, the success or failure of thermal comfort efforts is usually directly related to the success or failure of a building's HVAC systems (when passive systems are not used), even though the HVAC systems should be viewed as part of the larger architectural system. Last, but not least, maintaining appropriate thermal conditions through HVAC system operation is a major driver of building energy consumption.

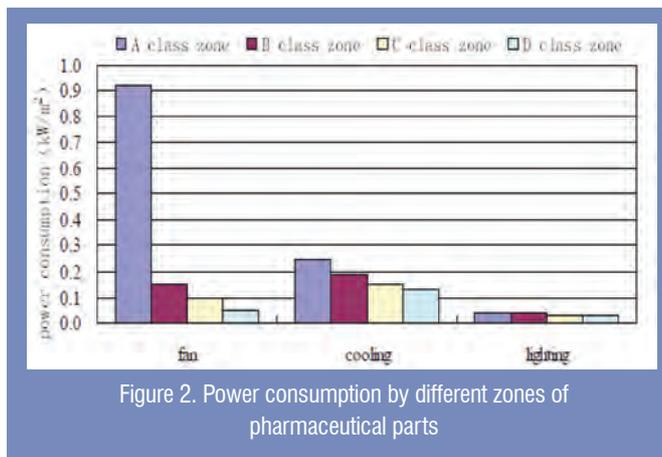
Through field investigation, the pharmaceutical factory adopts a shift working system, 8 hours per shift, working time of 250 days, the production cycle of each batch of drug for 7 days, after each production cycle need for equipment maintenance and disinfection. Fans run for 24 hours at the rate of 40 ~ 45Hz on production and the rate of 30 ~ 35Hz on duty. Through the data statistics of 2012, a conclusion was reached to the energy



consumption of each component and their respective percentage of total energy consumption. The percentage of each item of total energy consumption was such as shown in Fig. 1.

The figure 2 shows that the fan energy consumption accounted for 52.78 per cent of the total energy consumption, Chiller energy consumption accounted for 22.19 per cent, the fan energy consumption ratio is higher. Power consumption of clean area was such as shown in Fig. 2.

Fig. 2 shows that the power consumption load of the pharmaceutical production workshop was very high. In A class zone, fan power consumption was up to 0.92kW/m²; Cooling and lighting power consumption were respectively 0.25 kW/m² and 0.04 kW/m². In B class zone, fan power consumption was 0.15 kW/m²; Cooling and lighting power consumption were 0.19 kW/m² and 0.04 kW/m². In C class zone, fan power consumption was 0.10 kW/m²; Cooling and lighting power consumption were 0.15 kW/m² and 0.03kW/m². In D class zone, fan power consumption was 0.05kW/m²; Cooling and lighting power consumption were 0.13 kW/m² and 0.03 kW/m². Among all kinds of power consumption, fan power consumption was larger. Fan power consumption in A class zone was 18.4 times that in D class zone, and the level of lighting power consumption was no less essential. Therefore, to meet the purification production condition, lower the level or the area of clean room was an



effective energy-saving measure to reduce the energy consumption of the fan.

Storage in pharmaceutical parts

Many products can be safely stored at uncontrolled room temperature. However, the temperature in the upper part of a store can exceed (+) 40-degree C even in temperate climates. In cold climates, temperature will drop below freezing in unheated stores. Such temperature extremes may damage some items. In hot climates, it is necessary to store many items in air-conditioned rooms (Fig.3). In humid climates, dehumidifiers are useful for preventing moisture damage. In cold climates, stores may need to be heated in winter to protect products that are damaged by freezing. The potency of vaccines, sera, test kits, and many other items depends on cold storage. Vaccines in particular are temperature-sensitive and must be kept at precisely controlled temperature from the point of manufacturer to the point of administration. Cold chain defects are a frequent cause of problems in immunisation programs. Narcotics and other controlled substances should be kept in a secure room or in a safe. Ideally, a red warning light or warning bell that will active when the door is unlocked should be fixed close to the store. The keys to the secure store should be kept in safe. For the evaluation of this parameter, a titanium tetrachloride stick is taken and burnt and the burning stick is placed in front of the air handling unit (AHU). The distribution of smoke is observed. It should be uniform.

To achieve an appropriate cleanliness in the premises, high efficiency particulate air (HEPA) filters are used. The HEPA filters are employed to ensure the aseptic condition. The integrity of the filters should be checked at regular intervals by performing leak test. HEPA filters are a part of the AHU. The area of HVAC is divided into four hypothetical grids and the air velocity is measured at each grid and then the average air velocity (V) is calculated. The area of the HEPA filter inlet (A) is calculated in feet and the total air volume (T) is then calculated by multiplying the average velocity of air and the area of the inlet ($T = A \times V$). After this, the volume of the room is calculated and the air changes per hour are obtained by dividing the total air change by the volume of the room. In the AHU, the outside fresh air, combined with the return air from the cubicles, is treated by AHU

and supplied to the laboratory area. A part of the air exiting from the laboratory rooms is directly exhausted into the atmosphere by an exhaust fan, while the remaining air is recirculated to the AHU as return air by a return fan. The air entering into the AHU is filtered by pre-filters and medium filters and then air conditioned for humidity and temperature control, and is supplied to the laboratory area by a supply fan at desired pressure. The supply air is terminal filtered by HEPA filters at the entrance to the clean rooms. The fresh air intake is observed at the inlet on the fresh air dumper. The total air change is calculated. The intake fresh air is divided by the total air change in the room and multiplied by 100 to obtain the percent fresh air intake on each cycle by the HVAC system in all the individual rooms. The uniformity of temperature and humidity are monitored by employing a calibrated thermometer and manometer, respectively. The two parameters are monitored on daily basis, documented in the format and stabilisation is ensured within the specified limit. It is calculated by making use of the manometer attached at the walls of the adjacent area. The pressure difference is generally kept between 5 and 20 mmHg pressure. The recovery of temperature and humidity is checked. For this, the humidity and temperature are checked at the off position of the HVAC system. Then the humidity is increased to 75 per cent and temperature to 400-degree C and again the temperature and humidity are measured after switching on the HVAC system, and the time required to stabilise the temperature and humidity is noted. The designer to determine the type of heat recovery used to transfer heat between the exhaust air stream and the fresh outdoor airstream, such as:

- **Enthalpy wheel**—rotation transfers both heat and moisture between two side-by-side airstreams.
- **Heat pipe**—a sealed pipe with refrigerant that transfers heat between side-by-side airstreams.
- **Air-to-air heat exchanger**—typically a plate-and-frame heat exchanger that transfers heat between two side-by-side airstreams.
- **Run-around loop**—a system that pumps heat-transfer fluid between two heat exchangers, one in the outdoor airstream and the other in the exhaust.

Outdoor air (OA) rates for pharmaceutical manufacturing clean and utility spaces typically range between 5 per cent and 15 per cent. Clean room air change rates are high and drive small temperature differentials between supply air and room set points. Mixing return air with OA at 5 per cent–15 per cent at design winter conditions is more likely to lead to a cooling load rather than a heating load, making heat recovery on these systems ineffective. Air-handling systems with low air-change rates—such as those for mechanical utility spaces—do not benefit from exhaust-air heat recovery either. These areas have equipment that emits enough heat to eliminate the need for heating throughout the year.

