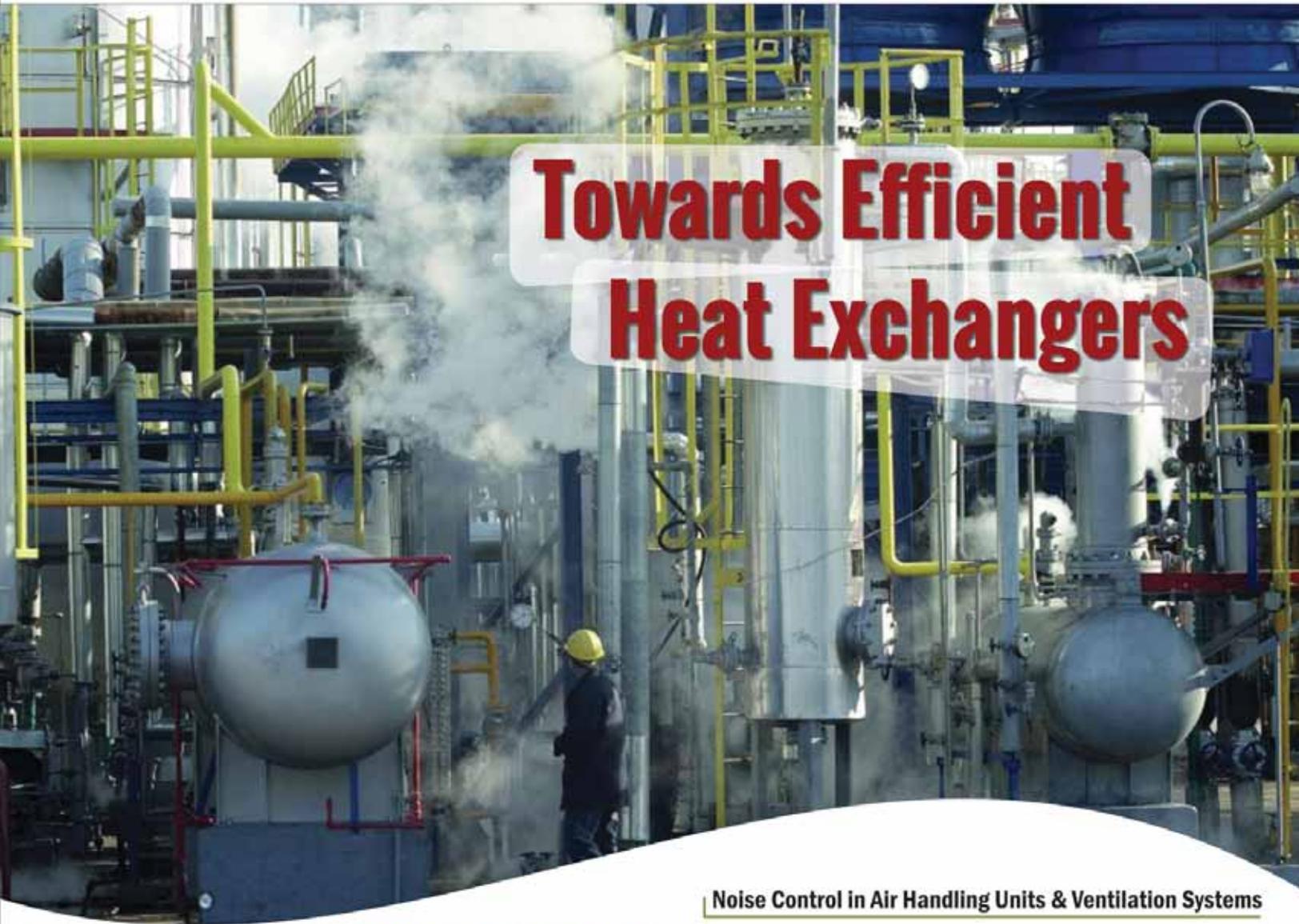


# Cooling India

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



## Towards Efficient Heat Exchangers



Moving from Heat Waste to Heat Recovery



Cooling Pavement to Combat Climate Change

Noise Control in Air Handling Units & Ventilation Systems

Wind Driven Ventilation: Holistic Approach of Cooling

Low Cost Ways to Save Energy in HVAC System

Smart City & Green Building

Design & Performance of Solar Assisted Air Conditioning

Wet & Dry Air Receivers in Compressor House





**Series DPT2500**  
Aerosense Differential Pressure Transmitter



**Series 2000,**  
Dwyer Magnehelic Gage.

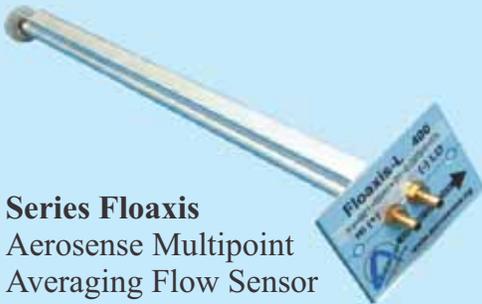
**ALM**<sup>®</sup>  
EXPERTS IN HVACR & BAS INSTRUMENTATION



**Series 160 - Pitot Tube**



**Psychlone**  
Handheld Thermo-Hygrometer



**Series Floaxis**  
Aerosense Multipoint Averaging Flow Sensor



**Series AVT**  
Aerosense Air Velocity cum Temperature Transmitter



**Series 490A**  
Dwyer Hydronic Differential Pressure Manometer



**Series SAH**  
Dwyer Smart Air Flow Hood  
**ALM**<sup>®</sup> is the Ambassador for Smart Air Hood in India.



**Series RHP**  
Dwyer Temperature/Humidity transmitter



**Series ADPS**  
Dwyer Differential Pressure Switch.



**Series CMT**  
Carbon Mono-Oxide transmitter



**Series CDPI**  
Digital Differential Pressure gage



**Series CDT**  
Carbon Dioxide Transmitter.



**A L M ENGINEERING & INSTRUMENTATION PVT. LTD.**

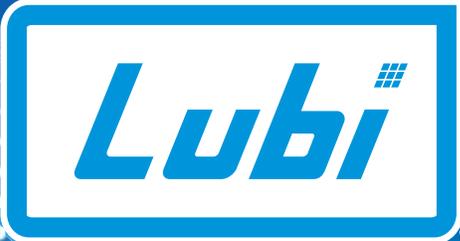
304, Damji Shamji Industrial Complex, L.B.S. Marg, Kurla (W), Mumbai-400070. INDIA

Tel.: +91 22 25126500 • Email: info@almontazar.com • sales@almontazar.com

Internet: www.almontazar.com

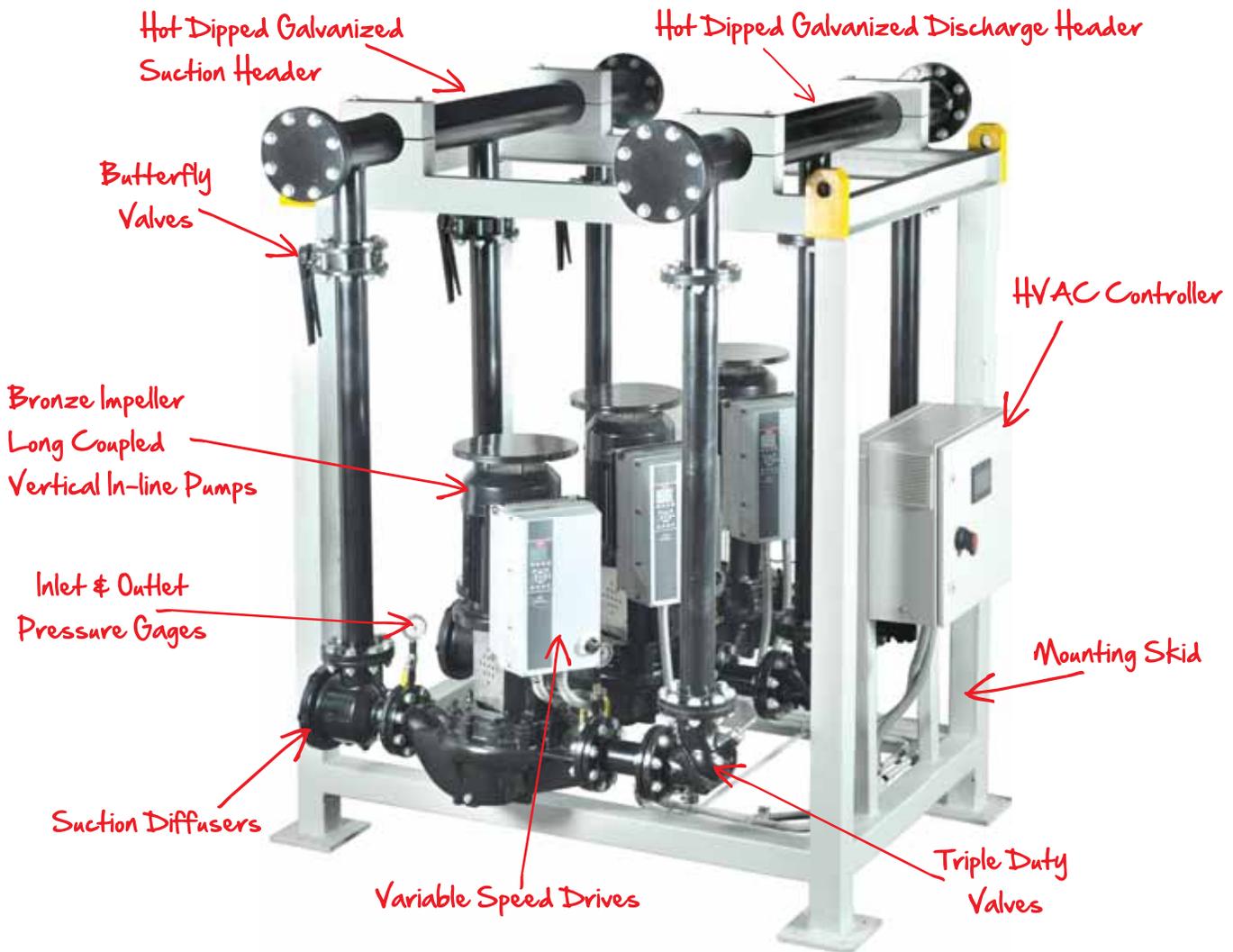


www.lubipumps.com



# HVAC Packaged Pumping Systems

QUALITY • INNOVATION • SUSTAINABILITY



- Factory Assembled & Tested
- Plug & Play Installation
- Space Saving Vertical In Line Pumps
- Smart Intellicon Controller with Touch Screen Controls

## LUBI INDUSTRIES LLP

Near Kalyan Mills, Naroda Road, Ahmedabad - 380 025, Gujarat, India. | Tel: +91 79 30610238 | Fax: +91 79 30610300  
 Email : [indsales@lubipumps.com](mailto:indsales@lubipumps.com) | Website : [www.lubipumps.com](http://www.lubipumps.com)



MA24-00



# Publisher's Letter

Hello and welcome once again to **Cooling India**. As I write this note, Japanese prime minister Shinzo Abe is in India to lay the foundation stone of the 508-km long Mumbai-Ahmedabad High Speed Rail. I can tell for sure, bullet train is not the main reason why the Japanese prime minister is here in India. That is a project which will not be ready till 2023 (as per government deadline). We all know infrastructure projects are never completed on time in our country. And given the gigantic scale of this project, it's everyone's guess when it will be completed. Be that as it may, it's a good beginning for a modern technology to be brought into the country.

The geo-political situation in this part of the world - starting from Japan till India is changing fast, with China claiming supremacy over the South China Sea from where an estimated US\$5 trillion worth of global trade passes. Gone are the days, when the world was only talking about two cold war countries. Today, the entire shift has been in the eastern part of the world, where one country China is challenging the supremacy of the US. Last month we also saw a face-off between India and China at Dokhlam. China is rapidly developing ports at Hambantota and Kyaukpyu in Sri Lanka and Myanmar respectively. We need to immediately get some contracts in south Asian countries to counter these projects undertaken by China in our neighbourhood, but we do not have the necessary band-width to match the current geopolitical needs. Both, the US and Japan need a partner country in this part of the world to counter growing China. They cannot find a better partner than India. Prime minister Modi's East Asia policy augers well for Japan.

In the nineties Japan invested primarily in sectors like automobiles, telecom and electrical equipment. Today the shift is towards infrastructure with projects like Delhi metro, now the bullet train and future projects like Delhi-Mumbai industrial corridor and so on. Not to forget the Indo-Japanese nuclear deal last year. We can ask Japan to help develop our much-neglected north-east states, and in doing so send a message to China. That apart, Japan's assistance can be sought for the much-talked smart city project. After all, it's about increasing the quality of life of the majority of the population and not just about 25,000 people who would be travelling by this high speed train per day and that too after next 10 years hopefully.

Hope you enjoy reading this issue as much as we have in bringing this to you. Should you have any comments please email me at [pravita@charypublications.in](mailto:pravita@charypublications.in)



**Pravita Iyer**  
Publisher & Director

Member, Indoor Air Quality Association (IAQA)



**Directors**  
Mahadevan Iyer  
Pravita Iyer

**Publisher**  
Pravita Iyer  
[pravita@charypublications.in](mailto:pravita@charypublications.in)

**Editor-in-Chief**  
Mahadevan Iyer  
[miyer@charypublications.in](mailto:miyer@charypublications.in)

**Associate Editor**  
Supriya Oundhakar  
[editorial@charypublications.in](mailto:editorial@charypublications.in)

**Advertising Manager**  
Nafisa Kaisar  
[nafisa@charypublications.in](mailto:nafisa@charypublications.in)

**Design**  
Nilesh Nimkar  
[charydesign@charypublications.in](mailto:charydesign@charypublications.in)

**Subscription Department**  
Priyanka Alugade  
[sub@charypublications.in](mailto:sub@charypublications.in)

**Accounts**  
Dattakumar Barge  
[accounts@charypublications.in](mailto:accounts@charypublications.in)

**Response Department**  
Sonali Pugaonkar  
[mktg@charypublications.in](mailto:mktg@charypublications.in)

**Digital Department**  
Ronak Parekh  
[dgmarketing@charypublications.in](mailto:dgmarketing@charypublications.in)

100/- Per Copy  
1000/- Annual Subscription

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

**Disclaimer:** Chary Publications does not take responsibility for claims made by advertisers relating to ownership, patents, and use of trademarks, copyrights and such other rights. While all efforts have been made to ensure the accuracy of the information in this magazine, opinions expressed and images are those of the authors, and do not necessarily reflect the views/collection of the owner, publisher, editor or the editorial team. Chary Publications shall not be held responsible/ liable for any consequences; in the event, such claims are found - not to be true. All objections, disputes, differences, claims and proceedings are subject to Mumbai jurisdiction only.

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

**Editor: Mahadevan Iyer**

[www.facebook.com/coolingindiainmagazine](https://www.facebook.com/coolingindiainmagazine)

[www.linkedin.com/in/coolingindia](https://www.linkedin.com/in/coolingindia)

[www.twitter.com/coolingmagazine](https://www.twitter.com/coolingmagazine)

# LOUVER TYPE MIST COOLING SYSTEM

*For*

## CHILLERS

**A Superior Alternative to Cooling Tower**



▲ *Louver Type MCS*

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

### Other Superior Features of LTMCS

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

**Over 300  
installations**

### Typical case study data of a 1200 TR Chiller

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



*Mist Resonance Engineering Pvt. Ltd.*

Regd Office : 'Anandi', 1304-1/7, Shukrawar Peth, Bajirao Road, Pune - 411 002. INDIA.

Tel : (+ 91 20) 2447 2726 / 2447 1184 ■ Fax : (+91 20) 2447 4972

E-mail : mistcreation@gmail.com ■ mistcool@vsnl.com ■ Website : www.mistcreation.com



# Contents

Vol. 13 No. 2 | September 2017

## Articles

- Noise Control in Air Handling Units & Ventilation Systems** 24  
– Aneesh Kadyan
- Microgroove Tubes for Low GWP Refrigerants** 29  
– Avinash Khemka
- Towards Efficient Heat Exchangers** 30  
– Dr. S. S. Verma
- Wind Driven Ventilation: Holistic Approach of Cooling** 40  
– Dr. J. Sarkar, Dr. A. Sarkar
- Low Cost Ways to Save Energy in HVAC System** 44  
– V Shridhar
- Smart City & Green Building** 46  
– Firoj Jena
- Design & Performance of Solar Assisted Air Conditioning** 50  
– Dr. M. S. Shashikala, Nagesh N
- Wet & Dry Air Receivers in Compressor House** 56  
– Ashok Sethuraman



## Interviews



“India’s emerging market is the strength for its domestic markets in the years to come”

36

**Tajudeen Basha**

Managing Director, Air Action Equipments (Air Master Group)

## Features

- 22** Cooling Pavement to Combat Climate Change
- 23** Johnson Controls to Make Texas Campuses More Sustainable
- 35** Moving from Heat Waste to Heat Recovery
- 39** Washington, DC Named First LEED Platinum City in the World
- 48** Italy’s Largest Hypermarket Opts for CO<sub>2</sub> Refrigeration
- 55** Demand Driven Distribution: Great for More than Leaks
- 59** Cold Storage Warehouse for Onion at Nashik
- 60** Indian Food Processing Industry: A Sunrise Sector

## Departments

- 4** Publisher’s Letter
- 6** Contents
- 8** News
- 16** Appointments
- 18** Awards
- 20** Market Watch
- 62** Post Event Report - DairyTech India 2017
- 66** Statistics
- 68** Product Profile
- 69** Event Calender
- 69** Index to Advertisers
- 70** Cooling Museum

# Engineering India's **skyscrapers** into towering examples of **energy efficiency**

With the demand for energy in India expected to increase 10 times in the next three decades, improving the energy performance of buildings is vital.

Danfoss provides cooling and ventilation solutions that ensure optimal indoor comfort and significantly reduce a building's energy consumption and CO<sub>2</sub> emissions. Tomorrow's skyscrapers, employing today's technologies can lead the path towards an energy efficient India.

Discover how today's technologies are engineering tomorrow's India at  
[www.danfoss.in](http://www.danfoss.in)

**20%**

**potential for  
reducing energy  
consumption in  
buildings with  
existing  
technologies**

ENGINEERING  
TOMORROW

*Danfoss*

## A O Smith names Warren as President

A O Smith Corporation announced the appointment of David R Warren as President and General Manager of its North America, India, Europe, and Export (NAIEE) water heater operations.

In this role, Warren will have profit and loss responsibility for the 10 brands that make up the operation. He will oversee the unit's 4,500 employees at facilities in US, Canada, India, Mexico, the Netherlands, Turkey, and the UK. "Dave brings extensive domestic and international experience to his new position," President and Chief Operating Officer Kevin J Wheeler said in making the announcement. "He has worked in a wide variety of functions and is very familiar with our customers and our global water heater markets."

"With Dave Warren and Kevin Wheeler, A O Smith has two executives with in-depth knowledge of the global water heater business," Chairman and Chief Executive Officer Ajita G Rajendra observed. "Both of them have been instrumental in helping develop our global water heater strategy and under their leadership, this business has enjoyed solid growth over the last several years." Warren has served as Vice President of the India, Europe, and export businesses, overseeing the company's international water heater operations in Europe, and water heater and water treatment operations in Turkey and India. He also was responsible for the company's export water heater activities. ■



## Carrier to Provide HVAC Systems Service for Zizhong People's Hospital

Carrier China recently signed a three-year service agreement with Zizhong County People's Hospital, a state-owned Grade II Level A hospital located in Sichuan Province. Carrier's service will ensure the stable operation of heating, ventilating and air conditioning (HVAC) systems, which is critical in medical facilities for infection control, removing noxious odors, diluting and expelling contaminants, and establishing climate conditions conducive to medical functioning and patient healing. Carrier China is a part of Carrier, a world leader in high-technology heating, air-conditioning and refrigeration solutions, a part of UTC Climate, Controls & Security, a unit of United Technologies Corp. Under the agreement, Carrier will provide maintenance service for two Carrier AquaForce® 30XW water-cooled chillers and auxiliary fan coils and air handling units, as well as cooling towers, water



pumps and power distribution cabinets. Carrier customized its maintenance solution for Zizhong County People's Hospital to prioritize HVAC system reliability while ensuring patient and occupant comfort and safety, and lowering energy costs. Carrier's

predictive maintenance approach will help identify potential problems before they occur and proactively schedule repairs at appropriate times. The service team is available

24/7 and committed to swift responses. "Following the successful delivery of Carrier products for Zizhong County People's Hospital, we are pleased to strengthen our relationship with this service agreement. This win underscores our well-proven track record and expertise in HVAC systems, and it is equally important to note Carrier's commitment to the healthcare segment to create a safe environment," said James Zhu, HVAC Service Director, Carrier China. ■

## Harrison Energy Partners to be Daikin's Authorized Service Provider

On its journey to become the number one HVAC leader, Daikin Applied has expanded Harrison Energy Partners' service territory to match their equipment sales and parts territory, including central, northwest and western Arkansas, and eastern Oklahoma, effective August 1, 2017. This move enhances the relationship announced on July 1, when HEP became Daikin Applied's factory sales and parts representative in the same region. In the process, Daikin Service employees will become HEP employees. HEP is the premier commercial and industrial HVAC firm in Arkansas. With strengths in HVAC applications and owner sales, system service, controls and energy services, HEP helps customers efficiently maintain comfort in their buildings. Aligning service teams provides a single point of contact for all customers in the region, from equipment consultations through the life of the system. Adding Daikin Applied's service team gives HEP factory insight and expertise to make HEP an unmatched

service force in the region. For CEO Bill Harrison, the move enhances HEP's ability to be a total solutions provider. "Delivering excellent service to our customers is the cornerstone of HEP's culture. Our customers expect the highest level of service and expertise, and we know adding Daikin's factory trained technicians only strengthens our value to customers."

Daikin Applied's EVP of Sales, Marketing and Aftermarket, Kirk Thorne, believes this change will continue to fuel Daikin's competitive advantage in the market. "HEP has established the strongest service position in the region." Thorne added, "The recognition HEP regularly earns as one of the 'Best Places to Work' in Arkansas gives us confidence our Daikin employees will prosper as members of the HEP team." Thorne emphasized that Daikin's strategies are market based. "This joint effort is well suited to the market conditions and capabilities of Harrison Energy Partners in central and western Arkansas and eastern Oklahoma. ■

# Pressure Independent Quick Compact Valve (PIQCV)

## ENERGY EFFICIENCY FOR ZONE APPLICATIONS

### Belimo Ball Valve Technology



0%  
LEAKAGE

- Pressure independent control valve
- For ON / OFF and modulating, cooling or heating applications
- DN15...25, adjustable flow rates, PN25
- Belimo ball valve design with zero leakage eliminates energy loss



BELIMO Actuators India Pvt. Ltd.  
23/ ABCD, Govt. Industrial Estate,  
Charkop Kandivali West, Mumbai 400067, India  
Tel: +91 22 4025 4800 E-mail: info.india@belimo.ch  
www.belimo.com  
Regional offices: Bengaluru, Chennai, Delhi & Kolkata

**BELIMO**<sup>®</sup>

## Govt Approves New Central Sector Scheme – SAMPADA

The Cabinet Committee on Economic Affairs chaired by the Prime Minister Narendra Modi has given its approval for re-structuring the schemes of the Ministry of Food Processing Industries (MoFPI) under new central sector scheme – SAMPADA (Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters) for the period 2016-20. SAMPADA with an allocation of Rs 6,000 crore is expected to leverage



investment of Rs 31,400 crore, handling of 334 lakh MT agro-produce valuing Rs 1,04,125 crore, benefit 20 lakh farmers and generate 5,30,500 direct or indirect employment in the country by the year 2019-20. The objective of SAMPADA is to supplement agriculture, modernize processing and decrease agri-waste. It is an umbrella scheme incorporating ongoing schemes of the ministry like mega food parks, integrated cold chain and value addition infrastructure, food safety and quality assurance infrastructure, etc.

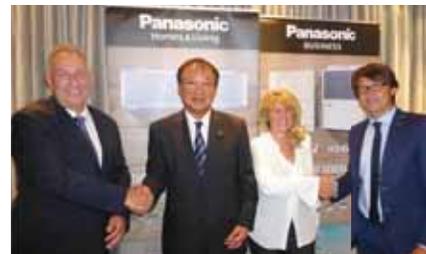
The SAMPADA includes new schemes of infrastructure for agro-processing clusters, creation of backward and forward linkages and creation or expansion of food processing & preservation capacities aim at development of modern infrastructure to encourage entrepreneurs to set up food processing units based on cluster approach, provide effective and seamless backward and forward integration for processed food industry by plugging gaps in supply chain and creation of processing and preservation capacities and modernization or expansion of existing food processing units. ■

## Panasonic Acquires UK AC Equipment Distributor AMP

Panasonic Corporation announced that it has completed the acquisition of AMP Air Conditioning Ltd (AMP), one of the largest independent air conditioning distributors in the United Kingdom. AMP has a wealth of experience in providing air conditioning equipment, mainly for commercial use, as well as an excellent sales network. The acquisition of AMP provides Panasonic with an opportunity to expand its presence in the UK air conditioning market, which is the largest market for commercial air conditioners throughout Europe.

“Europe is a key region for our global air conditioning business. Panasonic is committed to being a strategic partner for AMP and we aim to expand our business in Europe through this collaboration,” said Toshiyuki Takagi, President, Panasonic.

Panasonic sees Europe, an environmentally conscious region with strict environmental regulations for air conditioning products, as a market where the company's energy-saving,



The acquisition of AMP provides Panasonic with an opportunity to expand its presence in the UK air conditioning market.

environment-friendly and healthcare conscious technologies such as ‘nanoe’ can be fully exploited. The acquisition is part of Panasonic's overall strategy to expand sales, particularly of its commercial and industrial heating & cooling solutions.

“With AMP's know-how, Panasonic's strategy is to expand our business and services to their customers and provide even more comprehensive solutions. We look forward to welcoming AMP and its employees into the Panasonic family,” explained Makoto Takahashi, Chief Executive Officer, Panasonic Appliances Air Conditioning Europe (PAPAEU). ■

## Increased Energy Efficiency Could Lower Energy Demand in Canada

According to the International Energy Agency, approximately two-thirds of economically feasible global energy efficiency measures have not been implemented. If Canada were to pursue energy efficiency improvements more aggressively, it could reduce its energy consumption by up to 15 per cent by 2035, according to Canada report. Key areas for energy savings potential include lighting, space heating, and household electronics for residences, while in the commercial sector, lighting, computer and HVAC equipment hold the most promise. In Canada, electricity and natural gas utilities are largely responsible for the implementation of energy efficiency measures and the largest efficiency improvements will result from their actions, such as incentive programs to install energy efficient equipment or appliances, conducting energy audits, and performing energy efficient retrofits. Canada ranks among the most energy-

intensive of OECD countries, as well as among the highest GHG emitters per dollar of GDP produced.

Increasing energy efficiency could reduce energy demand in Canada by as much as 15 per cent by 2035, resulting in demand that is below 2017 levels. While energy efficiency improvements can help lower Canadian demand for energy, it is not a complete solution to help Canada meet its GHG emissions reduction goals.

“While energy efficiency is associated with several benefits, energy efficient measures have not been fully adopted to the extent that it would be economically efficient to do so, in part due to market and consumers behavioral failures,” said Len Coad, Research Director, Energy, Environment and Transportation Policy. “As Canada transitions towards a lower carbon future, energy efficiency could contribute to our efforts to address climate change by reducing both the country's energy intensity and growth in energy demand.” ■

Protect your life and property from fire with air master fire dampers



# air master

## UL Classified Fire & Smoke Dampers



**India:**

Air Master Fire Safety Equipments  
#2, K Narayanapura Main Road,  
Thanisandra, Bangalore 560077.  
+91 80 28444569 / 70  
sales@airmaster.co

**Middle East:**

Air Master Equipments Emirates LLC.  
PO Box. 3180, Ajman, U.A.E.  
+971 6 7436900  
sales@airmaster.ae

NOW IN  
**INDIA**

Motorised Fire Damper  
Motorised Smoke Damper  
Combination Damper  
Curtain Type Damper

Visit website for more details:

[www.airmaster.co](http://www.airmaster.co)



Air Distribution

Air Control

Fire & Smoke

## Friedrich Rushes 200 A/C Units to Aid Aransas County

**2**00 Friedrich Chill room air conditioners, totaling 10,400-pounds of window A/C units worth an estimated USD 55,000, will be loaded up for delivery to Rockport, a town almost completely devastated by Hurricane and Tropical Storm Harvey. The Friedrich A/C units will be used by the Rockport Volunteer Fire Department, which is struggling to provide shelter for emergency responders in the area, including law enforcement officers, volunteer firefighters and emergency medical personnel and dispatchers, after many have lost their own homes and businesses.



**A**s a result, nearly 100 emergency responders are currently camped out in the tiny Rockport fire station, where conditions are exhausting, uncomfortable and cramped. The situation is similar across the county, in fire stations and police stations alike. "The destruction is unfathomable and the community desperately needs help, so we're doing everything we can to keep our local emergency responders in the area," said Gillian Tate, volunteer firefighter. "Those of us that still have homes standing in the area must get them up and running as soon as possible with water, showers, and air conditioning, to provide adequate shelter for our emergency responders so they can continue to provide assistance and support for so many here who need it."

## TCL Uses Honeywell Solstice® for Energy-Efficiency

**H**oneywell announced that TCL Corporation, one of China's largest manufacturers of appliances and electronics, is using Honeywell's Solstice® Liquid Blowing Agent (LBA) in its refrigerator insulation to increase energy efficiency and further reduce climate impact. TCL manufactures approximately two million refrigerators annually at its world-class appliance industrial manufacturing park in Hefei. Chinese manufacturers produce 70 million refrigerators per year, which is more than half of all refrigerators produced globally. Many are insulated with foam made with high-global-warming-potential (high-GWP) chemicals such as hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs). Blowing agents are a critical ingredient in foam insulation used in appliances, allowing the foam to expand and enabling its excellent insulating

performance, which in turn improves energy efficiency.

Blowing agent blends made with HFCs and hydrocarbons can have GWPs of more than 150. Solstice LBA has a GWP of 1, which enables TCL to export its products to Europe and meet the region's

# Honeywell



stringent F-Gas regulations. By transitioning to Solstice LBA, which is based on next-generation hydrofluoro-olefin (HFO) technology, TCL joins more than a dozen appliance manufacturers worldwide that have chosen Honeywell's ultra-low-GWP blowing agent to improve insulation performance, reduce energy use and meet changing environmental regulations. ■

## Cooling Towers Market Size Worth USD 4.85 Bn by 2025

**T**he global cooling towers market is expected to reach USD 4.85 billion by 2025, according to a new report conducted by Grand View Research, Inc. Cooling towers are used in power plants, particularly in thermoelectric power plants, to remove excess heat from the plant. With the rising global demand for electricity, the number of power plants is also expected to increase, thereby, driving growth of this market. Furthermore, a tremendous rise in the number of construction activities across the residential and commercial sectors in developing countries is expected to boost the demand for this product. Additionally, rapid global industrialization

is also a key driver expected to favorably impact the cooling towers market growth over the forecast period.

Technological advancements are expected to provide improved cooling capacity, minimum components, improved installation & energy savings, and low maintenance cost, which is further anticipated to escalate market growth in the near future. Moreover, stringent government regulations relating to the use of cooling towers across different regions are also expected to positively impact market growth. However, environmental concerns related to cooling towers such as plume, drift, and water contamination are anticipated to moderately hamper the market demand. Nevertheless, the emergence of plume abated towers and drift eliminators is expected to overcome these environmental concerns and drive market growth in the near future. Energy-efficient towers provide optimal cooling while exhibiting eco-friendly properties. ■





INFRARED GUIDED  
MEASUREMENT

YOU'RE  
GUESSING

**STOP GUESSING** and know exactly where you should be working with FLIR's patented Infrared Guided Measurement™. IGM identifies and verifies problems invisible to the naked eye to lead you exactly where you should be looking. Electrical to HVAC, water damage to insulation deficiencies, stop guessing and start working with FLIR IGM enhanced meters.



To see the FLIR family of IGM products in action go to [www.flir.in/IGM](http://www.flir.in/IGM)

Images for illustrative purposes only.