Some of the general requirements may be stated in the form of certain parameters like:

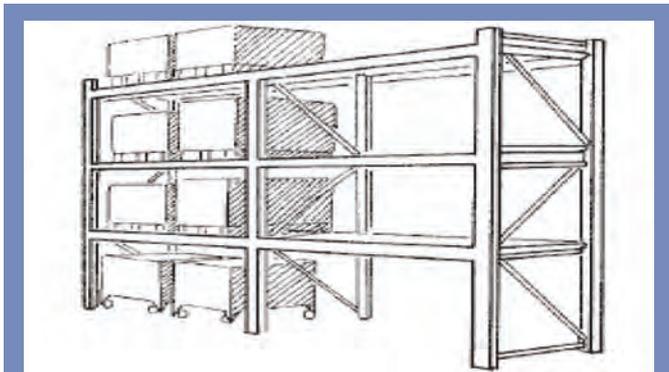


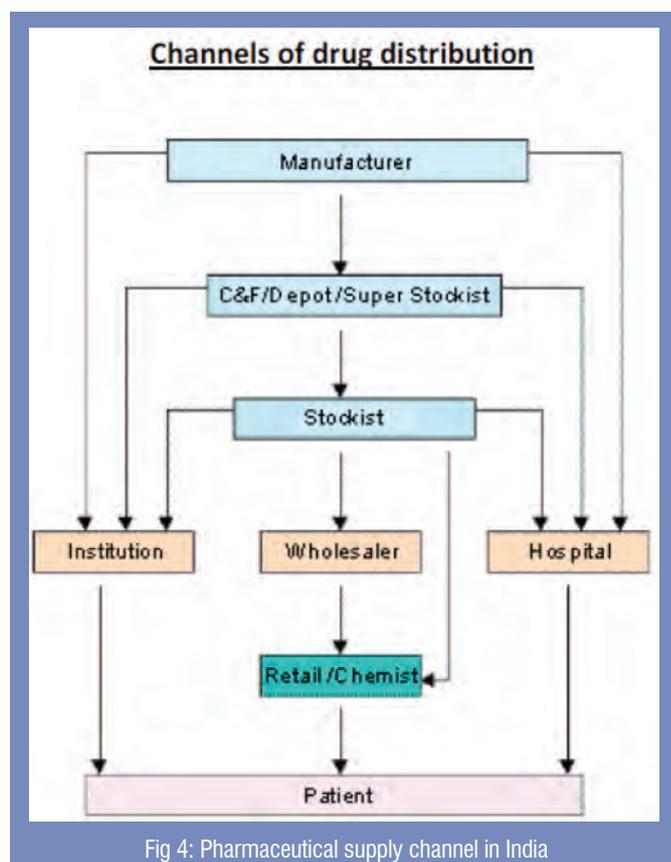
Fig. 3: Storage in heavy-duty racks in air-conditioned area

- Size of the equipment.
- Speed of the equipment.
- Effectiveness of the equipment.
- Availability of spares, change parts, and prompt services at reasonable cost.
- Ease of operation, cleaning, and maintenance.
- Low dust and sound generation.
- Lesser breakdowns.
- Materials of construction.
- Auto-control system.
- Easy change over.
- Overall good construction and workmanship, etc.

The fresh air intake is observed at the inlet on the fresh air dumper. The total air change is calculated. The intake fresh air is divided by the total air change in the room and multiplied by 100 to obtain the per cent fresh air intake on each cycle by the HVAC system in all the individual rooms.

Distribution channel in India

There are many activities in the area of cold chain management in pharmaceuticals due increased government initiative and funding in this area. India has an old but quite good public distribution system for pharmaceuticals across the country. The major pharmaceuticals are in localised pockets near to Delhi and are distributed all over the country from there. The pharmaceuticals need to be delivered to air conditioned stockiest and warehouses in order to be processed though (Fig.4). Warehousing in pharmaceuticals cold supply chains is a very big problem in this



case. This sector is rather unorganised and inefficient and the public distribution system in pharmaceuticals is not very effective either. There is a lot of wastage during storage, lead times are high and security issues are not considered. The aim would be to develop good warehouses and cold chains. So finally, the pharmaceuticals cold chain needs to be improved significantly. Therefore, the government is currently making substantial investments in this area, mainly in the pharmaceutical cold chains though. Even though the logistics sector is growing, whether it is roads, aviation, railways, containers or the use of various modes of transport, the amount of the technical knowledge in the sector is quite low. But in the manufacturing part of the curriculum, workers have an understanding of different technologies so that they can find a natural way to enter those sectors. In the areas of logistics there is a great need for education, but there are not enough institutions that offer training in logistics. However, the skill development efforts in the transportation, warehousing and packaging sector are an important trend. Not only skills, but also attitude and behaviour are important in managing pharmaceuticals cold chains need to be dramatically improved. India is a very rapidly developing country, especially when it comes to its infrastructure. For co-operations, the needs of other countries should be identified in order to find concrete and efficient solutions to reach a win-win-situation for both sides.

Conclusions

The pharmaceutical plants are a venue where facilities are provided for medicine research also. The installation of the HVAC system to that place has an important role in controlling the comfort, IAQ, aseptic conditions and suitable indoor thermal conditions for creating an ideal working environment to researchers and staff and drug manufacturing plant. The IAQ and thermal comfort in the plant side is important as it may affect the work and health of the workers and quality of drugs. A very clean indoor environment for pharmaceutical goods and thermal comfort for productivity and satisfaction of indoor building occupants are the characteristics of a pharmaceutical plant. To ensure a clean environment the IAQ must be maintained within the acceptable limit suggested by ASHRAE. A pharmaceutical plant always has a chemical and a washing room where TVOC (total volatile organic compound) concentration is obviously too high. There should be an increased ventilation rate for better dilution in order to keep the TVOC concentration below the standard limits. In order to minimise the energy-use, the temperature set point for room air should be in between 22.5 and 26-degree C. ■



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Exploring dry and adiabatic cooling solutions

Dinesh Badgandi, CEO, Thermax Cooling Solutions, gives an overview on heat dissipation technology and its inclusion within the Indian market, while in conversation with **Ranjana Konatt – Editor (Brand Positioning)**

Is there an urgent need to be associated with processes such as heat dissipation technology? What is the need within the HVACR industry?

Thermax Cooling Solutions Ltd is a 100% subsidiary of Thermax Group. The company is associated with heat dissipation and we are presently focusing on the industry by offering solutions using air-cooled systems. The whole idea is to optimise processes while also trying to address the need within the industry. Thermax is associated with energy and the environment. We have always

associated with optimising processes and the industry as a whole. Our main focus is to provide optimised solutions to the industry. The need within the industry is that we need proper dissipation of energy and we feel that this segment is very helpful to us.

How big of an opportunity is it to explore both dry and adiabatic cooling solutions? Is the government promoting high-value micro-cold chain requirements in India?

We see the need as an opportunity to use both dry and adiabatic cooling solutions. This is a big opportunity and with the government also promoting and supporting high value – micro-cold chain requirements in India, we see that this segment is here to grow. Conservation of water is a key challenge as well, and every industry globally is facing the issue concerning the optimisation of water. The company is dedicated to introducing and addressing customer requirements to optimise the dissipation requirements. Many industrial processes use various energy sources for heating application in their processes. This heating in the process is conducted through process fluids such as air, water, steam, pulp, chemicals etc. Thermax cooling solutions use air- and water-cooled systems to bring down the temperatures of these fluids. For instance: Steam coming out of the turbine in a power plant needs to be condensed to enhance the efficiency of the power plant. Our product Air cooler condenser condenses the steam to condensate (hot water) which can be reused as boiler feed water in a power plant. This equipment is critical for the turbine operations and overall power plant efficiency.

What is Thermax Cooling doing differently when it comes to heat dissipation through air-cooled systems? What are

the challenges concerning the acceptance of the technology within the Indian market?

Thermax has deployed its expertise in heat and mass transfer while designing these products. In depth process and metallurgy knowledge, reliable component selection ensures optimizes the energy usage and increases the productivity of customer processes. A high capital cost, the availability of space in the plant are some of the key challenges deploying dry cooling solutions in Domestic market.

What are the challenges sighted when it comes to introducing the concept to the market, is heat dissipation a concept that must first be captured at a micro level within the industry?

Yes, a big challenge is selling or introducing the concept to the market. Heat dissipation is something that needs to be captured at a very micro level in the industry. There are industries, processes that are globally accepted and used, but the challenge is to bring it to a level where it is easily accepted by the customer so that it fits into the broader scheme of things. Most of it is based on the return on investment, and there is a requirement of adaptability of the product within the process. Another challenge is the adaptation of the systems and processes, cost is also a factor to be considered. The main rider in the broader scope of things is the conservation of water and the optimal use of power. We see MNCs adopting principles and being used globally; this will help us establish industry parameters. Thermax has started the offerings in process cooling space in last two to three years and it aims to be market leader in the domestic market and amongst top five in selective international markets. ■

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Changing Patterns in Warehouse Cooling

Warehouses represent a vast underestimated opportunity for improved operations, lower operational costs, reduced climate impact and a more sustainable building stock through energy management.