For more details call us on: +91-11-4560 3555 or write to us at [flirindia@flir.com.hk](mailto:flirindia@flir.com.hk)

FLIR Systems India Pvt. Ltd.  
1111, D Mall, Netaji Subhash Place, Pitampura, New Delhi - 110034  
Fax: +91-11-4721 2006 | Website: [www.flir.in](http://www.flir.in)



The World's **Sixth Sense**®

## Hudson Technologies to Acquire Airgas-Refrigerants

**H**udson Technologies announced that it has entered into a definitive agreement to acquire Airgas-Refrigerants, a subsidiary of Airgas, a leading US supplier of industrial gases, in a transaction valued on a gross basis at approximately USD 220 million. ARI is a leading refrigerant distributor and EPA certified reclaimer in the US. ARI distributes, reclaims and packages refrigerant gases for a variety of end uses. Potential benefits of the acquisition include:

ARI's HFC distribution business will favorably position Hudson as the industry shifts from Hydro chlorofluorocarbons (HCFCs) to Hydro fluorocarbons (HFCs).

- Broader customer network will provide Hudson with access to refrigerant for reclamation while also strengthening distribution capabilities.
- Adding incremental reclamation processing capacity to support the anticipated growth in reclamation volume from the ongoing phase out of HCFC (R-22) production and the future phase down of HFC production.
- Enabling Hudson to sell its state-of-the-art Global Energy Services offerings to a broader base of customers.
- Enhancing geographic footprint in US.
- Combining two highly complementary businesses.

As of March 31, 2017, trailing 12 month proforma revenue of the combined business is approximately \$250 million. The transaction is expected to be accretive to earnings beginning one year following the close of the transaction. The acquisition will be financed with available cash balances plus borrowings under an enhanced asset based lending facility of \$150 million from PNC Bank and a new term loan from funds advised by FS Investments and sub-advised by GSO Capital Partners LP of between \$95 million and \$110 million. No additional Hudson equity will be issued to finance this transaction. ■

## Beijer Ref Acquires DX Por in Portugal

**T**he Swedish refrigeration wholesale group, Beijer Ref AB, is acquiring the assets of the HVAC distribution company DX Por, which has its head office located in Porto, Portugal. DX Por was established in 2005. The company reports sales of approximately SEK 40 million. DX Por is the main distributor of Toshiba HVAC (Heating, Ventilation, Air Conditioning) in Portugal.

The Portuguese market for such products is estimated to be worth nearly SEK 900 million, recovering after 2008 crisis. "The acquisition complements our

footprint in the Iberian Peninsula with an entity in Portugal and will strengthen the distribution of Toshiba air-conditioning systems in this country. This is fully in line with our strategy", says Per Bertland, CEO of Beijer Ref.

DX Por management will continue to take an active part in the company. The company will be integrated into Beijer Ref's organisation and included in the company's accounts from September 2017. The acquisition is not expected to affect the Group's earnings or financial position significantly. ■

## Dantherm Group Acquires Aerial in Germany

**A**erial is headquartered in Hamburg, and is a leading manufacturer of dehumidifiers and building dryers in Europe. Aerial has more than 25 years' experience in the drying business and a 40 employee strong workforce within sales, development and production. The main customers are in the construction and water damage restoration industry, water management sector and the refrigeration and air conditioning sector. The acquisition

range of dehumidifiers and drying technology to make us a true leader in this industry. Germany is an important market for us and we are excited about the opportunities that Aerial provides in terms of market presence in Germany and product offering to existing and new partners and customers in Europe."

Karsten Meier, Geschäftsführer at Aerial says, "I am happy that Dantherm is the new owner of Aerial. This will give the



of Aerial is another key milestone in Dantherm's expansion strategy following the acquisitions of Calorex Heat Pumps Ltd in the UK, Schönmann AG in Switzerland, Master Climate Solutions Group (MCS) in Italy, Poland, Russia, Spain and China as well as the acquisition of Water Surveillance in Denmark. Torben Duer, CEO, Dantherm Group, says, "The acquisition of Aerial further expands our

company I started more than 25 years ago further opportunities to grow in and outside Germany and to develop our drying technology for use across the Dantherm Group."

Aerial and Dantherm will continue to operate in the market as two independent brands, and will utilise each other's market and product strengths and continue to deliver quality market leading products to our customers and partners. ■

One Stop solution provider for **Thermal Break Profiles & AHU Accessories.**



Manufacturers,  
Supplier & Exporter of  
**Thermal Break Profiles  
& AHU Accessories.**



## **TECHNICAL SOLUTIONS & ENGINEERS**

**Manufacturers of Thermal Break Profile & Air Handling Unit's Components**

**Office Address:** Silver Streak, Plot Number 64A, Sector - 19,  
Koparkhairane, Navi Mumbai - 400 709, Maharashtra, INDIA.

**Factory Address:** R-695, TTC Industrial Area, Rabale MIDC,  
Near Alfa laval Co., Rabale, Navi Mumbai - 400701.

Ph.: +91-22-27544895

+91-22-27550069

Cell: +91-9819442291 / 9819442292

E-mail: [sales@tse.net.in](mailto:sales@tse.net.in) / [techs.solution@gmail.com](mailto:techs.solution@gmail.com)

Website : [www.tse.net.in](http://www.tse.net.in)

### Former Danfoss Boss Becomes CEO at Lego

The LEGO Group announced that its Board of Directors has appointed Niels B Christiansen, 51, as CEO of the LEGO Group effective October 1, 2017. Christiansen was most recently CEO of global industrial technology company, Danfoss, a position he held for nine years until end of June 2017. Christiansen replaces Bali Padda, 61, a long-standing LEGO Group executive, who will assume a special advisory role with LEGO Brand Group.



Niels B Christiansen

Niels has broad experience leading large, global high-tech companies. He was most recently President & CEO of Danfoss A/S, a position he left in June 2017. Niels joined Danfoss in 2004 as Executive Vice President and a member of the Executive Committee for Danfoss. He became

Chief Operating Officer in 2005, Vice-CEO in 2006 and President & CEO in 2008.

Jørgen Vig Knudstorp, Executive Chairman of LEGO Brand Group said, 'Niels is a great leader who delivered outstanding results while CEO of Danfoss. There, he transformed a traditional industrial company into a technology leader. His experience in digitalisation and globalisation, implementing a transformative strategy, and creating an agile, high performing, international team will benefit the LEGO Group. The Board is confident that under Niels, the

LEGO Group will continue to flourish and bring play experiences to more children around the world.' Knudstorp said the transition to a new CEO occurred more rapidly than the Board had anticipated. ■

### Ferguson Names Alex Hutcherson as New COO

Ferguson announces the appointment of Alex Hutcherson as Chief Operating Officer.

In his new role, Hutcherson is responsible for the national execution of the company's strategy and has direct responsibility for Ferguson's sourcing, supply chain, product management, change management, national sales and corporate services teams. He succeeds Kevin Murphy, who was recently named CEO. Hutcherson joined Ferguson in 1988 as a trainee in Cocoa Beach, Florida. He has held numerous positions within the organization for more than 29 years, including branch manager, general manager and area manager. In 2012, Hutcherson was promoted to Vice President of HVAC and took on the senior vice president of HVAC role in 2016.



Alex Hutcherson

"I am both honored and humbled to have this opportunity," said COO Alex Hutcherson. "I look forward to working with operational teams across the business to provide greater speed of execution and enhanced capabilities and services, ensuring Ferguson remains the best path to market for our suppliers."

"Alex brings a wealth of experience to the role, having served in numerous leadership positions during his 29-year tenure with Ferguson," said CEO Kevin Murphy. "I am confident that Ferguson is well-positioned for future growth and success with these changes to our leadership team."

A native of Lynchburg, VA, Hutcherson is a graduate of Old Dominion University. ■

### Nexstar Network Adds Bobby Hamilton as Sewer Solutions Specialist

Nexstar Network is thrilled to announce the addition of Bobby Hamilton to its training team as a trainer and sewer solutions specialist. Hamilton became a member trainer with Nexstar in 2013, and will continue to teach Nexstar classes as a full-time Nexstar employee. In his new role as sewer solutions specialist, he will help Nexstar member companies maximize their sewer solution offerings in private coaching sessions. Hamilton is a third-generation plumber with a rich Nexstar tradition. After honing his craft in the field, Hamilton was the chief architect in the growth of the sewer and underground department at Bob Hamilton Plumbing Heating A/C Rooter in Overland Park, KS. They implemented the



Bobby Hamilton

Nexstar Sewer Sales Program in 2008, and Hamilton helped grow it from USD 165,000 to nearly USD 7 million annually in the last nine years.

Nexstar Director of Training Keith Mercurio said that Hamilton will be a great asset to the Nexstar membership. "His unique skill set and expertise and in sales and leadership will help members achieve similar success in their own businesses," Mercurio said. "Nexstar is now able to offer

two to four-day customized Sewer Sales and Underground Management onsite for our members, as well as follow-up coaching and training through Bobby's new role." ■



## 10 YEARS OF REWARDING BRILLIANT MINDS!

The Emerson Cup completes a decade of service to the HVACR industry.



The Emerson Cup's long journey has been fulfilling and rewarding. Over the years, it has set benchmarks, promoted innovation and rewarded outstanding talent from the HVACR industry. This year, to mark the occasion of its 10th anniversary, the Emerson Cup has tied up with IGBC to present and reward the latest crop of exceptional talent from the industry. These are professionals from across the country, who have made a mark for themselves with their creative and energy-efficient products and designs.

The Emerson Cup continues on this momentous journey of excellence, firmly focused on its objective - to promote deserving talent and create a healthier, friendlier planet for all.

This year The Emerson Cup is on **October 6<sup>th</sup>** at **Jaipur**.

Do visit and follow us on [www.Facebook.com/EmersonComResIN](https://www.facebook.com/EmersonComResIN) and [www.Twitter.com/EmersonComResIN](https://www.twitter.com/EmersonComResIN)



☎ 1800 209 1700  
✉ [EmersonCup@Emerson.com](mailto:EmersonCup@Emerson.com)  
🌐 [www.EmersonClimate.com/TheEmersonCup](http://www.EmersonClimate.com/TheEmersonCup)



EMERSON. CONSIDER IT SOLVED.™

## Outstanding Product Design from Mulfingen

**E**bm-papst received the renowned 'Red Dot Award 2017: Product Design' for its AxiBlade axial fan. The jury was impressed by the fan's modular structure, which sets special standards when it comes to flexibility and functionality.

A record number of over 5,500 products from 54 countries registered for this year's competition. In July 2017, a 39-person jury in Essen, Germany conferred one of the most renowned awards in the design sector on a product from ebm-papst. When justifying its choice, the jury stated: "AxiBlade has an impressive modular structure. Its flexibility and functionality set special standards." Designs from a total of 47 categories received awards in the Product Design area of the Red Dot Awards. AxiBlade entered the competition in the "Industrial devices, machines and automation" category.

Based on a modular system, the AxiBlade axial fan is used in ventilation, refrigeration and air conditioning systems. It features housings with aerodynamically optimized geometries complemented by profiled impeller geometry and winglets for maximum efficiency. This combination allows AxiBlade axial fans to operate in a wide variety of applications with optimum efficiency of up to 54%. They can also achieve a noise reduction



AxiBlade entered the competition in the "Industrial devices, machines and automation" category, achieving a noise reduction of up to 8 dB(A) when compared to the standard program. One of the largest design competitions in the world, the Red Dot Award is organized by Design Zentrum Nordrhein Westfalen. The first jury met in 1955 in order to evaluate the best designs of that era. Since then, the coveted Red Dot has been the world's highly esteemed seal of outstanding design quality. ■

## Winners of 2017 HVACR Leadership Awards Announced

**W**inners of the HVACR Leadership Awards were announced at CCN Live 2017 in Sydney last week. The half day event featured a lineup of six speakers who were able to update the audience on where the industry is heading before the official award presentation began.

More than 100 HVACR professionals attended the event with award winners announced in all seven categories. CCN's HVACR Leadership Awards were sponsored by ABB, Airefrig Australia, Daikin, Hitachi, Innotech and Toshiba.

The Contractor of the Year Award, which was sponsored by Airefrig Australia, went to Airepair Air Conditioning Services managing director, Brad Wiseman. Once again Daikin Australia sponsored the Woman of the Year in HVACR Award which continues to be a highly competitive category. There were six finalists competing for the coveted prize which went to Airmaster commercial manager, Kelli McDonald. Hitachi



Winners of 2017 HVACR Awards

sponsored the Tradie of the Year Award which was presented to Grosvenor Engineering Group technician, Jason Glendinning. Johnson Controls regional manager, Samit Sen, took out the Innovator of the Year Award which was sponsored by Toshiba. The winner of the Leader in Energy Savings and Sustainability Award, which was sponsored by Innotech, was ebm-papst ANZ manager of EC upgrades, Thomas Heine. Once again ABB sponsored the Rising Star Award which was presented to two winners. There was the Female Rising Star Award which went to Heatcraft Australia technician, Shayne Boyle and Male Rising Star Award which went to Temperzone technician, Sean Hart.

The HVACR Leader of the Year Award went to industry veteran and Teco Australia service operations manager, Kenneth Ball. ■



# Big Smart Fan

High Volume Low Speed ( HVLS)



An European Product

## Benefits

- Low Capital, Installation and Maintenance costs
- Low noise level < 45 dBA with standard gear reducer
- Sizes are available between 2.5m till 7.3m
- IE4 SUPER Premium Efficiency motors are available
- Permanent Magnet motors available
- Low noise levels <35 dBA with permanent magnet motors
- High performance & Energy saving
- Lower power consumptions lead to power saving more than 30% compare to a conventional ventilation methods
- Summer Cooling - Winter Destratification
- Pole installation option available for open areas
- Solar powered Outdoors fans available for warm climates

## Recommended Applications

- Places with maximum air movement required e.g. Farms, Animal Husbandry Facilities etc.
- Big buildings with high ceilings e.g. warehouses, Hangers, Industrial facilities, Malls, Shopping centres, Sports Halls etc.
- Intensively used areas where people come together e.g. Entertaining centres, Cafeterias, Libraries, Museums, Mosques, Temples, Gurdwaras, Theatres, Opera, Concert halls, Exhibition Centres, showrooms etc.



## GAPS Engineering & Consultancy

416, JOP Plaza, Sector-18, Noida U.P. - 201301

Tele: +91-120-4311197 ♦ Mob: +91 98 715 66 133 ♦ E-mail: gaurav@gapsenco.com

Web: [www.gapsenco.com](http://www.gapsenco.com)

# Heat Exchanger Market worth USD 20.65 bn by 2022

The market is driven by the rising HVACR deployments, increasing power generation capacities, and rise in technological advances in heat exchangers. Asia Pacific and Middle East & Africa are estimated to witness strong growth in the next five years...



commonly used heat exchanger across all industries. Increased government investments on commercial building & construction projects are driving the demand for HVACR equipment which in turn drives the demand for shell & tube heat exchangers, globally.

Europe has been a leader for heat exchangers with respect to demand as well as production capacity. This region has the presence of most of the global leaders in heat exchanger manufacturing. It has a relatively slow growth rate as a result of its dominant market size and slow economic activity as compared to the other regions. The demand in this region is boosted mainly due to the increased replacement

demand for the heat exchangers.

Alfa Laval AB (Sweden), Danfoss A/S (Denmark), Kelvion Holdings GmbH (Germany), SPX Corporation (US), Xylem Inc. (US), API Heat Transfer Inc. (US), Gunter AG & Co KG (Germany), Hamon & Cie International SA (Belgium), Hindustan Dorr-Oliver Limited (India), Hisaka Works Limited (Japan), HRS Heat Exchangers (India), Modine Manufacturing Company (US), Sierra S.p.A (Italy), Sondex Holdings A/S (Denmark), and SWEP International AB (Denmark) are the other most active players in the heat exchanger market. ■

The market size of heat exchanger is estimated to grow from USD 13.89 Billion in 2017 to USD 20.65 Billion by 2022, at a CAGR of 8.3% from 2017 to 2022. The market is driven by the rising HVACR deployments, increasing power generation capacities, and rise in technological advances in heat exchangers. Asia Pacific and Middle East & Africa are estimated to witness strong growth in the next five years. The demand across these regions is reinforced by the emerging markets, namely, China, India, and Saudi Arabia. The chemical segment dominated the heat exchangers market having accounted for the largest share in 2016. Heat exchangers have been successfully employed for years in the chemical industry for applications such as the heating and cooling of base, intermediate, and final products. With growing demand for chemicals in the emerging economies, the market for heat exchangers is further expected to rise during the forecast period.

Shell & tube heat exchangers are the most common types of heat exchangers used globally. They are extensively used as power condensers, preheaters, oil coolers, and steam generators. They offer a relatively large ratio of heat transfer area to volume, weight, and other additional advantages making them the most



# AEROFOAM<sup>®</sup> XLPE

INSULATION SOLUTIONS



CROSS LINKED CLOSED CELL  
POLYOLEFIN FOAM SUITABLE FOR  
CONDENSATION CONTROL  
THERMAL INSULATION  
SOUND ABSORPTION  
DUCT INSULATION  
ROOF, WALL INSULATION  
LOW VOC EMISSION  
DUST AND FIBRE FREE



www.rhira.com  
www.aerofoam.co.in

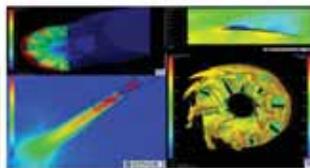


HIRA TECHNOLOGIES PVT. LTD.

Plot No.I-02, (Part - II), Khed Industrial Park DTA, Village, Kanhersar, Tal- Khed, Dist - Pune (India) Pin code 410505  
Tel: 7767809341 / 7767809350 | Email: info@rhira.com Website: www.aerofoam.co.in



## TESTING AND R&D FACILITIES



## CERTIFICATIONS



## CONTACT US

Plot I-02, (Part-I), Khed City, Zone DTA, Kanhersar, Tal - Khed, Rajgurunagar, Pune - 410505  
Tel: 7767 8000 15 / 16 | Email: info@maico.co.in | Web: www.maico.co.in

# Cooling Pavement to Combat Climate Change

Normal black asphalt absorbs 80 to 95 percent of sunlight, while the grey “cool pavement” reflects it — dramatically lowering ground temperature and reducing urban street heat, advocates of the method say.



Normal black asphalt absorbs 80 to 95 percent of sunlight, while the grey “cool pavement” reflects it.

In Los Angeles, where summer temperatures regularly surpass 100 degrees Fahrenheit (38 degrees Celsius), workers are coating streets in special gray treatments in a bid to do just that. The City of Angels, home to four million people, is the first major city to test the technology. Normal black asphalt absorbs 80 to 95 percent of sunlight, while the grey “cool pavement” reflects it — dramatically lowering ground temperature and reducing urban street heat, advocates of the method say.

During a demonstration of the technique, Jeff Luzar — Sales Director at

GuardTop, which markets the product — showed how applying the paint could drop street temperatures by about 12 degrees Fahrenheit after just one coat. Los Angeles is the first city in California to test the treatment on a public road, after initial trials on parking lots, according to Greg Spotts, Assistant Director of the city’s Bureau of Street Services.

“We’re hoping to inspire other cities to experiment with different ways to reduce the heat island effect,” he said. “And we’re hoping to get manufacturers to come up with some new products.”

“Potentially there could be a huge

market for cool pavement products, and in fact, it’s part of a much larger economic trend where solutions for climate change could be the next great investments for the future,” Spotts added. The city will also monitor how Angelenos react to the newfangled asphalt — and how quickly the notoriously thick LA traffic dirties the grey coating.

## ‘Right approach’

George Ban-Weiss, an Assistant Professor of Civil and Environmental Engineering at the University of Southern California, said cool pavements show promise in reducing heat, but “may have some environmental penalties. Recent and current research is working out whether the environmental benefits of cool pavements outweigh those penalties,” Ban-Weiss told AFP.

Still, “the city of Los Angeles is taking the right approach and installing and assessing several cool pavement test sections before committing to widespread adoption,” he said. Ban-Weiss noted that heat mitigation strategies like planting trees along streets and using cool roofing materials were more “no-brainer” remedies. Alan Barreca, an environmental science professor at the University of California, Los Angeles, said the pavement cooling technology could be more equitable than current methods like air conditioning. “Not everyone has the resources to use air conditioning, so there’s concern that some low-income families will suffer,” he said. “That bothers me on a moral dimension. The pavement would provide benefits to everyone. It can protect people who have to be outdoors,” he added. Plus, he added, “lower temperatures — due to the pavement — mean less reliance on air conditioning. So, that means less greenhouse gases.” ■

## Johnson Controls to Make Texas Campuses More Sustainable

Independent Colleges and Universities of Texas (ICUT) is partnering with Johnson Controls to assess and evaluate campus-wide infrastructure needs for more than 40 member institution campuses. Through this collaboration, ICUT and Johnson Controls are helping members make campuses safer, smarter and more sustainable.

“We are excited about the opportunities this partnership provides for our members,” said Ray Martinez, ICUT’s President. “This means better access to valuable information about planning facility upgrades, ultra-efficient campus technologies, and programs and tools that make it all possible.”

With a long history of completing more than 3,000 major infrastructure projects in North America, Johnson Controls will provide ICUT members with an array of professional services and training on issues relating to improving aging infrastructure. Members will learn about topics like environmental and energy management programs, campus security, smart technology, and the use of renewables.

“The needs of colleges and universities are shifting to focus on reducing the operational costs of aging buildings and systems,” Larry Jones, Account Executive and Performance Infrastructure Expert at Johnson Controls



“The needs of colleges and universities are shifting to focus on reducing the operational costs of aging buildings and systems,” said Larry Jones, Account Executive and Performance Infrastructure Expert at Johnson Controls. “Planning for advancements in technology, security and energy independence is crucial for not only reducing utility costs and improving campus safety and resilience, but also for attracting and retaining students.”

In the past five years, Johnson Controls has invested USD 15 million in infrastructure renewal programs for higher education institutions nationwide to transform campuses and engage students through experiential learning. ■




MAXR100 for AIR CONDITIONERS/ HEAT PUMPS/ REFRIGERATION SYSTEMS & CHILLERS.

**MAXR100 BENEFITS:**

- Restores like new performance
- Reduces energy consumption by 10% to 30%
- Reduces humidity up to 50%
- Softens & conditions seals
- Quieter running of equipment
- Reduced compressor running time
- Extends lubricant life
- Extends equipment life
- Less downtime & maintenance cost
- Outstanding anti friction protection
- Reduces Oxidation
- Protects Mechanical Parts
- Lower vents temperatures
- Rapidly improves operation conditions

SAVE YOUR ENERGY  
COSTS BY 10 to 30%



MAXR100 tested & verified by M/s. INTERTEK Testing Services NA,INC, Ohio for Metal Compatibility, Oil Miscibility and Chemical stability (as per ASHRAE 97)



**AMNYK INDIA**

40, Bank Street Khatau Building, Ground Floor, Mumbai 400001, India  
 Mob: + 917416093193, 9502280193, Tel: +91 22 22660120 / 22663059, Email: info@amnyk.com

# Noise Control in Air Handling Units & Ventilation Systems

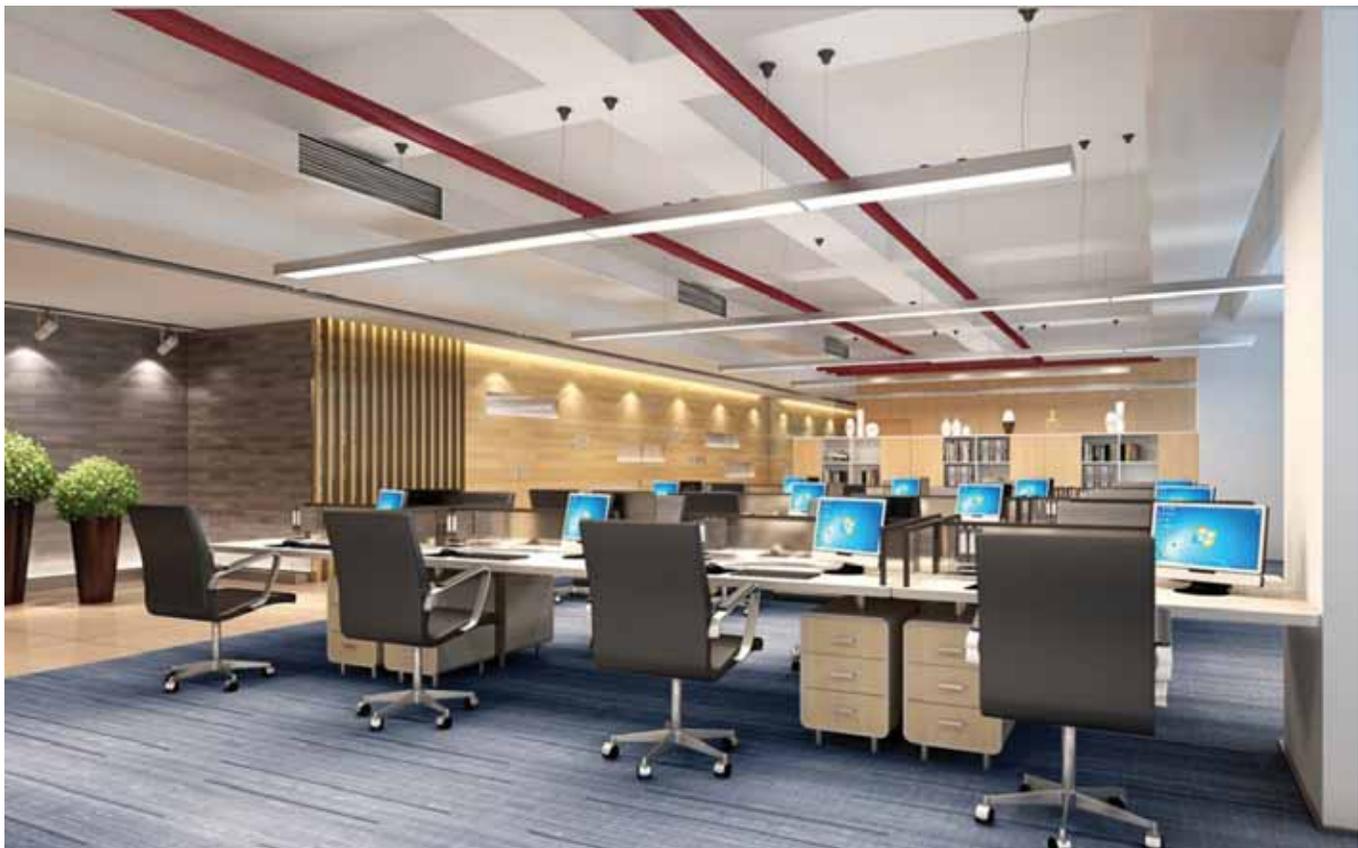
While the design usually caters for the least amount of noise from the AHU and ducting systems, changes in the operating profile as well as improper maintenance cause the noise levels to increase beyond design levels. There is, thus, a need for the O&M teams to firstly understand that noise in the workspace from the AHU/Ventilation system is a problem and then plan mitigation strategies to minimize the noise so as to have a healthy and productive workspace...

**M**odern offices, with no or minimal partitions on the floor plate allow for greater amounts of light to permeate the workstations as well as gives the workforce a sense of "openness". Added benefits include lower cost to build

and increased engagement of the people on the work floor. One drawback of the open plan office design that is seen in mostly all new spaces is the increased noise levels on the work floor. This noise can originate from the chatter of the teams

working on the floor, or an employee speaking loudly on his or her mobile. An often ignored source of noise is that generated from moving machinery in an office environment, most prominently the air handling unit and also from the air movement in the ventilation system. The background noise increases due to the AHU noise or the ducting system generated noise and has a negative impact on the occupants in terms of their productivity and long term health.

Most people associate Indoor Environment Quality (IEQ) with thermal comforts, air quality and to an extent the ambient light levels. A key component of the quality of the work environment is the noise levels that the occupants are exposed to on a regular basis. The effect



of high work place noise levels is not as visible as for example, low light or foul air and hence are not addressed with the impotence that is needed.

### Impact of AHU Noise

Many organizations are now using video conferencing (VC) for meeting across cities or offices. This saves the organization cost of travel of the employees as well as time while allowing for face to face interaction which is needed in such meetings. During a VC session at a large IT services firm with an important client, the attendees were hearing a “humming” sound which was impacting the quality of the interaction as the members could not hear the discussions clearly. After multiple checks by the audio Visual maintenance team, the VC system was found to be working properly. Further, investigations pinned the noise to be coming from the AHU room that was adjacent to the VC room. Low frequency noise due to vibrations of the AHU were generating the noise which was transmitted through the structure and was getting picked up by the sensitive VC system microphones. The impact – an important client meeting to close out a large value contract was postponed and there was also reputational damage to the firm in front of its customers.

In another incident, a throbbing sound was heard in the washroom for a few days. The maintenance team attributed it to the AHU placed adjacent to the washroom but did not carry out immediate repairs as temperature in the workspace was being maintained and hence did not see the ‘noise’ as an immediate problem. Within two days, part of the false ceiling of a section of the work space near the washroom fell and when the incident was investigated, it was seen that the supporting structure of the ceiling tiles had



got dislodged due to the vibrations of the AHU that was adjacent to the washroom. While poor quality of installation the false ceiling was a major cause of the incident, a contributing factor was the vibrations of the AHU, the telltale sign of which was the noise that was heard in the washroom but ignored by the maintenance team.

### Sources of Noise in AHUs & Ventilation System

Different workspaces have different noise level requirements – libraries, conference and meeting rooms will have a much lower ambient noise rating whereas offices will have a more tolerant noise criterion. The noise level is typically measured using the decibel scale (dB). However, for ventilation systems, the following are the noise measurement approaches typically followed in the industry:

- Noise Criteria (NC) which is the most popular way to assess noise in workspaces and is expressed by a

number e.g. NC 40.

- Room Criteria (RC) which is an enhancement of the NC method and assess the impact on speech of the background noise.
- Quality Assessment Index (QAI) is a guide to support the RC approach and takes into consideration the user’s reaction to changes in the background noise. A QAI rating of less than 5dB is acceptable and within 5 – 10 dB is in the marginal band of acceptability.

Noise from ventilation systems and AHU’s can be classified based on their frequency which in turn is a function of the component of the system that is generating the noise. The table shows the relationship between the type of noise and the equipment’s generating the noise<sup>1</sup>.

### Minimizing AHU & Ventilations System Noise during Operations

To be able to reduce the noise due to the AHU and ventilation system components it is important to understand the mode of transmission of noise in the workspace. Typically, noise is generated by the fans and fan coil units, grilles/diffusers and Variable Air Volume (VAV) components of a HVAC system. A target ambient noise level using the NC/RC criteria is established based on the type of

#### Noise Sources in Workspaces

Type of Noise	Source
Throbbing	Turbulent Airflow, Fans
Rumbling	Poor air flow, improper vibration isolation
Loud sound, roar	VAV boxes, Fans, air flow
Humming, Buzz	VAV Units. Poor vibration isolation
Whining	Chillers, Pumps
Hiss, Whistling	Diffusers, Grills



work space and is factored in the design of the of the ventilation system and selection of the components. A well balanced system will easily achieve the design noise levels as the quality of system components and ducting are of a very advanced and high level these days. While the system works as per design and desired noise levels are achieved in the early stages of the system operations, the common observation is that the system deviates after a short time (usually 1 – 2 years), mainly due to the changes in the internal layout of the work space (cabins converted to work desks, more staff than planned for etc.). Poor maintenance is also a contributing factor for the high noise levels once the building has become operational. Some of the common causes of increased noise levels and their remedy are listed below:

**AHU noise:** This is the most common reasons for increase in the ambient noise in offices. The characteristics of AHU

noise is a throbbing noise or an in some cases a humming sound. Physical vibrations that get transmitted through the structure also are a common problem in AHU operations and lead to both noise and structural failures. The key contributors to noise from AHUs are:

- Improper vibration isolation dampers which could be due to a design fault or poor maintenance of the isolators that are installed.
- Imbalance in the AHU fan leading to cyclic noise from the fan itself. In addition, due to the varying speed, the air flow patterns are disturbed leading to noise from the exit points such as diffusers and grills
- Faulty drive system may not directly generate noise, but loose or broken

belts may lead to power air flows which will result in noise at the egress points. In addition, vibrations levels of the unit itself will increase leading to higher transmitted noise.

- Monthly check of the vibration levels of the AHU will help identify the condition of the assembly and proactively carry out repairs to the motor/fan etc.