In the early 20th century, warehouses had narrow floor plans or had large spaces with high ceilings. Both of these configurations were favourable for natural ventilation due to proximity of windows for wind-driven natural ventilation or the provision for a warm stratified upper air layer to accumulate and exhaust indoor pollutants in the case of stack-driven natural ventilation.

A typical warehouse has metal cladding-steel frame structure and overheating can easily occur due to solar radiation and stratified space especially in regions with hot and humid climate such as north and south India.

With the increasing momentum of the use of mechanical ventilation, natural ventilation and air conditioning during the second half of the 20th century, existing knowledge on the integration of natural ventilation systems as a design and architecture features had become obsolete. Now, the increasing of expectations and thermal comfort and indoor air quality (IAQ) standards had made designers and

warehouse owners to choose the more reliable air ventilation option.

When we talk about air conditioning a warehouse, we don't just mean warehouses, we mean air conditioning any large space such as workshops, production lines, depots, soft play areas, trampoline parks, storage facilities, racks, packing area etc.

Warehouses represent a vast underestimated opportunity for improved operations, lower operational costs, reduced climate impact and a more sustainable building stock through energy management. Overall, heating, ventilation and air conditioning (HVAC) accounts for roughly 30-40 per cent of total energy cost in a warehouse.

Challenges in Warehouse Airconditioning

As the warehouse has minimal air inlets and the roof of the warehouse is heavily insulated, the presence of heat and high humidity is easily sensed in the warehouse compound. The heat gained from morning to evening is

due to radiation on the roof, human activity and machineries.

It is extremely difficult to arrange exhaust fans to ensure that fresh air reaches all locations in the warehouse. Obstructions, such as storage racks, interfere with air flow, and stagnant regions tend to develop in corners of the space.

Best Practices in Warehouse Airconditioning

From the traditional naturally ventilated warehouses of the past, warehouse owners are making changes to the air-conditioning approach and moving to HVAC/TFA system to provide comfort environment to employees to increase productivity. The change is also being driven due to the type of storage that the warehouses are being used for.

A best practice is to vary space conditioning temperatures and ventilation rates in accordance with occupancy patterns, warehouse activities and the needs of the stored goods. Using

programmable thermostats with time clocks, setbacks and demand control ventilation to reduce energy requirements of HVAC equipment helps automate the air conditioning system which in turn reduces the staffing needed for O&M as well as operational costs. Installing IoT based thermostats on heaters will allow for monitoring and control of multiple HVAC units that sometimes get left in the heating position even during the summer. Another smart strategy that is finding more favour with designers of warehousing structures is to divide the building into thermal zones with separate controls based on space function.

Conclusion

The key driver for the change in air conditioning approach for warehouses is to improve human comfort in an enclosed warehouse with minimal cost as this improves the productivity of the employees working in the space. The proposed ideas are aimed to enhance human comfort of

the workers comfort as the current temperature and humidity that are found inside the majority of warehouse in the country are way below standard comfort level due to minimal air exits in the warehouse. The poor IAQ is physically taxing for the staff to conduct tasks consistently in the warehouse.

The other objective of designers is to develop an energy efficient solution for a warehousing organisation that also enhances the ventilation system. Costs are a key factor in warehouse operations and hence, any change has to consider the Return on Investment (ROI) in addition to the human comfort aspects. ■



Prashant Yadav,
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Cold Chain Conundrum

The article talks about that most food loss and waste in developing countries occurs during production and after it is harvested, the greatest potential for reduction is investment in infrastructure related to storage, transport, cold-chains, and distribution.

How do we sustainably feed nearly 10 billion people by 2050? This is the pressing question recently faced by WRI and partners from the World Bank, UNDP and UN Environment as they launched the 'World Resources Report: Creating a Sustainable Food Future'.

This follows the outcome of the EAT-Lancet Commission report released earlier this year, led by an international group of leading academics, which considered how we can deliver healthy diets for such a large number of people from a sustainable food system.

WRI estimated that we will need to produce 56 per cent more food in 2050 than we did in 2010. But alongside defining demand, supply and diet, there is the tricky fourth dimension of economically effective market reach. Without efficient physical connectivity, production cannot and does not translate into supply.

A well organised and sustainable food logistics network is absolutely critical to supply the production, with minimum product losses, and feed the 10 billion,

and without such a distribution network, the other three dimensions are largely a matter of academic conjecture.

Cold-chain infrastructure is essential to economically effective market reach through efficient connectivity. According to UNFAO, “the lack of sufficient and efficient cold-chain infrastructure is a major contributor to food losses and waste in NENA (Near-East, North Africa), estimated to be 55 per cent of fruits and vegetables, 22 per cent of meats, 30 per cent of fish and seafood, and 20 per cent of dairy”.

As one example, UNFAO estimates that 35 per cent of fish caught is lost, noting that “most of the losses are due to a lack of knowledge or equipment, such as refrigeration or ice-makers, needed to keep fish fresh”.

Given that most food loss and waste in developing countries occurs during production and after it is harvested, the greatest potential for reduction is investment in infrastructure related to storage, transport, cold-chains, and distribution.

Both the WRI and EAT-Lancet studies equally recognise the important role of cold-chains and market connectivity in matching increased supply to increased demand. As one example, both set targets for reducing food loss and food waste by 50 per cent and cold-chains are an essential enabling technology in helping to reach such an outcome.

The total food that is lost and wasted across the world today represents a combined 1.3 billion tonnes, or the production of nearly 30 per cent of the world’s agricultural land, and hence WRI goes as far as to call for the target to be met by 2030.

However, neither piece of work, nor indeed the IFC nor UNFAO, tries to quantify what would actually be required to successfully meet these targets - let alone transport, store and distribute nearly 6 billion tonnes of food by 2050, a substantial portion of which will be fresh and temperature sensitive produce - in terms of the physical numbers and capacity of temperature-controlled road vehicles, cargo ships, multi-modal containers, domestic refrigerators, chilled display cabinets, cold storages, pack houses, ripening chambers, pre-coolers and a plethora of other cold-chain supporting equipment and infrastructure in the energy, transport, retail and food logistics sectors.

Furthermore, appropriate business operating models, cold-chain management systems and training and skills development will be needed too.

As to an indication of the size of the challenge, currently 70 per cent of food in the mature developed markets of the world passes through a cold-chain at some point on route from the point of production to our table. By comparison, in India barely 10 per cent of the produce that could benefit from using the cold-chain actually does so



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– with 1/20 of the population of India, the UK has 10x more refrigerated vehicles alone.

India is the world's second largest producer of vegetables and fruit and among the top ten in fish and meat, but the bulk of these perishable products face risk on the journey to the consumer due to exposure to high temperatures, inadequate handling and logistical support. Reportedly, upwards of 25 per cent of such produce is lost due to a lack of farm-gate preconditioning including precooling, refrigerated vehicles and shipping containers and other supply chain bottlenecks.

Importantly, this infrastructure deficit restricts market expansion which in turn dissuades efforts to improve productivity. Any efforts to produce more food, without concurrent logistics enablement, means higher supply at markets in immediate proximity to production points at time of harvest, and a lower product valuation as these markets are in surplus.

Given the use of refrigerants and insulation in cold-chains, the sector is important not only for its effect on our ability to deliver the Paris Agreement on Climate Change but also for a successful outcome to the Montreal Protocol and Kigali Amendment.

In this regard, other than a commitment to achieving zero-carbon cold-chain logistics with no emission of pollutants, neither the WRI nor EAT-Lancet reports consider the potential environmental impact if we do not achieve such a laudable aspiration, let alone the infrastructure investment required to make it happen or the scale of the clean energy resources needed to deliver on it.

Alongside providing enough nutritious food to feed nearly 10 billion people and delivering it using clean energy, we must simultaneously improve the livelihoods of the nearly half a billion small and marginal farmers who are essential to today's global food system and the major stakeholders in its future. According to the Africa Agriculture Status Report (AASR), 80 per cent of Africa's 51 million farms are smaller than two hectares. In combination they produce 70 per cent of the continent's total food requirements.