**Ventilation System noise:** The flow of air across orifices and openings generates noise inherently. Thus, the aim of the design is to minimize the noise that is generated. Poor design such as abrupt change in direction, sudden change in duct diameters to accommodate aesthetics, etc. lead to increased noise. In addition, leakages through duct joints also contribute to the noise as this is uncontrolled and often not detected as the ducting is over the false ceiling and not seen. Imbalance in the system during operations is another major contributor to the noise in the ducting system. The air

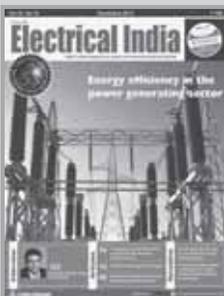
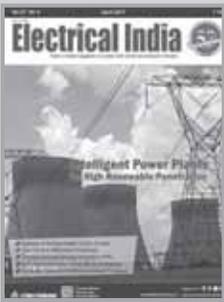
balancing issues can come up due to change in configuration of the office, blockages of the exits by the employees or non-functional dampers. The approach to reduce ventilation system noise is:

- Carry out six monthly checks for leakages and disruptions in the ventilation system. This will highlight the disruptions in the air flow and enable proactive repairs to get the system back to design point.
- Annual measurement of CFM at designated points where the arrangements exist. This will allow the O&M team to assess the health of the AHU and system and undertake repairs where needed.
- Quarterly or at least six monthly IEQ checks which cover noise measurements.
- Whenever any office layout change is planned, a detailed study of the ventilation system and the flow patterns should be carried out to ensure that the air flow patterns are not changed drastically to keep the noise within acceptable limits.

Background noise usually remains that – background noise and is not given that much importance in modern work spaces, unless it is a specific requirement as in a library or auditorium. However, the detrimental impact of high ambient noise in other work space are well documented and have an impact on productivity and employee wellbeing. While the design usually caters for the least amount of noise from the AHU and ducting systems, changes in the operating profile as well as improper maintenance cause the noise levels to increase beyond design levels. There is, thus, a need for the O&M teams to firstly understand that noise in the workspace from the AHU/Ventilation system is a problem and then plan mitigation strategies to minimize the noise so as to have a healthy and productive workspace. ■

**Aneesh Kadyan**  
Senior Director – Operations,  
CBRE South Asia Pvt Ltd, DLF  
City Phase II, Gurgaon





Since 1961

The Subscription In-charge  
**Electrical India**  
Chary Publications Pvt. Ltd.  
906, The Corporate Park, Plot No. 14 & 15,  
Sector - 18, Vashi, Navi Mumbai - 400 703  
Email: sub@charypublications.in

If you are already a Subscriber,  
Enter your  
Subscription/Order no. \_\_\_\_\_

**SUBSCRIBE / RENEW  
ONLINE  
Log on to –  
www.electricalindia.in**

Yes, I would like to subscribe **Electrical India** for \_\_\_\_\_ years  
at ₹ \_\_\_\_\_ (US\$ \_\_\_\_\_ overseas scbscribers)

**Payment details:**

Cheque / DD No. \_\_\_\_\_ dated \_\_\_\_\_  
drawn on bank \_\_\_\_\_ branch \_\_\_\_\_

In favour of **CHARY PUBLICATIONS PVT. LTD.**

**Bank details for Wire Transfer**

Bank Name: **Bank of India** Branch: **Chembur, Mumbai - 400 071**

IFSC Code: **BKID 000009** Bank a/c number: **000920110000322** SWIFT CODE : **BKIDINBBCHM**

Name: \_\_\_\_\_

Company: \_\_\_\_\_ Designation: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ Pin: \_\_\_\_\_

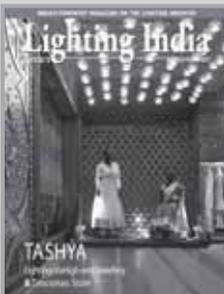
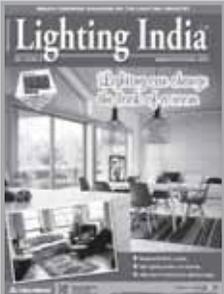
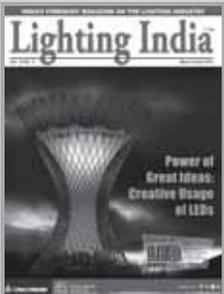
Phone: \_\_\_\_\_

Email: \_\_\_\_\_

Signature: \_\_\_\_\_

No. of Years	Amount	US \$	Tick ✓
<input type="checkbox"/> 1 (12 Issues)	1000	300	
<input type="checkbox"/> 2 (24 Issues)	1750	560	
<input type="checkbox"/> 3 (36 Issues)	2500	720	
<input type="checkbox"/> 5 (60 Issues)	4000	1000	

SUBSCRIBE



Lighting India

The Subscription In-charge  
**Lighting India**  
Chary Publications Pvt. Ltd.  
906, The Corporate Park, Plot No. 14 & 15,  
Sector - 18, Vashi, Navi Mumbai - 400 703  
Email: sub@charypublications.in

If you are already a Subscriber,  
Enter your  
Subscription/Order no. \_\_\_\_\_

**SUBSCRIBE / RENEW  
ONLINE  
Log on to –  
www.lightingindia.in**

Yes, I would like to subscribe **Lighting India** for \_\_\_\_\_ years  
at ₹ \_\_\_\_\_ (US\$ \_\_\_\_\_ overseas scbscribers)

**Payment details:**

Cheque / DD No. \_\_\_\_\_ dated \_\_\_\_\_  
drawn on bank \_\_\_\_\_ branch \_\_\_\_\_

In favour of **CHARY PUBLICATIONS PVT. LTD.**

**Bank details for Wire Transfer**

Bank Name: **Bank of India** Branch: **Chembur, Mumbai - 400 071**

IFSC Code: **BKID 000009** Bank a/c number: **000920110000322** SWIFT CODE : **BKIDINBBCHM**

Name: \_\_\_\_\_

Company: \_\_\_\_\_ Designation: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ Pin: \_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_

Signature: \_\_\_\_\_

No. of Years	Amount	US \$	Tick ✓
<input type="checkbox"/> 1 (6 Issues)	750	150	
<input type="checkbox"/> 2 (12 Issues)	1350	275	
<input type="checkbox"/> 3 (18 Issues)	2000	400	
<input type="checkbox"/> 5 (30 Issues)	3000	600	

SUBSCRIBE

# Electrical India walking hand in hand with the power industry for over 5 decades

## Who can Subscribe?

### Industries:

- Power Generation Equipments
- Transmission and Distribution
- Rectifiers
- Switchgears & Controls
- Transformers, Transformer Oil and Lubricants
- Financial Institutions Financing Power Plants
- Automation, Electronics and Instrumentation
- Test and Measuring Equipments
- Energy Management
- Power Generation
- Motors, Starters and Pumps
- Lighting and Lighting Components
- Safety Devices
- Nuclear Energy
- Capacitors and Condensers
- HVAC
- Circuit Breakers & Relays
- Cables, Contractors and Accessories
- UPS

... and related accessories.

## Professional Readers - EI

### Industries:

- Manufacturers of Electrical/Electronic Goods
- Power Generation
- Fertilizers, Chemicals and Petrochemicals
- Oil and Gas
- Paper and Pulp
- Independent Power Producers
- Military / Defence
- Textile
- Drugs and Pharmaceuticals
- Sugar
- Construction & Packaging Industry
- Renewable Energy & SEB's
- Govt. and Semi-Govt. Bodies
- Institutions

### Professionals:

- Engineers & Policy Makers
- Corporate Management
- Distributors, Traders, Contractors and Suppliers
- Wholesalers, Agents, Retailers
- Advisors / Consultants
- Purchase Managers & Diplomats
- Entrepreneurs & Investors
- Technical Management and Education / Research Training
- Architects

Several Others...

“We travel nook & corner to get the world at your door step”

## Who can Subscribe?

### Industries:

- Shopping Plazas, Cinema Halls and Theatres
- Entertainment Industry: eg. Hotels, Restaurants, Gymnasium & Malls
- Stage & Studio Lighting
- Automobile Industry
- Manufacturers
  - Lighting
    - Neon Lamp
    - Pole
    - Decorative Luminaire
    - Glass & Glass Furnace
  - Machine
  - LED
  - Switch & switchgear
  - Electric Measuring Instrument
- Suppliers
  - Chemical
  - Starter
  - Lighting Products
  - Brass Component
  - Plastic Component
  - Gas
  - Cable Wire
  - Lamp Component
  - Electric Component
  - Steel Component
- Research & Testing Laboratories
- Electronics in Lighting
- Furnace Refractories

... and related accessories.

## Professional Readers - LI

### Industries:

- Top Industrialists & Manufacturers
- Lighting Engineers & Designers
- Architects & Interior Designers
- Event Managers
- Consultants, Contractors & Traders, Project Managers
- Plant Engineers of Large Companies
- Builders & Developers
- Mechanical & Electrical Engineers
- Lighting Products Manufacturers, Suppliers & Distributors
- Entertainment Industry
- Construction Industry
- Hotels & Restaurants
- Fitness Centers
- Hospitals
- Airports Authority of India
- Importers & Exporters
- Municipal Corporations All Over India
- Government Utilities:
  - Ministry of Power
  - Central Public Works Department
  - Electricity Utilities
- Non-conventional energy providers
- Manufacturers from other allied industries
- Universities, Technical & Research Institutions

Several Others...

# INDIA COLD CHAIN SHOW 2017

12-13-14 DECEMBER 2017

BOMBAY EXHIBITION CENTRE  
GOREGAON (EAST), MUMBAI

COLD CHAIN TOUR



## THE POWER CENTER OF COLD CHAIN INDUSTRY



[www.IndiaColdChainShow.com](http://www.IndiaColdChainShow.com)

Conference Partner



Registration Partner



Lanyard Partner



Supported By



Media Partner



Organised By



For Details  
Contact :

Neeraj Negi  
T : +91-9654181043  
E : neeraj.negi@reedmanch.com

Bharani Prasad  
T : +91-9871628542  
E : bharani.prasad@reedmanch.com

# Towards Efficient Heat Exchangers

As a result, forethought regarding future expansions and upgrades must be given when installing heat exchangers. Finding the balance between the initial and running cost of a heat exchanger can feel overwhelming. Given the inherent mathematical and mechanical problems associated with choosing the right heat exchanger, it is exceedingly necessary to consult a professional...

molecules. The greater a material's temperature, the greater is the thermal agitation of its constituent molecules (manifested both in linear motion and vibrational modes). It is natural for regions containing greater molecular kinetic energy to pass this energy to regions with less kinetic energy. Several material properties serve to modulate the heat transferred between two regions at differing temperatures. Examples include thermal conductivities, specific heats, material densities, fluid velocities, fluid viscosities, surface emissivities, and more.

The heat content,  $Q$ , of an object depends upon its specific heat,  $c$ , and its mass,  $m$ . The heat transfer is the measurement of the thermal energy transferred when an object having a defined specific heat and mass undergoes a defined temperature change.

Heat transfer = (mass) × (specific heat) × (temperature change)

$Q = mc\Delta T$ , where  $Q$  = heat content in Joules,  $m$  = mass,  $c$  = specific heat, J/g C,  $T$  = temperature, and  $\Delta T$  = change in temperature.

## Heat Transfer Devices

**Heat sink:** a heat sink is a component that transfers heat generated within a solid material to a fluid medium, such as air or a liquid. Examples of heat sinks are the heat exchangers used in refrigeration and air conditioning systems or the radiator in a car.

**Heat pipe:** a heat pipe is another heat-transfer device that combines thermal conductivity and phase transition to efficiently transfer heat between two solid interfaces.

**Heat exchanger:** A heat exchanger is



## Basics of Heat Transfer

Heat, a measure of thermal energy, can be transferred from one point to another. Without the use of external agency of work/energy, heat flows from the point of higher temperature to one of lower temperature. Heat transfer takes place in three main ways: conduction, convection and radiation. The process of conduction in thermal dynamics is dependent on the factors such as heat transfer coefficient of

the material, area, thickness through which the heat is transferred and the change in temperature. In the simplest of terms, the discipline of heat transfer is concerned with only two things: temperature, and the flow of heat. Temperature represents the amount of thermal energy available, whereas heat flow represents the movement of thermal energy from place to place. On a microscopic scale, thermal energy is related to the kinetic energy of

a device used to transfer heat between a solid object and a fluid, or between two or more fluids. The fluids may be separated by a solid wall to prevent mixing or they may be in direct contact. Heat exchangers are widely used in refrigeration, air conditioning, space heating, power generation, and chemical processing. One common example of a heat exchanger is a car's radiator, in which the hot coolant fluid is cooled by the flow of air over the radiator's surface. Common types of heat exchanger flows include parallel flow, counter flow, and cross flow. In parallel flow, both fluids move in the same direction while transferring heat; in counter flow, the fluids move in opposite directions; and in cross flow, the fluids move at right angles to each other. Common constructions for heat exchanger include shell and tube, double pipe, extruded finned pipe, spiral fin pipe, u-tube, and stacked plate. The basic component of a heat exchanger can be viewed as a tube with one fluid running through it and another fluid flowing by on the outside. There are thus three heat

transfer operations that need to be described:

- Convective heat transfer from fluid to the inner wall of the tube,
- Conductive heat transfer through the tube wall, and
- Convective heat transfer from the outer tube wall to the outside fluid.

Heat exchangers are typically classified according to flow arrangement and type of construction. The simplest heat exchanger is one for which the hot and cold fluids move in the same or opposite directions in a concentric tube (or double-pipe) construction. Alternatively, the fluids may be in cross flow (perpendicular to each other). The two configurations differ according to whether the fluid moving over the tubes is unmixed or mixed. Some of heat exchanger types in use are summarized as:

- Shell and tube heat exchanger
- Plate heat exchangers
- Plate and shell heat exchanger
- Adiabatic wheel heat exchanger
- Plate fin heat exchanger

- Pillow plate heat exchanger
- Fluid heat exchangers
- Waste heat recovery units
- Dynamic scraped surface heat exchanger
- Phase-change heat exchangers
- Direct contact heat exchangers
- Micro-channel heat exchangers

### Heat Exchanger Efficiency

The science of thermodynamics is universally concerned with the relationship between heat and temperature, and energy and work. Though thermodynamics is by no means simple enough to explain in brief terms, one of its main tenets essentially states that 100% efficiency is unattainable in the real world. As a result of this problem, the right manufacturing and selection of heat exchangers is fundamentally important to increase thermal efficiency to its maximum potential and save on energy costs. Choosing the right heat exchanger can be a daunting task, because there is no single and best solution. Heat exchanger efficiency is calculated by comparing between the real

www.drirotors.com

**Don't Let Outdoor Pollutants**

**(PM2.5, PM10, SOx, NOx) affect your health**

**DRI APS™**

**Air Purification Systems**

**Fresh, Clean Healthy Air... Indoor**

**“Protect Yourself Indoors Against OUTDOOR POLLUTION”**

Desiccant Rotors International Pvt. Ltd.

Contact us for Existing Buildings Audit & New Projects : Mobile : +91 8826008129, Email : drimarketing@pahwa.com Web. : www.drirotors.com

CIN : U74899DL1984PTC017497

**PAHWA GROUP**  
Innovation is life

and perfect performance. Though perfect performance is calculable, it is unfeasible in the real world, because of the thermodynamic limitation that states nothing can be 100% efficient. The real performance of heat exchangers, however, can be optimized to achieve maximum efficiency by optimizing copious amounts of data for every application. For every heat exchanger and its operation conditions, there exists a solution that minimizes the amount of entropy, while maximizing the amount of heat transfer. Part of the optimization process requires

- the selection of a thermally conductive material with the desired properties
- a corrosion-resistant material must retain elasticity when dealing with high temperatures and pressure, and continuous contractions and expansions
- size, weight, and cost limitations must then also be accounted for, which requires adjustments to complex flow patterns

Overall heat exchanger efficiency is a combination of following efficiencies.

**Thermodynamic Efficiency:** is entirely dependent on terminal temperatures and nothing else:  $= (t_2 - t_1) / (T_1 - t_2)$ , where  $T_1$  is the temperature of the hot fluid at inlet,  $t_1$  is the temperature of the cold fluid at inlet, and  $t_2$  is the temperature of the cold fluid at outlet. We can calculate the effectiveness of a heat exchanger depends on of what type it is like counter current or co-current and can define which type of heat exchanger is more efficient on basis of design. For more heat recovery counter current HE is preferred over co current. However in some cases parallel design also preferred (isothermal heat transfer, fast heat transfer). For calculating effectiveness we can use-

counter current  $= (1 - \exp(-N(1-C))) / (1 - C \exp(-N(1-C)))$

co-current  $= (1 - \exp(-N(1+C))) / (1 + C)$

where  $C = C_{min} / C_{max}$

as if  $M_c C_c < M_h C_h$  then  $C = M_c C_c / M_h C_h$  ( $M_c$  mass flow rate of cold fluid,  $C_c$  heat capacity of cold fluid and so  $M_h$  and  $C_h$  for hot fluid)

$N = UA / C_{min}$

$U$  = overall heat transfer coefficient

$A$  = heat transfer area

**Temperature Transfer Efficiency:** Temperature transfer efficiency of a heat recovery unit can be expressed as:

$Mt = (t_2 - t_1) / (t_3 - t_1)$ , where

$\mu t$  = temperature transfer efficiency

$t_1$  = temperature in outside make-up air before the heat exchanger (C)

$t_2$  = temperature in outside make-up air after the heat exchanger (C)

$t_3$  = temperature in outlet air before the heat exchanger (C)

**Moisture Transfer Efficiency:** Moisture transfer efficiency of an heat recovery unit can be expressed as:

$\mu m = (x_2 - x_1) / (x_3 - x_1)$ , where

$\mu m$  = moisture transfer efficiency

$x_1$  = moisture outside make-up air before the heat exchanger (kg/kg)

$x_2$  = moisture outside make-up air after the heat exchanger (kg/kg)

$x_3$  = moisture outlet air before the heat exchanger (kg/kg)

**Enthalpy Transfer efficiency:** Enthalpy transfer efficiency of an heat recovery unit can be expressed as:

$Me = (h_2 - h_1) / (h_3 - h_1)$ , where

$\mu e$  = enthalpy transfer efficiency

$h_1$  = enthalpy outside make-up air before the heat exchanger (kJ/kg)

$h_2$  = enthalpy outside make-up air after the heat exchanger (kJ/kg)

$h_3$  = enthalpy outlet air before the heat exchanger (kJ/kg)

## Efficiency Improvement

There is a constant battle in any industry to be able to increase performance and production, while keeping costs at a minimum. A big part of being able to keep costs low is the ability to operate at a high level of efficiency. And, when it comes to efficiency, we want to look at all the equipment we use in order to find areas where we can get better. For example, there are ways to improve heat exchanger performance and get more for our money from these valuable pieces of equipment. The performance of a heat exchanger is evaluated on the basis of its efficiency. The more efficient a heat exchanger is, the more value it offers consumers. The

efficiency of heat exchangers may not worry much if the only heat exchangers are exposed to be the ones in home air conditioner and refrigerator. However, in case of heat exchangers use in automobiles or in factories, then the efficiency of heat exchangers can have serious financial implications. A significant amount of savings can be made simply by increasing the efficiency of a heat exchanger by a minimal percentage. In the current global economic atmosphere, cutting costs even by the smallest percentage can make a massive difference at the end of the month or the year.

**The effects of operating variables:**

There are a few operating variables that are worth noting when it comes to improving heat exchanger's performance. One such variable is operating pressure, which refers to the pressure differential between the suction and discharge of each stream within heat exchanger. If there are deposits present, the pressure differential can be affected, which results in inadequate flow and a less efficient heat exchanger. Operating temperature is another variable to take into consideration. It's important to monitor both the inlet and outlet temperature, in order to prevent the fluids from condensing and coating the internal components of heat exchanger, which, again, can result in decreased efficiency. The effects of nature and the properties of the heat exchanger are also important. For example, a heat exchanger that is designed to handle cooling water shouldn't be used for a hydrocarbon application, as the exchanger would be unlikely to stand up to the job, based on the materials of construction within the unit. Monitoring surface thickness, and steady sampling and analyzing for metals is important for process personnel to do in order to get the most efficiency from a heat exchanger. If the operating variables are monitored and controlled closely, it will help keep your heat exchanger not only running for a longer period of time without breaking down, but also help your heat exchanger run at its maximum level of efficiency.

**The advantages of compact heat exchangers:** Compact heat exchangers are

becoming more popular for a number of applications, and for major industries and businesses all over the world. They can bring huge potential savings over their more traditional shell-and-tubes counterparts. Here are a few of the cost-savings benefits that more efficient, compact heat exchangers can bring. Energy savings is one area where compact heat exchangers can be beneficial. A compact heat exchanger, for example, can be up to five times more efficient than a shell-and-tubes heat exchanger. More energy is put back to use which would have been wasted in older, less thermally efficient heat exchangers. Compact heat exchangers also offer energy savings when it comes to fuel consumption. They use less fuel to power themselves, which also means they operate with lower emissions. Compact heat exchangers also operate with less maintenance. A major reason for this is that compact heat exchangers, specifically, spiral heat exchangers, run with a highly turbulent flow, allowing them to essentially self-clean, lowering cleaning costs. They are, therefore, excellent for heavy-fouling duties. Compact heat exchangers can also help to operate at a higher level of production, which is always a good thing. One way they can do this is by “debottlenecking” in relation to heating or cooling.

In addition, the reduction in physical space required by compact heat exchangers makes a significant difference. The physical space that would have otherwise been used by a heat exchanger can be used to increase production without having to reinvent the wheel and invest in expensive construction on the plant. Finally, compact heat exchangers can help

with cost-savings simply because their initial costs are much lower than similar shell-and-tube models. For one thing, fewer materials are needed for heat exchangers with a smaller footprint, and, if more expensive materials are required for tougher jobs, those costs are subsequently lowered as well. In addition to the purchase price being lower, installation costs are also much lower in a compact heat exchanger. Finally, switching to a compact heat exchanger means that we can increase production while still using the same utility systems already have in place. Clearly, getting as much efficiency as possible out of heat exchanger is extremely important, and will save money and help increase production.

**Follow installation guidelines:** Increasing the efficiency of the heat exchanger begins with getting the installation of the device absolutely on spot. If we have bought the heat exchanger from a reputable manufacturer, we are sure to have received a set of installation guidelines from the makers of the device. These guidelines should not be overlooked under any circumstances. Failure to follow the guidelines will not only compromise the efficiency of the heat exchanger, but may also hamper the basic operation of the device. More often than not, the most efficient way of installing the heat exchanger is by keeping the fluids flowing in a counter-current arrangement. When it comes to air cooled heat exchangers, make sure that no part of the core is blocked. The slightest of obstructions will compromise the cooling capacity.

**Changing the flow rate:** Whenever technicians come in for routine inspection and repair work, we can ask them to check if the flow of the fluids in both the primary

and the secondary side of the heat exchanger has the correct velocity. Increase flow rates enhance the capacity of the heat exchanger to transfer heat. It is advised not to excessively increase the velocity, as it adds on to the mass and makes it more difficult for the energy to be removed.

**Removing corrosion:** If there is any corrosion on any region of the heat exchanger, then it should be removed immediately in order the device not to become inefficient. Sometimes the corrosion becomes so bad that we need to have the tube plates replaced. Make sure to carry out all the necessary removals and replacements for the sake of a smoother operating heat exchanger. A perfectly installed and well maintained heat exchanger is bound to remain efficient for extended periods of time.

**Effects of heat exchanger operating pressure:** The pressure differential between the suction and discharge of each fluid stream is the main driving force of that stream. The pressure differential is affected by fluid flow rates, pipe surface friction, number of heat exchanger passes, bulk density and viscosity. Deposits, if present, reduce the available surface area and increase the pressure differential, thus resulting in inadequate flow. If a pressure difference is noticed, the system should undergo troubleshooting to identify the cause.

**Effects of nature and properties of heat exchanger:** Regarding the properties and nature of the heat exchanger, process personnel must pay particular attention to the chemical relationship between the heat exchanger materials of construction and the chemical nature of the fluid stream in transit. For example, process personnel

**Russ Air**  
ENVIRONMENT YOU TRUST!

GLOBAL LEADERS IN TECHNOLOGY

INDUSTRIAL AIR CURTAINS & AIR DOORS  
PVC STRIP CURTAINS & ROLLS  
INSECT KILLERS & ARRESTORS

Projects In Pharma | Food & Beverage | Cold Storages | Automotive | Chemical | Real Estate | Retail | Hospitality | Healthcare

Tel: +91 22 2600 7979 | +91 8691912000 | Email: sales@russairtec.com | Web: www.russairtec.com



would be ill advised to use a heat exchanger designed to handle cooling water for a hydrocarbon application, as the materials of construction would likely not stand up to the conditions of the application. To ensure a long service life, process personnel should have a firm understanding of material properties and their corresponding effects at varying conditions. Further, process personnel should take special care in the operation and maintenance of the heat exchanger.

## Towards Efficient Heat Exchangers

There are a wide range of heat exchanger problems which may cause poor performance, or in some cases cause the exchanger to stop working all together. Much of the time heat exchanger performance issues can be fixed with a variety of simple solutions which will ensure that process plant can continue to maximize its performance. However, in some instances the most common heat exchanger problems can be a lot harder to resolve, leading to ever increasing operating costs and high capital costs to implement a suitable solution. Some of the most common heat exchanger problems for many process plants include the following:

- Vibration issues
- Exchanger leakage
- Increasing exchanger energy consumption
- Pass Partition bypassing (thermal leakage)
- Air cooler air recirculation
- Fouling

All of the above problems can

contribute to an under-performing exchanger, the main issue is determining the critical problem (or combination) that needs to be resolved in order to improve performance. An audited approach to analyzing the given heat exchangers needs to be adopted, as one particular problem can

be closely linked to another problem on the list; acting as a chain reaction. A lot of exchanger leakage can be found to come from flow distribution issues. If the flow through the exchanger is not uniform, then high flow velocities can cause an additional problem, vibration. This vibration can increase the effect of erosion in exchangers which then leads to frequent leakage of exchangers creating problematic maintenance and associated costs. Closely linked to flow distribution problems is the high energy consumption in terms of utilities that can be created. With varying flow velocities occurring there will be tubes or areas on the shell side where poorer heat transfer is taking place compared to other areas inside the heat exchanger. Operationally fans and pumps are usually increased in power to overcome the poor heat transfer, but such technologies can greatly improve the heat transfer efficiency, and as a result decrease the demand of cooling or heating energy needed for a given duty. Traditional engineering practices such as site visits, taking measurements and examining the exchanger in operation also play a part in determining pass partition bypassing through thermal infrared readings, resolving an unidentified problem with a simple solution. Onsite audits can also determine air recirculation problems, taking into account the exchangers surrounding environment which also can have an impact, i.e. high winds, nearby exhaust gas etc. Finally the problem of fouling can come in many forms listed below but it is essential to determine the type of fouling and it's mechanism to offer

a solution. Different types of fouling can be described as the following;

- Crystallization
- Decomposition
- Polymerization and or oxidation
- Settlement of sludge, rust or dust particles
- Biological deposits
- Corrosion

## Conclusion

The complexities of heat exchanger R&D and continuous new technologies make it an esoteric field and, as a result, it's essential to contact an expert, like Fluid Dynamics, in the field to reap the benefits of choosing the right heat exchanger. Investing time, money, and effort into finding the right heat exchanger can save countless hours and plentiful future costs, so it will be worth the initial investment to make. The complexities of heat exchanger design and selection are innumerable and include leakage, cross contamination, corrosion, cleaning, maintenance, capital and running costs, durability, layout, baffle size and number, tube thickness, diameter, and length, stream flow rates, inlet and outlet temperatures, operating pressure, pressure consistency, replacement costs, load fatigue, stresses from heat and pressure on structural components, condensation, stream properties, size constraints, material type, and fouling. Although many manufacturers of heat exchangers believe they've fully optimized their products, technological advances will make the process never-ending. As a result, forethought regarding future expansions and upgrades must be given when installing heat exchangers. Finding the balance between the initial and running cost of a heat exchanger can feel overwhelming. Given the inherent mathematical and mechanical problems associated with choosing the right heat exchanger, it is exceedingly necessary to consult a professional. ■

Dr. S. S. Verma  
Department of Physics,  
S.L.I.E.T., Longowal,  
Distt. Sangrur - Punjab



# Moving from Heat Waste to Heat Recovery

Using the heat waste of a data center is a good example of how it is actively possible to move towards low-carbon district heating. Furthermore, as demonstrated in several projects throughout Europe, heat pumps are an energy efficient and economical solution for district heating systems...

## Project

Mitsubishi Electric Hydronics & IT Cooling Systems through its brand Climaveneta has recently supplied two heat pumps for Fortum's district heating in Espoo, Finland. Fortum, a Finnish energy company, will utilize waste heat from a data center and supply the heat into a district heating network. The data center belongs to Ericsson, a multi-national networking and telecommunications equipment and services company based in Sweden.

## Win-Win Solution

Ericsson needed more cooling production on their site since their IT load was going to increase quite rapidly and they had relatively old cooling equipment that couldn't support the new incoming IT loads. The company was also looking for an economic and ecological solution for this problem. At the same time, Fortum wanted a sustainable solution that could provide constant heating capacity to their local district heating network with reasonable investment cost and payback time. "It was clear from the very beginning that we wanted to recover all waste heat available and not waste any of it to the environment. With minor modifications we were able to convert the data center to a heat production plant and simultaneously with the same equipment, able to provide the cooling for the data center," says Petteri Hajanti of Granlund, the HVAC system designer, who concludes: "This solution provides great benefits to the business of both companies."

## Innovative Way of Heat Waste Recovery

Using the heat waste of a data center is a good example of how it is actively possible to move towards low-carbon district heating. Furthermore, as demonstrated in several projects throughout Europe, heat pumps are an energy efficient and economical solution for district heating systems. "We want to produce heating in a sustainable and of course innovative way and this project shows that we are able to do that," says Mottonen Ilkka of Fortum. This cooperation model can be repeated in many cases, above all in Northern countries. The main thing to consider is the availability of heat sources next to district heating networks. These could be data centers, geothermal fields, waste heat from industry,

or even a lot of buildings that produce excess heat. The heat source is the key element to keep in mind when designing an innovative and efficient system. "In this project, we have been able to create a very complex technical system, which brings benefits to the whole society in the form of recovering the heat from the data center to the district heating," says Janne Puranen of Coromatic.



Climaveneta has recently supplied two heat pumps for Fortum's district heating in Espoo, Finland.

## Climaveneta Heat Pumps

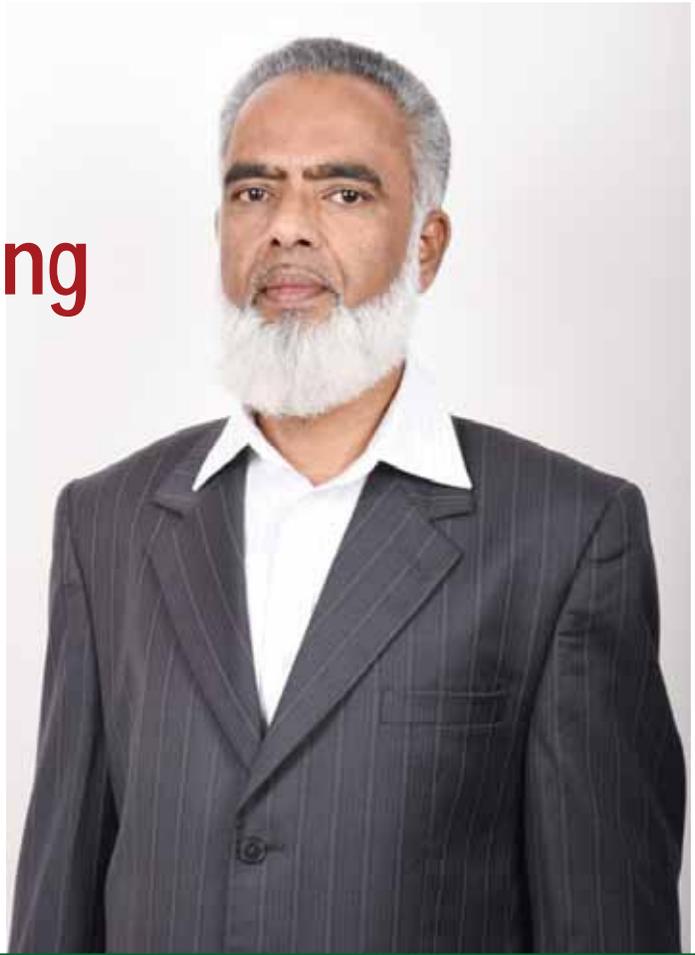
To recover the heat waste of the data center and serve the district heating network, two Climaveneta FOCS2-W HFO/H/CA/S 5422 heat pumps have been supplied through Coromatic, the leading Nordic critical facility solutions provider. FOCS2-W HFO heat pumps have a compact and essential design that leads to

more flexibility during the design phase, especially, in replacement project like this. The units are characterised by competitive efficiency levels both at full and part loads (EER 5.06, ESEER 6.23), which ensure minimum running costs and a quick return on investment. In this project, Climaveneta heat pumps cool the water of a data center from 15°C down to 10°C. The extracted heat is injected into the district heating system as hot water at 70° that mixes with return city water coming at 50°C. All power absorbed by the data center increases the return water of the district heating system, thus, reducing the Delta T between return and supply water: this serves the city and boosts the energy efficiency of the whole system.