Elsewhere, smallholder farmers provide around 80 per cent of the food consumed in Asia and this statistical pattern is repeated in developing economies around the globe. Overall, the EATLancet study identified that currently, small and medium sized farms provide more than 50 per cent of the essential nutrients in the global food supply.

The deployment of cold-chains does not just enhance food security, in terms of increasing reliable access to a sufficient quantity of nutritious food, it also allows farmers to earn more by ensuring the quality of their produce and providing the efficient and effective connectivity needed to sell it further afield - reaching consumption centres in distant cities and urban conurbations.

Such capacity is both empowering and galvanising as the farmers can begin to consider growing higher value produce for new markets. It also provides opportunities to produce and sell food better suited to new growing conditions as they emerge, thereby, helping them to build capacity for resilience and adapt to a changing climate.

The central philosophical challenge to be addressed is that feeding the world is largely perceived today as a large-scale industrial enterprise, with land consolidation into larger, mechanised production units being the default business model for economic efficiency. But for sustainability we need new radically innovative models which economically empower the marginal and small farmer - and create rural employment and resilience, in alignment with existing human backdrop and current on the ground reality.

The cold-chain is at the heart of this and India has recognised it as such in the deployment of integrated cold-chains is identified as a key pillar to fulfil Prime Minister Modi's vision of doubling farmers' incomes by 2022. The reality of business dictates that no matter how appropriate a shift in philosophy might be, cold-chains will only be taken up by small and marginal farmers and associated supply chain players if they are affordable within the local economic context.

There are a range of price points within the various options, including shading or simple evaporation cooling. But the investments will likely increase in scope as operations increase in size and complexity. Given the high capital requirement, marginal and small farmers across economies are likely to adopt "pay as you use" type services and funding models will need to be innovative, driven through empowered Farmer Producer Organisations (FPOs), be they as Farmer Producer Companies (FPCs) or co-operatives.

Equally key is to enable small and marginal farmers through FPOs and other knowledge transfer channels to understand how to avail services of the integrated components of pre-cooling, storage and transport to gain the economic advantages available from cross-geography access, distance-price arbitrage, time-arbitrage and cross-seasonal trading. This is where new value is created and logistics management is as important as the physical infrastructure required to enable the flow of food from point of production to point of consumption.

Cold-chains can be an essential contributor to the United Nations Sustainable Development Goals - not least SDG 1 (End Poverty); SDG 2 (Zero Hunger); SDG 3 (Good Health and Well Being); SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action), the Paris Agreement on Climate Change and the Kigali Amendment to the Montreal Protocol.

The key question we need to answer is: "How do you create the local and global, temperature controlled "field to fork" connectivity to feed 10 billion people sustainably from hundreds of millions of small-scale farmers whose livelihoods and well-being are often dependent on only 1-2 hectares, as well as ensure they are climate change adaptation ready and resilient ... all without using fossil fuels? ■



Toby Peters,
Professor of Cold
Economy at the
University of
Birmingham

India Cold Chain Show 2019 concludes on a high note



India Cold Chain Show 2019 was held from 4-6 December at Bombay Exhibition Centre, Mumbai, which saw participation from leading stakeholders and industry players from across the globe. The cold chain industry wholeheartedly welcomed the event, which witnessed a substantial increase in visitor footfall. In a span of 3 days, key buyers flocked the venue to discover cost-effective range of products, solutions and technologies encompassing cold storage, refrigeration, ripening chambers, reefer transport, tracking and IoT, packaging, cold storage infrastructure, cold logistics, cold chain supply segments and much more.

The tradeshow was a converging point for exhibitors, influencers and decision-makers to forge connections, conduct business, gain insight, network as well as reconnect. The 'Cold Chain Summit' and 'Pharma Distribution Conference & Workshop' brought together over 50 leading industry speakers and successfully created a platform to learn, gain insights, socialise and find out about emerging trends in the cold chain in India. Leading professionals from pharmaceuticals, food processing, retail, meat and seafood, dairy, ice-cream, cold supply chain and other end-user industry

segments attended India's biggest event on cold chain and refrigeration to explore the best brands, innovative products and market trends in the cold chain.

Eminent speakers from companies like Hindustan Coca-Cola Beverage, Modern Bazaar, Big Basket, Chaayos, Honeywell Voice Solutions, Reliance Life Sciences, Mother Dairy, and Easyday Super Market (Future Group) shared insights on key topics during the conference.

Many leading companies supported the show such as Gandhi Automations, KII, Pluss Advanced Technologies, Arctic Refrigeration Pvt. Ltd., Rinac India Limited, Honeywell and many more alongside renowned names like Blue Cold Refrigeration, Daikin Airconditioning India, Everest Industries, Godrej & Boyce, Kirloskar Brothers, Lamilux India, Nilkamal, Rockwell Industries Ltd., Ice Make Refrigeration Limited, Frick India Limited, Subzero Insulation Technologies Pvt. Ltd., TCI Cold Chain Solutions and Schaefer Systems International, were part of this edition.

The 2019 edition of India Cold Chain Show saw unprecedented growth in visitor footfall, business as well as networking opportunities, the organisers claims. ■



“Turkey considers India as an important commercial partner”



The Indian and Turkish air-conditioning industries have become closer every year in line with the rising number of commercial partnerships between the two countries.

Alexander Kühnel, General Manager, Hannover Messe Sodex Fair

ISK-SODEX, the leading air-conditioning industry exhibition in Eurasia, held in Istanbul between 2–5 October. In an interview with Subhajit Roy, Alexander Kühnel, General Manager, Hannover Messe Sodex Fair talks about how this event contributes to the global air-conditioning industry. Excerpts:

First of all, I congratulate you and your team for holding such a successful ISK-SODEX 2019 exhibition. Can you tell us about the highlights of this exhibition?

This year's ISK-SODEX, held on October 2–5, 2019, was more successful than ever. Once again, we united stakeholders from all industries and allowed for significant international business volume and commercial connections. This year, ISK-SODEX hosted 1,021 exhibitors from 36 countries in a net stand area of 44,804 square metres. We had 85,371 visitors, 12 per cent of whom were foreigners. Visited by 10,027 foreigners from 106 countries, ISK-SODEX set a new record with a 4-per cent increase in foreign visitors compared to 2018.

How does this year's exhibition contribute to the global air-conditioning industry?

The air-conditioning industry is a growing one with an annual global trade volume of nearly \$1.5 trillion. And lately, it has also become an industry on the upsurge in Turkey. The products are manufactured at international standards and exported to over 200 countries. The Turkish air-conditioning industry is a driving force in national exports and aims to achieve \$5 billion in exports by the end of 2019. Considerable steps have also been taken to encourage companies and ensure the sustainability of this growth. These advantages and Turkey's geopolitical location make ISK-SODEX the most significant and leading international air conditioning systems exhibition in the Eurasia region. International companies recognise Turkey's potential and are willing to come here to establish new partnerships. ISK-SODEX is a very important platform that helps connect Turkish manufacturers of national and international companies with local and international customers. Thousands of buyers over 100 countries came to Istanbul to participate in B2B meetings held as a part of ISK-SODEX 2019 and to meet with ISK-SODEX exhibitors. At the end of the four-day exhibition, our exhibitors expressed their appreciation. Turkish exhibitors have realised new achievements, particularly with the new contracts they signed with foreign customers. Organised every two years

since 1997, ISK-SODEX has greatly contributed to both the Turkish and global air-conditioning industries and will continue to do so.

What will the next ISK-SODEX focus on? How will it differ to 2019's exhibition?

We try to improve ISK-SODEX every year. In 2021, the exhibition will offer yet another unforgettable experience in line with the industry's new trends and exhibitors' needs. During the exhibition, we'll gather every element of the air-conditioning industry and carry out support programs aimed at helping it. We will offer exhibitors and visitors new opportunities to meet, make new business contacts, and share knowledge and experience.

Do you have any plans to attract more visitors and exhibitors from the Indian market?