## Focus on HFO Refrigerant

FOCS2-W HFO Climaveneta heat pumps have been selected for their efficiency and sustainability as they use HFO-1234ze refrigerant (1,3,3,3-Tetrafluoropropene). The 4th generation refrigerant HFOs are the perfect solution to keep ODP=0 and GWP levels near zero. HFO 1234ze is a gas blend characterised by extremely low GWP while maintaining high efficiency values. Thanks to its compatibility with standard construction materials and operating performance similar to R134a, the new HFO 1234ze is the perfect alternative to HFC refrigerants. "In this heat pump project we selected a new refrigerant, with low GWP because we want to act in a sustainable way, in a way that helps the environment," says Mottonen Ilkka. ■

**“India’s emerging market is the strength for its domestic markets in the years to come”**



**Air Master** is a group of companies first established in Dubai in the year 1987 by an Indian entity. With a humble beginning reaching to the heights of world’s tallest tower Burj Khalifa and world’s tallest hotel JW Marriott Marquis in Dubai, it’s a journey of pride to success. The leading manufacturer who brought for the first time in India, the quality HVAC air distribution products, air control products and related accessories. Air Action is an Air Master enterprise in Karnataka and has completed 25 years of satisfaction to the industry. At Air Master, we strive to make all our products and processes sustainable and energy efficient by constant research and developments, informs **Tajudeen Basha**, Managing Director, Air Action Equipments (Air Master Group) Bangalore in an interaction with **Cooling India**....

**Can you please take us through Air Master’s journey in India?**

Air Master is proud to have completed 25 years in India producing the best quality Air Terminals and accessories. Air Master was started in Middle East about 30 years ago. Since our inception in India, we have grown at a steady pace to keep up with the market demand. It’s a family venture and today, the second generation obtaining post graduations from foreign universities adds more valuable growth in terms of technology and innovation in India and Middle East region. Currently, we

manufacture in eight plants in the Middle East and four in India with a steady growth of success with satisfied customers world wide.

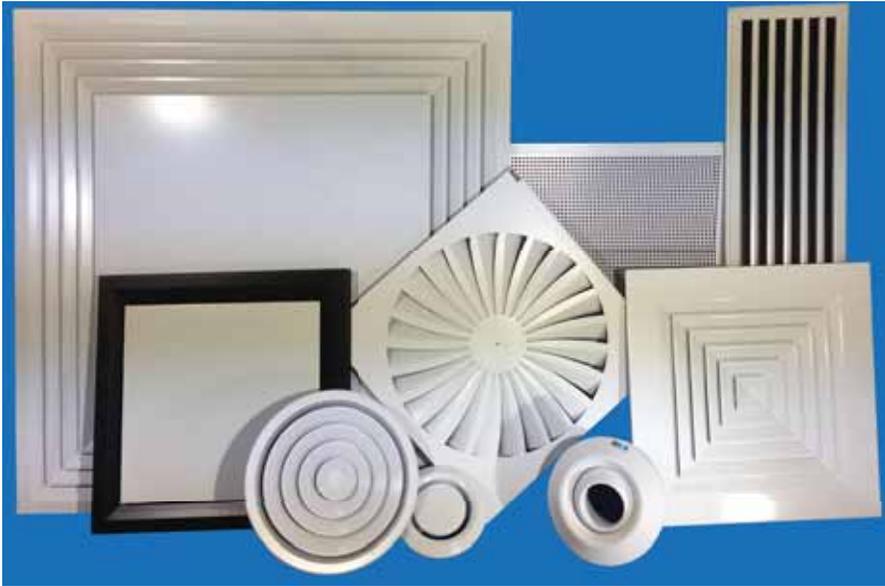
**What are the products offered by the company particularly catering to Indian markets?**

Over the decades we have specialized in the manufacturing of wide range of quality air terminal products such as Grilles, Registers, Louvers, Diffusers, Jet nozzles and ducting accessories such as volume control dampers, fire dampers, sound attenuators, VAVs and access doors etc.

This year has been another important milestone for Air Master with the launch of UL Classified Fire and Smoke Dampers in India to meet the growing demand in the industry. Our new plant in Bangalore dedicated to UL Fire Dampers has been approved by Underwriter Laboratory USA with multiple listing code.

**What are the growth drivers of your products in India?**

Market demand has been a major growth driver as air conditioning has now become a necessity rather than a luxury. The boom in IT sector a decade ago led to a huge



demand in air conditioning for our products. The demand from other industries such as hospitality, shopping malls, commercial establishments, manufacturing and Infrastructure developments also attribute to our growth. Our clients are more of MNCs and the major portion of the market growth is backed by foreign investments and collaborations in India

systems. As project costs have been on the rise, awareness of sustainability and its subsequent implementation with performance has also increased. Products are expected to be environment friendly and energy efficient while adding more focus on the aesthetic aspect of the product. At Air Master, we strive to make all our products and processes sustainable and energy efficient by constant research



Over the decades we have specialized in the manufacturing of wide range of quality air terminal products such as Grilles, Registers, Louvers, Diffusers, Jet nozzles and ducting accessories such as UL Classified, fire dampers, sound attenuators, VAVs and access doors etc.

**What are the trends in the current HVAC market? How would you envisage the growth with particular emphasis on energy efficiency and sustainability?**

As more and more MNCs are setting up their hubs in India and the knowledge for air outlets products and their design has increased while the economic growth is healthy with 'Make in India' initiatives in all sectors of business, the HVAC Industry is poised for a strong growth.

With the technology and innovations in our hands now, there are various types of air distribution products that have vastly improved the air quality and air distribution

and developments. Our operations are less energy consuming due to advanced machinery and skills, including our powder coating methods which are automated and environment-friendly.

**What kind of technological innovations would you like to incorporate in your products considering the rising global temperature? Do you have R&D hub in India?**

We design our products based on applications and collaborate ourselves with consultants as well as architects to ensure that the right products are chosen. We also customize our products and

design them to suit specific needs such that the air is distributed exactly the amount of cooling and area as required. This reduces the overall load on air conditioning and reduces energy consumption. VAVs is one of our energy efficient products that control the air based on temperature and pressure and also the under floor air conditioning, which is showing a rising interest in India now-a-days for its low energy consumption.

The technology is not just restricted to our products, but a major part is hidden in the manufacturing operations. We are increasingly making use of automated technology that delivers precise quality and consume less resources and energy on the whole and achieve maximum productivity.

Our products have been tested and certified renowned third party laboratories





most preferred brand due to our quality and on time deliveries.

### What are HVAC projects accomplished by the company? What hurdles do you usually face during the completion of these projects?

In the Middle East, certainly Burj Khalifa the world tallest building is in one of our flagship projects with non-negotiable dead line for supplies besides hotels like Marriot hotel towers –world’s tallest hotel, Atlantis, Abu Dhabi Palace and Oman Palace hotels, Dubai , Riyadh Cochin and Chennai metros and stadiums like Khalifa-Doha.

In India, we have been a part of many prestigious projects and carried out various challenging projects in sectors such as business parks, leading IT software parks, 7

& 5 star hotels, hospitals, airport terminals, power stations, oil and gas, manufacturing plants, shopping malls, universities etc. We have supplied to almost all major airports in South India and many five star hotels such as Leela Palace, Marriott, Hilton, Sheraton, Shangri La, Taj Group etc. Other projects to name a few are Bosch, Toyota, Prestige Golfshire, Embassy Boulevard, Bangalore World Trade Center, Shantiniketan, Kingfisher Towers, ANZ, IBM, Wipro, Infosys, Cognizant, Accenture, Amazon, ISRO, BEL, BARC and many more. Finishing a project within a given deadline is a difficult task for a contractor, which we understand and ensure that the project is completed by offering our full support and carry out this efficiently with complete dedication.

### What is your outlook for HVAC industry in India?

Currently, India’s HVAC industry is poised for growth at Rs 25000 crore. We strive to serve all regions of India, GCC Countries, Africa, Europe and some parts South Asia. We are always in search of new business opportunities and products to further expand our wings of innovation to serve our customers in the best possible way we can. ■

such as ETL, UL and BSRIA for efficiency and performance and we are the first one to supply such products in India. We have an inhouse R&D facility in Dubai and are setting up a similar one in Bangalore very soon.

### How would you differentiate Indian refrigeration markets from the Global markets, while offering your services and products? Do you face any competition in Indian markets?

Air conditioning systems vary based on geographical conditions. India’s tropical climate is contrast to the world’s severe climatic conditions. Although most

range of products under one roof has contributed to our fame as a reliable supplier. Our trademark values of quality, integrity and reliability and cooperation have enabled us to emerge as a market leader and have kept us ahead of any changes in the business environment.

### What opportunities would you envisage for your company with the Indian Government’s focus on development of infrastructure like smart cities, urban transportation projects?

India’s emerging economy is strength for its domestic market, with economic policies on the positive run. Government



Competition has always been tough, but our unique talent and capability with adamant quality standards with committed deliveries along with wide range of products under one roof has contributed to our fame as a reliable supplier.

products are similar, there are a few differences which are not demanded to the local conditions. Competition has always been tough, but our unique talent and capability with adamant quality standards with committed deliveries along with wide

infra projects have Immensely increased in the past few years such as ISRO, BEL Bhabha Atomic Research etc. Metro stations and international airports are also the major government projects that we have catered to. We have always been the

# Washington, DC Named First LEED Platinum City in the World

Washington, DC recognized by the USGBC for Achieving Sustainability and Resiliency Goals....



Mayor Bowser was presented the honor by Mahesh Ramanujam, President and CEO of the US Green Building Council (USGBC), at an event on the steps of Dunbar High School – the highest rated LEED-certified school in the United States.

Washington, DC was named the first LEED for Cities Platinum city in the world. Mayor Bowser was presented this honor by Mahesh Ramanujam, President and CEO of the US Green Building Council (USGBC), at an event on the steps of Dunbar High School – the highest rated LEED-certified school in the United States. The Mayor and Ramanujam were joined by Mayor Bowser's Chief Technology Officer, Archana Vemulapalli, and Jay Wilson, the District Department of Energy and Environment's green building expert.

"It is in the best interest of Washington, DC's safety, economy, and future to take sustainability and resiliency seriously, and as the nation's capital, we have a special obligation to lead the way on environmental issues," said Mayor Bowser. "We are proud to be recognized as the world's first LEED Platinum city. Our commitment to these issues will not yield, and we look forward to continuing to build a greener, more resilient, and more sustainable DC." LEED (Leadership in Energy and Environmental Design) is the most widely used green building rating system in the world and is designed to help buildings achieve high performance in key areas of human and environmental health. LEED for Cities was launched last year and enables cities to measure and communicate performance, focusing on outcomes from ongoing sustainability efforts across an array of metrics, including energy, water, waste, transportation, and human experience (which includes education, prosperity, equity and health & safety). LEED for Cities projects

benchmark and track performance using Arc, a state-of-the-art digital platform that uses data to provide greater transparency into sustainability efforts and helps cities make more informed decisions. Washington, DC's LEED Platinum certification recognizes the outcomes, rather than intent, of the city's leadership in creating a sustainable and resilient built environment, which includes reducing greenhouse gas emissions, supporting clean energy innovation, and focusing on inclusive prosperity and livability in all eight wards.

"Washington, DC is setting the bar for smart cities all around the world by leveraging technology and data to achieve sustainability and resiliency goals, creating healthy and safe communities where citizens can thrive," said Mahesh Ramanujam, President and CEO at USGBC and GBCI. "Mayor Bowser and the city are once again showing that our nation's capital is performing at the highest levels."

As the district looks to achieve the goals of the Sustainable DC Plan and the targets of the Paris Climate Accord, tracking and improving upon the city's progress is essential. As part of achieving these goals, under Smarter DC, the Office of the Chief Technology Officer works to develop more open access to data and LEED for Cities will be a valuable tool in these efforts.

"Smarter DC is fundamentally about leveraging technology strategically to deliver a more sustainable, resilient, equitable, and healthy city transparently," said Chief Technology Officer Vemulapalli. Today, the Bowser Administration also announced that Brookland Middle School has achieved LEED Platinum certification by the USGBC. The school was awarded 85 out of a possible 109 points, making Brookland Middle School the third DC Public Schools (DCPS) project to achieve Platinum certification and the 19th LEED certified DCPS facility. Throughout the Bowser Administration, Washington, DC has served as a leading city on issues of sustainability. Over the past two and a half years, the Administration has released Climate Ready DC, entered into one of the largest municipal onsite solar projects in the US, completed the largest wind power purchase agreement deal of its kind ever entered into by an American city, launched Sustainable DC 2.0, and, most recently, signed a Mayor's order pledging to uphold the commitments in the Paris Climate Accord. Today, 65 percent of DC neighborhoods are walk able, 58 percent of commuter trips are by bike, walking, or public transit, and the DC Government is 100 percent powered by renewable energy and DC is on track to derive at least one-half of the entire city's electricity from renewable resources by 2032. ■

# Wind Driven Ventilation: Holistic Approach of Cooling

Wind speed plays a major role in natural ventilation. From the view of human comfort wind speed should neither be very large nor very low. Best wind speed ranges for passive cooling is the wind speed for breeze which varies from 2-8 m/s. Now the question is the availability of this wind speed range in that particular location. This article focuses on wind meteorology, wind driven natural ventilation techniques and effects on natural ventilated building cooling and design in Indian scenario...

**W**ind driven ventilation arises from the different pressures created by wind around a building or structure, and openings being formed on the perimeter which then permit flow through the building. Due to rapid increase of environmental pollution it is very much necessary to maintain harmony

with nature. Most of the technologies for cooling such as conventional refrigeration and air conditioning are not ecofriendly. On the other hand, India has a lot of urban and suburban areas in the coastal regions where wind speeds are very much prominent. In the wind zone map of India, basic wind speed of India varies from 33

m/s in Bangalore to 55 m/s in Darbhanga. Based on the availability of wind speed, wind induced natural ventilation can be considered to be an appropriate technology for holistic cooling in India. However, for successful implementation of this technology, it is required to give attention on some key processing areas such as wind speed data measurement, non-stationary analysis of wind speed data, probabilistic modeling of wind speed data, wind direction analysis with wind rose, probabilistic modeling of wind direction, physics of wind flow and natural circulation leading to corridor setting. The knowledge of the urban climatology i.e. the wind around the buildings is crucial when evaluating the air quality and thermal comfort inside buildings as air and heat exchange depends on the wind pressure on facades.

As naturally occurring wind blows



across a building, the wind hits the windward wall causing a direct positive pressure. The wind moves around the building and leaves the leeward wall with a negative pressure, also known as a sucking effect. If there are any openings on the windward and leeward walls of the building, fresh air will rush in the windward wall opening and exit the leeward wall opening to balance and relieve the pressures on the windward and leeward walls. Capturing the wind and bring ventilation to the building depend on the building shape, building orientation and location, building form and dimensions, window typologies and operations, types, shape and size of openings, construction methods and detailing, external elements, urban planning consideration, etc.