The Indian and Turkish air-conditioning industries have become closer every year in line with the rising number of commercial partnerships between the two countries. Turkey considers India as an important commercial partner. Therefore, we believe, India and other countries in the Indian subcontinent are also important markets for ISK-SODEX, too. For our upcoming ISK – SODEX edition which will held between 29 September – 2 October 2021, we expect to have more attraction from the Indian market, too. ■



Postharvest Handling and STORAGE OF POTATO



This article elaborates the significance of postharvest operations on quality of potatoes.

Potato has emerged as fourth most important food crop in India after rice, wheat and maize. Indian vegetable basket is incomplete without Potato. It is an important part of breakfast, lunch and dinner worldwide. India is one of the highly populated nations in the world and to feed all of its population, no crop other than potato can make an impact. Currently India is the third largest producer of potatoes in the world. The production level of the country hovers around 47 million tonnes. The major potato growing states are Uttar Pradesh, West Bengal, Punjab, Bihar, Haryana, Madhya Pradesh, Gujarat and Maharashtra. More than 90 per cent potato crop is grown in winter season (Rabi) under assured irrigation facility from October to March. The rest is being taken up during rainy season (Kharif). This article elaborates the significance of postharvest operations on quality of potatoes.

Harvesting

During harvesting of potatoes, following practices are to be considered-

- Follow the practice of dehauling cutting of haulms / aerial parts by sickle or destroying by machines, when the crop attains 80-90 days and when the aerial part of the plant turns yellow.



- Always harvest in dry weather.
- Stop irrigation about two weeks before dehauling.
- Avoid bruising and skinning of tubers otherwise tubers become susceptible to rot diseases.
- Harvest the crop after 10-15 days of haulm cutting.
- Harvesting can be done by tractor drawn potato digger or manually with help of spade or khurpi.

Drying and Curing

The harvested potato should be cured in the field. For optimum



suberisation, curing is essential for healing the wounds of tubers resulted from cutting and bruising during harvesting. Expose to sun causes the greening of potatoes. Always dry the harvested tuber in storage shed. All the damaged and diseased tubers should be removed during sorting.

Packaging

Handling and packaging of potatoes are done generally on farm. After harvesting, the tubers are kept in a heaped condition temporarily and covered with straw. After a few days, sorting is done for separating the diseased and cut tubers. The sound tubers are packed in hessian cloth bags or nettlon bags. The Ordinary hessian bags are used for packing potatoes with a capacity of 80 kgs, 50 kgs and 20kgs. The nettlon bags made of plastic net are used to pack 25 kgs potato and preferred for export purpose.



Netlon bag

Jute bag

Netlon retail bag

Storage

Storing potatoes for longer period in normal temperature is not

Types	Temperature (0C)	Relative Humidity (%)	Remarks
Seed potato	0-2	90-95	No sprouting
Ware potato	0-2	90-95	Potato becomes sweet
Ware potato with CIPC fogging	10-12	90-95	No sprouting and no sweetness. Suitable for culinary and processing purposes and export depending on varieties. Save energy and running cost of cold stores

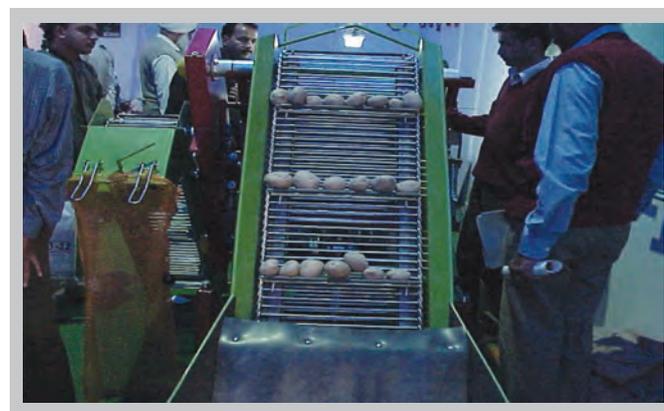
possible as it is a living material and through respiration, the changes occurs due to heat, resulting in loss of dry matter and ultimate deterioration of quality of tubers. At optimum condition, the quality of potatoes remains good in storage for 3-5 weeks. The best temperature and humidity condition for storage of potatoes are as follows:

Grading

The different grades of potato as suggested by Directorate of Marketing and Inspection, Faridabad are as under:

Size Code	Equatorial diameter in mm.
A	18.1-28.0
B	28.1-45.0
C	45.1-65.0
D	65.1-80.0
E	more than 80

Note: The size code 'A' shall be marked as 'Baby Potato'.



Grading plays an important role in marketing of potato. The potato should be packed in different bags as per recommended grades before marketing. Potato marketing in India suffers from severe constraints like wide price fluctuations, existence of large number of middlemen, storage and transportation bottlenecks and lack of other marketing infrastructures. Indian potato marketing system is not efficient, integrated and is not in a position to face the emerging challenges of potato production and utilization.

Studies on marketing margins or price spread reveals that as the number of market functionaries increases, they add cost to the commodity in the marketing channel which results in the fall of producers show in consumer's rupee. Farmers are advised to make their own cooperative groups or Farmers Producers Organisations and follow standard postharvest handling practices for self-marketing of produce. Various Government agencies like National Horticulture Board, National Horticulture Mission and Ministry of Food Processing and Industries provide financial assistance for creation of postharvest and cold chain infrastructure for horticultural crops.

Storage of potato with CIPC applications: A potential technology for potato processing

Potatoes are mostly produced during the winter season from November to March, but are consumed year-round. Therefore, storage of potato under optimum conditions is very important part of supply chain in order to avoid glut like situation in the market. Problems of potato during storage are: Sweetness, sprouting, and decay.

In general practice, the seed and ware potatoes are stored by the farmers at low temperature (0-3-degree C), which is ideal for suppressing sprouting, but physiological changes at this temperature results in accumulation of sugars in the tubers, giving sweetish taste resulting in lowering the culinary qualities of stored potatoes as well as making them unfit for preparation of French fries. Thus, the stored potatoes fetch lower price in the market compared to 'Pahari' potatoes from hilly areas. Storage of potatoes at high temperature (10 ± 2-degree C and 90-95 per cent RH coupled with application of sprout-suppressant chemicals like CIPC is a viable technology, which can enhance the storage life, maintain the low sugar levels and improve culinary/ processing qualities in the potatoes during storage.

What is CIPC?

Chlorpropham (Isopropyl - N (3-

Chlorophenyl carbamates), popularly known as CIPC, is an effective sprout inhibitor. It acts by blocking the process of cell division (mitosis). In store, CIPC is currently applied as a hot fog of fine solid particles (of the order of 5µm in diameter) on the potatoes. The mechanism of action of the applied chemical is believed to involve volatilisation of the deposited solid and subsequent transport of the vapour to the eyes of the tubers inducing the required sprout suppression. This chemical currently is being marketed in India by United Phosphorus Ltd., Mumbai under the brand name 'Oorja'. This commercial formulation is said to contain 50 per cent active ingredient (a.i.) and 40 ml of this formulation is required for fogging of one tonne of potatoes.

Procedure for CIPC application

The disease free fully cured, mature tubers are loaded in the cold storage and temperature is maintained at 18.3-degree C during loading.

- Temperature of the storage is brought down from 18.3-degree C to 10-degree C gradually in one week.
- Chlorpropham fog is injected @ 40 ml/tonne using DYNA fogging machine into the storage chamber loaded with potatoes. The first fogging is done at the first sign of sprout growth and second fogging is done 60 days later.
- Refrigeration is not used when CIPC fog is flushed into store. For this, the refrigeration unit is switched off prior to, during and upto 40 hours after the treatment. Then doors are opened for half an hour after 40 hours to flush out the accumulated gases. Thereafter the temperature of cold storage is maintained at 10 ± 1-degree C and 90-95 per cent RH.
- The chamber should be completely leak proof to ensure that there is no loss of refrigeration during storage period; otherwise there will be more consumption of electricity to maintain uniform temperature.
- Humidity should be maintained at 90-95 per cent level inside the chamber to avoid shrinkage in the treated

potatoes. Humidifier should be installed to get optimum humidity level.

Important points to keep in mind for storage of potato

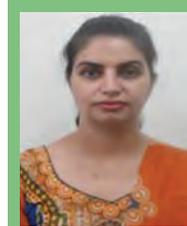
- **Air circulation:** The air circulation inside the storage chamber during the loading of potato and pull-down period should be minimum 50 CFM/MT of Potato (85 CMH/ MT of Potato).
- **Relative humidity:** Maintaining high relative humidity (95 per cent RH) in storage is very important to prevent tuber dehydration. It helps to control the total shrinkage loss.
- **Ventilation of cold stores:** Always ventilate the storage chambers periodically. Atleast, 2 to 6 air changes per day is good enough to maintain desirable level of CO₂ level less than 4,000 ppm inside the storage room.
- **Storage cleanliness:** Disinfection or cleaning of the storage facility is a good practice in all storages and is essential for seed producers. Cleaning of the store must be completed in time for the new harvest to begin. ■



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Punjab Horticultural
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Exploring new technologies with a keen interest in R&D - Danfoss



Anuraga Chandra, Head – Cooling Sales, India Region, Danfoss Industries gives an overview of the products and technologies recently launched by the company.
- By Ranjana Konatt, Editor (Brand Positioning)

There has been an increasing emphasis on the momentum in innovation through active research and development. The inclusion of new products is likely to drive the next wave of change in the industry. Anuraga Chandra, Head – Cooling Sales, India Region, Danfoss Industries says: “Danfoss seeks to align itself with the global vision of the United Nation’s goal of providing integrated cooling solutions across sectors, encompassing inter alia transition to natural refrigerants, enhancing the energy efficiency, safety, reliability and better technology.” This commitment is in lines with Danfoss’ partnership with UN SEforAll and its Cooling for All vision. “At Danfoss, we are greatly committed to increased industry-academia engagement to better enhance skill development among students. The impact of such an endeavour can be widespread when the industry at large adopts similar practices,” Chandra said.

An overview of the new products brought to the market by Danfoss:

Danfoss Intelligent Purging System (IPS)

The Danfoss Intelligent Purging System (IPS) is an automatic, self-contained operating unit that helps remove non-condensable gases in a safe, energy-efficient and environmentally friendly way. This helps maintain an optimum refrigeration capacity and system efficiency, allowing professionals to achieve maximum system performance. With its compact and cost-effective design (with few mechanical and electrical connection interfaces), easy installation and automatic purging functionality,



the new Danfoss IPS help improve the operational safety, efficiency and cost-effectiveness of industrial refrigeration systems.

Danfoss Gas Detector

The Danfoss Gas Detectors are based on a digital platform that delivers multiple communication and integration options for improved operational reliability, easy calibration and maintenance efficiency, cost-effectiveness, and regulatory compliance. The Danfoss Gas Detection Solution provides a high degree of flexibility when designing and building your gas detection system. The portfolio ranges from basic to heavy-duty models complemented by a range of accessories. Easy to replace and pre-calibrated sensors for plug and play replacement and service



due notifications and information enabling optimized maintenance and planning are among the many features of this product.

Danfoss Plate Heat Exchanger

The Danfoss Plate Heat Exchanger (semi-welded plate heat exchangers) are optimized for industrial applications such as Condensers, Flooded and Pumped Evaporators, Sub-Coolers, Desuperheaters, Superheaters, Economizers and Oil Coolers. It has a reliable design with operational safety and is easy to configure. The design has been verified through thermal and mechanical tests. Furthermore, each semi-welded plate cassette and fully assembled plate heat exchanger are thoroughly leak tested with helium before they leave the Danfoss factory. The product



range includes the sizes SW19-SW59, with more to come, and can handle temperatures ranging from -40°C up to 120°C (-40°F up to 248°F) and pressure ranges up to 25 bar (300 psi). The SW19-59 range features excellent heat transfer capabilities via improved thermal performance due to optimized plate geometry supporting high turbulent flow enabling a compact design and supporting the lower charge. The new Gasket system improves plate pack stability. The new range is easy to service and maintain.

The EKE 400

The EKE 400 is an application for industrial refrigeration applications which can control the operation of the valves and the fans for evaporators to achieve optimal cooling mode and defrost sequence for an efficient, safe and trouble-free operation of the evaporators, complying with IAR1 safety recommendations for hot gas defrost. The EKE 400 controller is a dedicated controller for evaporators typically used in industrial refrigeration applications. EKE 400 will be able to manage the complete operation in cooling and defrost mode, which means that it can control the operation of the valves and fans for each evaporator and control and optimise defrost sequence and performance. It is applicable for defrosting flooded evaporators including Ammonia and CO₂ and supports various defrost methods.

The ICFD

The ICFD is a product specially designed



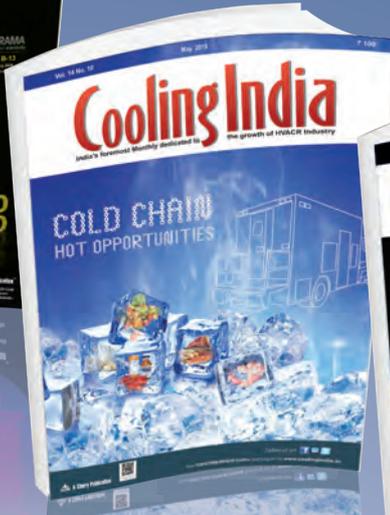
to improve defrost performance and reduce energy consumption. The ICFD Defrost Module is a compact liquid-based drain module packaged into Danfoss' widely acknowledged ICF valve station. It is a formula that unites the well-known benefits of the Danfoss ICF technology with the most efficient defrost method known into a single state-of-the-art defrost solution for industrial refrigeration applications. Apart from improved defrost performance and reduced energy consumption, the ICFD has a broad application range, improved job site efficiency and easy system design.

The ICSH 2 Step Solenoid Valve

The ICSH 2 Step Solenoid Valve for safe and soft gas injection is a very efficient and common method used within industrial refrigeration. This product



exemplifies sound design practices, taking into account the safety risks caused by the slightest shifts in operating conditions. If not controlled carefully, the injection of hot gas into the evaporators may cause hydraulic shocks in the refrigeration system and represent a safety risk. Therefore, it is important to make the hot gas injection in a controlled and smooth way to ensure the maximum operation and system safety. Apart from improved safety features, the ICSH 2 Step Solenoid Valve Complies with latest IAR safety recommendations on soft gas applications, is easy to upgrade and install as it is fully compatible with Danfoss ICFV platform, has an easy system design with the Cool selector application tool, and most of all, its compact design is space-saving. ■



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Logistics and Warehousing: Importance of choosing the right loading bay equipment



A loading dock is typically an elevated opening (or openings) in a building's sidewall where shipments are sorted and staged for loading and unloading of trailers, shipping containers or rail cars. To make that area more accessible and safer during the movement of goods, loading dock equipment and attachments are used. Because the shipping and receiving process requires personnel to conduct loading and unloading processes, dock equipment is designed to ensure the safety of both the workers and the loads as they enter and exit the trailer. Typical equipment includes attachments that secure and bridge the gap between the vehicle and the dock, lighting to illuminate the inside of the trailer, building-to-vehicle communication systems and weather protection.

How the dock equipment is used

Dock equipment are used at the point where a trailer, shipping container or railcar is loaded or unloaded.

Shipping: At the dock faces where outbound shipments leave the facility.

Receiving: At the dock faces where inbound shipments arrive at a facility.

Yard: If a building has no elevated dock openings, or if all dock openings are

occupied by other vehicles, loading and unloading can be accomplished in the yard.

Benefits

- Dock equipment provides a variety of benefits including:
- Durable, long lifespan
- Low maintenance
- Optimum safety
- User-friendly
- Energy efficient.

On the dock itself, overhead doors, dock levelers, dock seals and canopies can help keep accidents and injuries to a minimum. A fixed dock leveler, for example, gives lift truck drivers an easier and safer route in and out of the trailer, while a shelter or seal helps keep out the elements and also helps keep the forklift from sliding or losing traction.

"In our plant, we use shelters because we don't heat or cool the building," says operations head at Gandhi Automations, "but we want to be able to protect our forklift drivers. So, a truck backs in and the structure will shelter the driver as he drives on and off the vehicle."

Guide to Temperature Controlled Logistics

Temperature controlled logistics is imperative for many pharmaceutical

products, as spoiled drugs can have serious consequences on the health and well-being.

Temperature controlled logistics specialises in the storage, preservation and transportation of cargo that is sensitive to atmospheric conditions and needs to maintain a certain temperature. This is imperative for many pharmaceutical products, as spoiled drugs can have serious consequences on the health and wellbeing.

Elevated temperatures or sub-zero temperature can affect the chemical stability of the medicine, food, poultry, agro products, or event horticulture and floriculture produce and may even alter its physical properties. This can come in the form of sedimentation and separation of emulsion systems.

Due to the implications of improperly stored materials, regulator demands have become more stringent and companies need to be able to prove that they're products are transported via a temperature-controlled supply chain.

The margin of error is different from product to product, but the industry has seen a greater regulatory emphasis on drugs that can maintain integrity between 2-degree C and 8-degree C. This temperature range is referred to as "cold-chain" – a temperature range where the product/material is maintained above sub-zero temperatures. These conditions must be assured by all parties, including the manufacturer, shipper, and wholesaler.

While the shipping services are responsible for maintaining the temperature of the cargo, it is the manufacturer's responsibility to ensure the optimal conditions for the product are understood by all involved parties. Some considerations to think about before choosing a temperature-controlled solution:

- The acceptable temperature and humidity range



Loading bay Equipment

- The margin of error for the temperature
- Acceptable levels of risk
- Potential areas of risk and touch points
- Specific no-go actions that may compromise the integrity of the product.

Additional conditions for selecting a cold storage system should be based, but not limited to the following criteria:

- Temperature range and volume of the medicine
- Temperature controls
- Back up temperature controls
- Layout of the storage unit and airflow
- External temperature logging and data tracking

- Cargo placement (avoid areas where temperature variation is likely such as near bay doors)
- Have temperatures been tested?
- Volume of medicinal product.

Are you searching for an efficient way to level the difference in height and distance between your warehouse floor and a docked vehicle? Search no more! Gandhi Automations manufactures loading bay solutions like dock levellers, dock shelters, sectional overhead doors. Their dock equipment are designed and factory-made in state-of-the-art manufacturing facility. The dock equipment meet international safety

standards like EN1398 for dock levellers and are CE marked.

Dock levellers from Gandhi Automations are the efficient solutions and can be manufactured to meet a client's specific requirements. Gandhi Automations has been manufacturing dock equipment for more than 22 years. This experience allows them to design reliable, modular and durable dock levellers. The company supplies high-quality service for each dock leveller to help a client reduce his/her operational costs and guarantee a safe working environment. ■

For more details, visit: www.geapl.co.in

BELIMO sensors: Perfect complement to actuators and valves

To achieve a good room climate and energy efficiency in heating, ventilation and air-conditioning (HVAC) plants reliable field devices such as actuators, control valves, and sensors are required. While actuators and valves control flows of air and water, sensors measure temperature, humidity, pressure, air quality or flows. They are installed in rooms, air ducts or pipes.

Sensible expansion of Belimo's range

Belimo has many years of experience in developing high-quality sensors for the HVAC industry that assure the reliable recording of information and guarantee the best possible data quality. The company is expanding its core business of



components with integrated sensors by adding autonomous sensors that can be applied to any system design. Belimo's complete product range of sensors is optimally tailored to Belimo actuators and valves that can be seamlessly integrated into existing or new building automation systems.

Innovation in detail

For instance, the air quality sensor measures CO2 content with two channels to compensate for possible deviations. That means greater accuracy and long-term stability. In addition, the same device also records humidity and temperature values and feeds the data into the system through just one bus interface. As a result, installation and integration

costs can be reduced. ■

For more detail, contact: info.india@belimo.ch



Refcold India 2019

Studying potential in the cold chain

Industry representatives from the cold chain industry study the drivers influencing change, while also assessing India as a potential market for global investors

- By Ranjana Konatt, Editor – Brand Positioning

The HVACR industry is constantly evolving and is posed with the challenge to adhere to international standards. Pursuing the HVACR industry and proving to be a platform for dialogue and networking – the Refcold India 2019 Exhibition was held from November 21st to the 23rd at the Hitex Exhibition Center, Hyderabad. The exhibition hosted both national and international exhibitors representing the cold storage, cold chain service, transportation, and industrial refrigeration sectors. Also, the event was home to riveting discussions and presentations around the global trends within the industrial refrigerant sector and its relevance to India in food processing applications; cold chain solutions and energy management within the agricultural sector, and the routes to building a sustainable cold chain.

Focusing on a global trend within the industrial refrigeration sector and its relevance in India, Carsten Dahlgaard, Senior Sales Director – Industrial Refrigeration, Danfoss - Denmark said: “Globally we are seeing that safety and the total cost of ownership are the market drivers within the industry.” The cooling sector

follows a five-point system and it generally looks at - global warming, safety, reliability, cost and efficiency. "These five points are crucial to the industrial refrigeration sector," he said. In China especially, there is a focus on safety owing to industrial accidents that have occurred in the past. He added: "A lot is going on politically concerning global warming. Some agreements call out refrigerants. One of them is R32 which is a new refrigerant used in air-conditioning. We understand and the industry acknowledges that it needs to move more towards a phase-out of certain refrigerants or at least the use of refrigerants with a low index." In terms of cold storage, Harshal Surange, CEO and Director - ACR Project Consultants asserted that in addition to the adherence of policies, operation practices within the scope of cold storage and refrigeration is also crucial. He said: "The concept of energy-efficient cold storage must be properly understood. We need to assess the design that we have in place for a good energy efficiency level and economic operation." For instance, he said: "Today most fruits and vegetables have a certain shelf-life and after it is harvested, nearly 98% of the product reaches the market in a non-refrigerated manner." He pointed to this as an industry issue often related to the practises adopted when dealing with the cold chain.

On the global front, Max Wang, Sanhua International, Singapore Pvt Ltd, said: "In the past decade, CAAR and ISHRAE have established close partnerships – the two sides have extensive co-operation in media communication and technical exchange." CAAR represents an organising committee at the expo to promote and upgrade such exhibitions. While referring to the inclusion and the joint India-Chinese connections, he added: "The Chinese and the Indians can get a deeper understanding of the market through such events. Chinese brands and products serve the Indian market and we hope that with the opportunity, and we hope we can establish a long-term mechanism while deepening the exchanges between the two countries."

Here's what some of the exhibitors had to say, excerpts...

Jegapriyan Govindarajan, Managing Director, Tecumseh Products Company

"We are headquartered in Hyderabad. So far, we are pleased with the participation at Refcold India 2019. The company has been specialising in commercial refrigeration and we have a long history here in India. Globally, we are a market leader in commercial refrigeration. Today, there is a need for both the industry as well as for regulatory bodies to work together. In the food sector, the market is facing a serious problem concerning the wastage of food. The market has unique requirements, and though we have good products we need to adapt them to the Indian market conditions. We have recently opened a technology centre in New Delhi which is a state-of-the-art centre and is already developing cooling solutions that would suit the Indian market. An exhibition like this is an ideal platform for us to connect with new customers and understand what they need from the market. Concerning solutions, we specialise in reciprocating compressors, scroll compressors, condensing units, rotary compressors that are energy efficient and are used across commercial and household applications."



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Dimpi Barot, Gandhi Automations

"We specialise in entrance automation and loading equipment and have a major portion of the market share in India. Our products are motorised high-speed doors, dock levellers, motorised rolling shutters, gates and several such automated products that are used in industrial warehousing. We have come up with a bunch of new products where we specialise in cold storage refrigeration. Manufacturing industries need a controlled environment, and a wide range of our prime high-speed doors are available for various operations, inclusive of areas with special requirements for temperature control, hygiene, storage and handling of frozen foods. Deep freezer automatic roll-up doors are needed in cold storages, warehousing, loading bays and on conveyor systems. We also customise for many of our clients and have a huge manufacturing unit located in Bhiwandi. We are gradually specialising into new products in cold storage refrigeration and are coming up with new products where we can monitor temperatures."



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Shubham Kshirsagar, Jr. Associate Marcom, Testo India

“Testo has several products and we specialise in temperature monitoring instrumentation technology. Our applications are used in the HVACR, cold chain, facilities management, food, pharma and health industries. We specialise in instrumentation technology used in data logging, electrical measurement, humidity measurement, pressure and flow measurement, thermal imagers, transmitters, and smart probes. Our loggers function both online and offline and our instruments are crucial to the functioning of the cold chain, and to the maintain the integrity of the product being carried across the cold chain.”



Akriti Gupta, Vice President, Sales, mitzvah air curtains

“Ours is a twenty-year-old company, and we are actively engaged in manufacturing and supplying a broad assortment of air curtains, strip curtains, PVC rolls, curtain track hooks, baffle filters, evaporator chassis, wall corners and SS coasters. We were established in the year 2000 at Noida. Over the years we have realised that people are still not aware of the usefulness of air curtains in cold storage and refrigeration. Overall, it is an industry issue and clients must be made aware of the technicalities and the uses for the product. For every project whether HVACR or industrial refrigeration and transportation – air curtains are very necessary. Another challenge within the cold storage industry is maintaining the temperature at an optimal level and tracking it. Overall, the market is low but for our product, the market demand continues to be high.”



Harikrishna Pansuriya, Engineer - Material Handling System, Natural Storage Solutions

“We are based in Ahmedabad. We specialise in cold storage solutions, ripening chambers, ICE plants, shooting and grading lines, blast freezers, vacuum freeze-drying, and more. At the expo, we are displaying our spiral freeze technology that is used to freeze samosas, burger patties, and parathas. Within the scope of the cold chain, it is crucial to understand that the cold chain can be broken anytime, and though there are mechanical or electrical monitoring systems – the problem is left unsolved if the consignment is not consistently checked for temperature. Also, we have HACCP - Hazard Analysis and Critical Control Point that is done to ensure the safety of groceries. This method ensures the safety of food.”





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Forthcoming Events

DairyTech Pune

Venue: Hindustan Antibiotics Ltd. Sr. no 198, MIDC, Pimpri Colony, Pimpri-Chinchwad, Pune
Date: 10th to 12th January 2020
Website: www.dairytechpune.com

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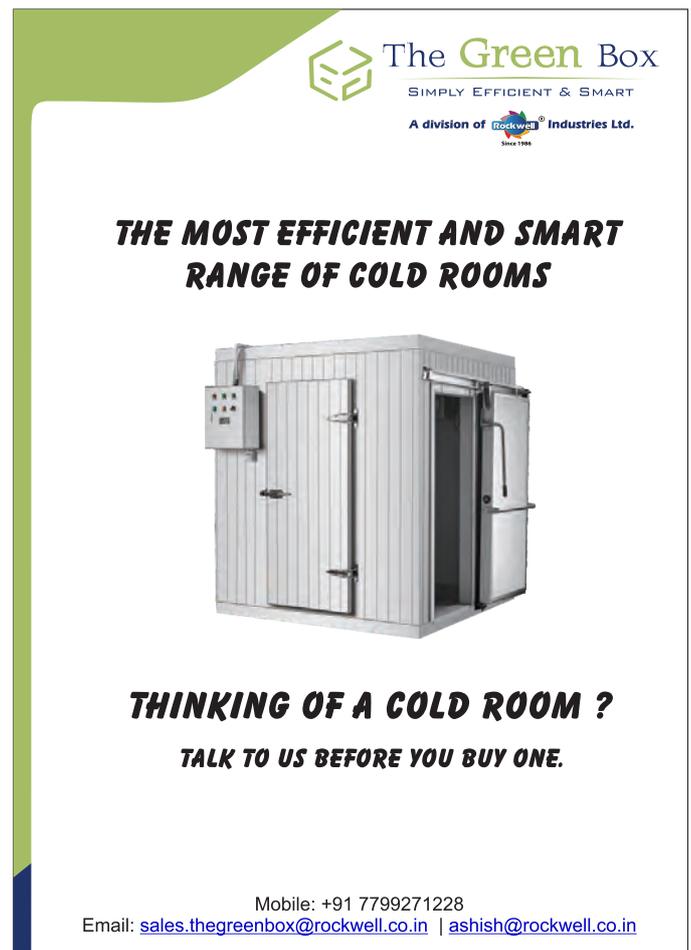
Venue: Orange County Convention Centre, Orlando
Date: 3rd to 5th February 2020
Website: www.ahrexpo.com

Global Logistics Show

Venue: Somaiya International Convention Centre, Mumbai
Date: 20th to 22nd February 2020
Website: www.globallogisticsshow.com

ACREX India 2020

Venue: IEML, Greater Noida, Delhi NCR
Date: 27th to 29th February 2020
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Starbucks Reserve Roastery Shanghai celebrates LEED Platinum achievement

It's a 'green' birthday for the Starbucks Reserve Roastery Shanghai ('Roastery'), as China's coffee wonderland celebrates its second anniversary this month. Today, the Roastery received a meaningful birthday 'gift' in the form of a LEED Platinum plaque – a recognition of Starbucks partners' (employees) tireless efforts towards operating not just a theatre for immersive coffee experiences, but also one that lives and breathes environmental sustainability.

The Shanghai Roastery set a new benchmark in green retail as the first in mainland China's food retail industry to be certified LEED Platinum. Over 150 Roastery partners and onsite customers witnessed a simple plaque awarding ceremony, where they also



heard inspiring, behind-the-scenes stories from partners who had contributed to the achievement. As part of the celebration, the Roastery's iconic clacker board proudly shared the milestone with customers, who were invited to participate in interactive quizzes to win Starbucks memorabilia.

The achievement is the culmination of the sustained, concerted efforts of countless Starbucks partners committed to not just creating a welcoming third place for customers, but also a greener one. From incorporating eco-friendly features and technologies into the building's design and construction, down to planning every detail of the Roastery's day-to-day operations, utmost care has been taken to enhance its environmental friendliness. ■

Atlanta becomes sustainable city

The US Green Building Council (USGBC) announced that more than 100 cities and communities have now achieved LEED certification. The City of Atlanta, this year's Greenbuild host city, marked the 100th certification. USGBC launched LEED for Cities and Communities in 2016 as a globally consistent framework for measuring and tracking sustainability at the city and community scale. The rating system tracks progress across key performance indicators, including energy, waste, water, transportation, resilience, health and equity. Atlanta's Mayor Keisha Lance Bottoms and USGBC's President and CEO Mahesh Ramanujam announced the city's certification and work during the conference's Wednesday keynote.

Atlanta's Resilience Strategy was a central tenant contributing to its certification and builds on both the challenges and opportunities the city faces. By making resilience a key part of its



sustainability strategy, the city is focused on efforts that support residents and address some of the region's more pressing issues. Initiatives include the Atlanta Resilience Equity and Design Collective (RED Lab) partnership with Georgia Tech to help residents use data and technology to solve community issues that contribute to or detract from the liveability of their neighbourhoods.

The EV Rideshare Program provides transportation services to those with low mobility access, including previously incarcerated individuals. Additionally, the city's Clean Energy Plan is intended to move Atlanta to 100 percent clean energy by prioritising equity and affordable clean energy options. The city has also made impressive strides in reducing energy consumption in buildings through the Atlanta Better Buildings Challenge and reached its 2020 goal of 20 percent reduction ahead of schedule. ■

Environmental respect & comfort for Car Colossus

For Toyota, environmental respect is one of its core principles. Toyota's aspiration is to improve people's lives by providing the best mobility solutions. Environmental sustainability is one of Toyota's key commitments. Specifically, there are 6 environmental challenges defined with a holistic approach: from the development of zero-carbon-emission vehicles (CO₂), to zero emissions produced by their factories and throughout the life cycle of their products. All this by optimising the use of natural resources, promoting the creation of a society

in which recycling and recovery systems are increasingly used. In line with these principles, Toyota Motor Italia turned to Sodexo, the world leader in quality of life services and Facility Management services; in collaboration with AIKU Studio, an architecture and design firm, Sodexo Italia was commissioned by Toyota to revamp the new air conditioning system with about 1,000 kW cooling capacity, serving the office and multipurpose building. With the dual objective of increasing efficiency, Sodexo selected, purchased and installed the new HVAC units. ■



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