### Wind Meteorology

Wind speed plays a major role in natural ventilation. From the view of human comfort wind speed should neither be very large nor very low. Best wind speed ranges for passive cooling is the wind speed for breeze which varies from 2-8 m/s. Now the question is the availability of this wind speed range in that particular location. Wind speed is highly location specific. Even in a particular location wind speed greatly varies in different months. To determine availability of a particular wind speed range, an availability factor can be defined which can be equated to the probability of occurrence of wind speed in the particular range for that location. Wind speed data are generally measured either by cup and cone anemometer or dyne pressure tube anemograph. Care should be taken while measuring wind speeds as the current methods of measurements sometimes lead to sampling errors and the future prediction of wind speed from the supplied data by Meteorological Departments would be grossly affected. Suppose one anemometer pulse has been calibrated to 0.12 m/s depending on a particular instrument. Then two pulses would be equated to 0.24 m/s and three pulses would be equated to 0.36 m/s. Now if the Meteorological Department supplies the

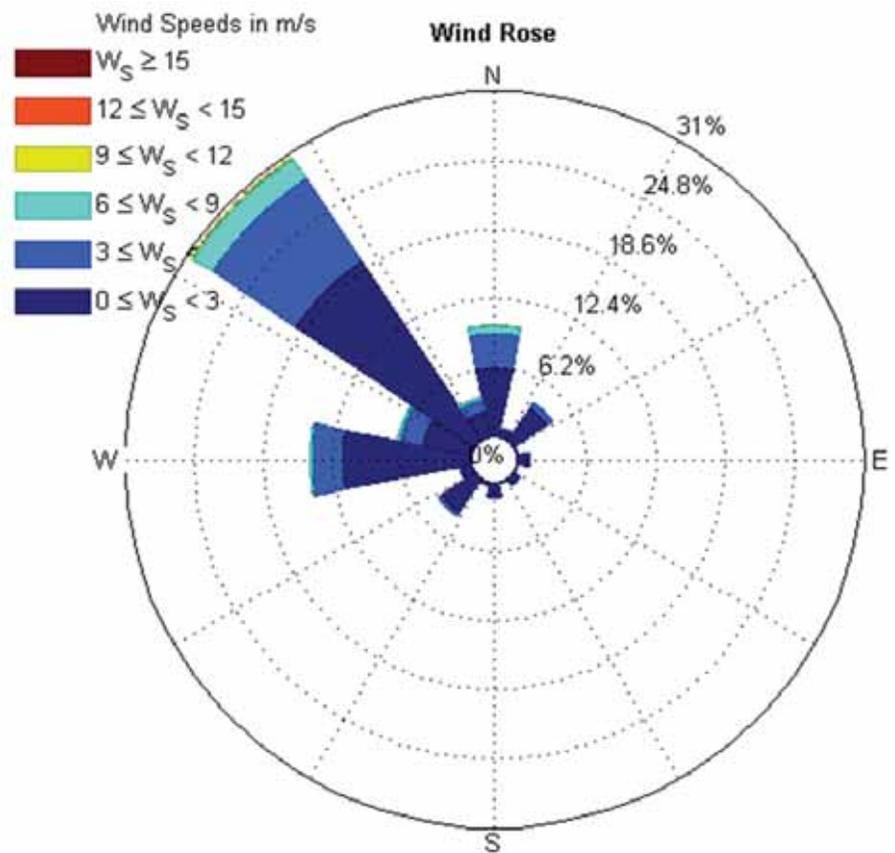


Figure 1: A typical wind rose of Trivandrum

wind speed data to the end user considering a class width of 0.1 m/s which has been considered as the finest interval in many European countries, the data would be supplied as 0.1, 0.2 and 0.4 m/s. Hence, in this calibration 0.3 m/s would never appear in the wind speed data set which may not be true while considering natural wind speeds. Hence, the trend of the wind speeds would be biased which leads to the erroneous future prediction. Moreover, in India the class width for supplying wind speed data is 1 km/h which is too higher than the case cited in this example and this would cause more sampling error. Not only this, in India wind speeds are initially measured in knots and later converted to integer km/h by multiplying a factor of 1.852. Since knot and km/h has no common integer multiple, sampling error in wind speed data would obviously be induced due to this conversion. After removing the influence of sampling error by increasing the class width of the histogram, the correct trend of the same can be obtained.

Since wind speeds are highly uncertain, it is very much necessary to know the availability of a certain range of wind speed which would be required for wind induced natural ventilation. For this wind speed, data should be modeled by a suitable probability distribution. But for any probabilistic modeling the parent dataset needs to be random whereas wind speed data are generally highly non-stationary unlike any other stationary random data. Also, for the wind speed analysis of wind driven natural ventilation block maxima cannot be taken for making the wind speed stationary, which is frequently used for the specification of the design wind speed for civil structures. Hence, in this case the trend and seasonality should be removed from the data. It is also required to remove white noise from the data and the residuals need to be modeled by Auto Regressive Integrated Moving Average (ARIMA) or Auto Regressive Moving Average (ARMA). After making wind speed data set as independent and identically distributed (iid) data, probabilistic models can be

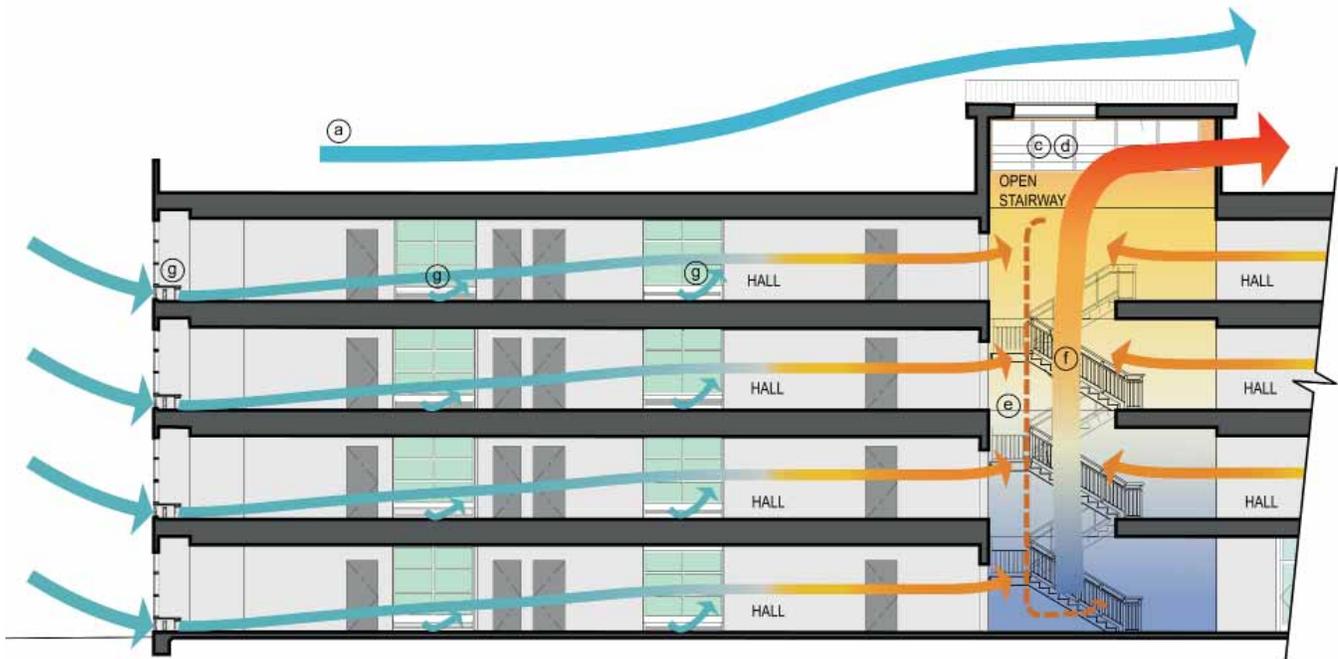


Figure 2: Wind direction distribution of Trivandrum

applied. Since wind speed data are highly non-Gaussian, World Meteorological Organization (WMO) suggested Weibull model for probability distribution of wind speed data. But sometimes other probability distributions such as Gamma, Inverse Weibull and other mixture models have also been found to be suitable for wind speed distributions of different locations of India. Sometimes bimodal or multi-modal distributions have been found to be suitable.

Wind direction also plays a crucial role for wind induced natural ventilation along with wind speed. Wind directions are generally measured by 16 point compass. After determining the available duration in the required wind speed, the most favorable wind direction should also be determined for a location which is required for the orientation of doors and windows as well as corridor setting. Wind rose can be used for this purpose. Wind rose is a pictorial representation of the fractions of wind coming from different directions. A typical wind rose for Trivandrum has been

shown in Figure 1. Due to climate change, atmospheric boundary layer also changes which has an influence on wind direction. For the uncertainty of wind direction, it is also required to fit wind direction data into some suitable probability distributions. Many researchers concluded that 2 component and 4 component von-Mises distributions are suitable for this purpose. A modeling of wind direction data of Trivandrum by von-Mises distribution has been shown in Figure 2.

Apart from the above discussions for natural ventilation, it is also equally important to understand the physics of wind flow. Due to adverse pressure gradient and subsequent flow separation stream line distortions take place and vortex eddies are formed leading to circulations. When wind flows over a bluff body, in the back side of the body there is always circulation. That is why, the persons who are sitting at the back of the auto rickshaw experience more wind rather than those sitting at front. Sometimes flow separation and large suction regions

are formed at the sharp edge. The formation of a horse shoe vortex has also been found at the bottom front corner of a bluff body. This flow circulation can be used for natural ventilation especially for the settings of windows and corridors. Figure 3 shows some simulation results regarding wind driven natural circulation.

Based on the above discussions a case study can be carried out for determining the configurations of doors and windows at some coastal locations. Three coastal locations have been considered in this study namely Kolkata, Ahmedabad and Trivandrum. After fitting the wind direction data into von Mises distribution the most probable wind directions for Kolkata, Ahmedabad and Trivandrum have been found as south, south-west and north-west respectively. Hence, in Kolkata wind flows from south, in Ahmedabad wind comes from south-west and goes to north-east and in Trivandrum wind flows from north-west towards south-east. Accordingly, the preferred window configurations among

Table 1: Table for preferred window configurations for some cities in India

Sl. No.	Station Name	Probable Wind Direction	Suitable Configuration from Fig. 3
1	Kolkata	South	C1
2	Ahmadabad	South-west	D1
3	Trivandrum	North-west	B1

Table 2: Summary of Various Wind Driven Ventilation Techniques

Wind Driven Ventilation Type	Feature/Application	
Passive	window openings	Primary method in most domestic buildings
	Atria & courtyards	Architectural integration into building Typically used in warmer climates for cooling
	Wing walls	Uses wind pressure mostly in domestic buildings, used to facilitate natural ventilation
	Chimney cowls/exhaust cowls	Placed on top of chimneys and roofs, uses wind induction and stack effect
	Wind towers	Wind pressure/stack effects Typically used in warmer climates, now integrated as part of natural ventilation strategy
	Wind catchers	Wind pressure/stack effects. Installed in Schools, offices, domestic buildings, industrial buildings
	Wind floor and air inlets	Wind floors are used on top of high rise buildings to facilitate natural ventilation. Air inlets are components of natural ventilation design
Directed Passive	Wind cowls/scoops	Uses wind pressure and faces into or away from prevailing wind (static)
	Rotating roof	Dymaxion dwelling machine with a rotating roof similar to a wind cowl. Used to naturally ventilate whole dwelling
	Wing Jetter system	Uses drag and lift forces to create a negative pressure and extract air
Active	Turbine ventilators	Combined wind turbine and extract fan design. Domestic and industrial use
	Rotating chimney cowl	Small spherical rotating ventilator placed on top of chimneys. Good at preventing down draughts
	EcoPower	Vertical axis wind turbine attached to extract fan

the configurations shown in Figure 3, for these locations have been tabulated in Table 1.

### Wind Driven Ventilation Techniques

Wind driven ventilation can be classified as cross ventilation and single-sided ventilation. Wind driven ventilation depends on wind behavior, on the interactions with the building envelope and on openings or other air exchange devices such as inlets or chimneys. Depending on

their operation and mode of engagement with the wind, the wind driven ventilation techniques can be grouped as (i) passive technique, (ii) directed passive technique and active technique (Table 2).

### Limitations of Wind Driven Ventilation

- Unpredictability and difficulties in harnessing due to speed and direction variations
- The quality of air it introduces in buildings may be polluted for example

due to proximity to an urban or industrial area

- May create a strong draught, discomfort.

### Conclusions

The passive cooling system through the natural ventilation of wind can be considered as a holistic solution in place of traditional cooling system. However, large uncertainties are involved in the availability of the desired wind speed range. Climate change can also influence both wind speed and direction. Accordingly, corridors should be oriented for passive cooling. Various traditional and modern wind driven ventilation techniques are discussed, which can be helpful to choose suitable ventilation technique with proper design strategies.

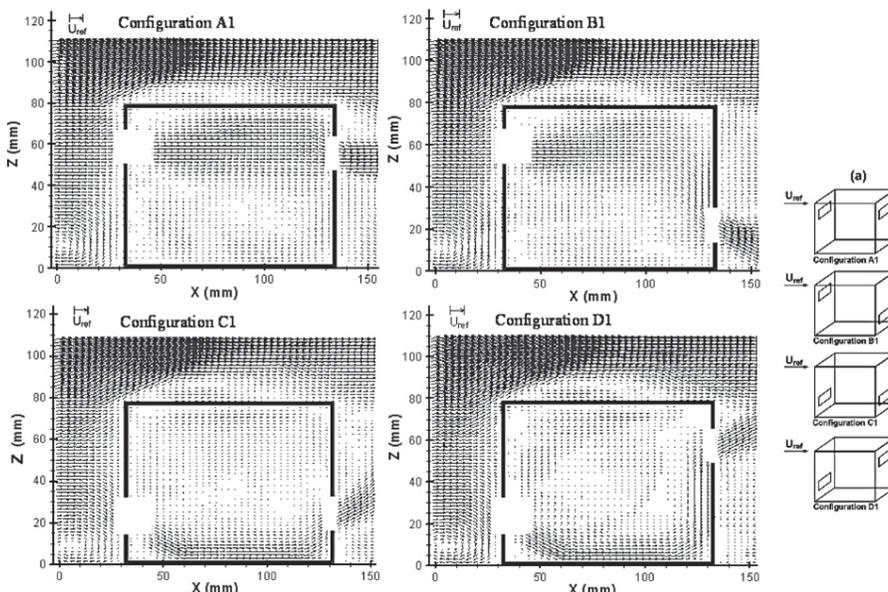


Figure 3: Numerical simulations of wind driven natural circulation in different configurations

**Dr. J. Sarkar**  
Associate Professor, Department of Mechanical Engineering, Indian Institute of Technology, Varanasi, India



**Dr. A. Sarkar**  
Associate Professor, Department of Mechanical Engineering, Indian Institute of Technology, Varanasi, India



# Low Cost Ways to Save Energy in HVAC System

Existing buildings present huge scope for low-cost energy-saving retrofit measures. Here are some suggestions. Analyze the energy consumption vis a vis design as only when you measure you can analyze improve and control...



## Air Handling Unit

Air handling unit filter replacement once it is with black soot not only improves the indoor air quality but also saves considerable energy. Air handling units fans tend to pump more air quantity which can be adjusted to the design air quantity by changing motor pulley and belts. Of course necessary care needs to be taken to limit the fan speed within the manufacturer's recommendation by this the fan operates to the design air quantity and saves energy.

## Keep Coils Clean

In a study, HVAC systems with dirty

evaporator coils and dirty condenser coils were 35-percent less efficient and 60-percent less efficient, respectively, than systems with clean coils. In addition to lowering the energy efficiency of HVAC systems, dirty evaporator coils can become a breeding ground for mold and bacteria, negatively impacting indoor-air quality.

To effectively clean condenser



and evaporator coils:

- Use a wet cleaning process: Pressurized water loosens deeply embedded dirt and debris, vastly improving the cleaning process.
- Use a powerful-yet-delicate cleaning system: High-pressure equipment can damage fins, especially those on evaporator coils. Ideally, a system should deliver 125 to 200 psi of pressure and up to a half-gallon of flow per minute.
- Vacuum coils and fins: Before cleaning coils, remove dry debris with a vacuum that can reach dust and dirt in tight

spaces. Other options include the use of compressed air.

- Clear blockages: Before beginning wet cleaning, make sure condensate pans and lines are free of blockages, as major damage from flooding and HVAC-system condensate can result. To remove debris prior to cleaning, consider using a wet/dry vacuum.
- Apply alkaline non-caustic cleaning foam: Use of a non-caustic cleaner helps to protect coils from corrosion.
- Apply a mold-control agent: Add a mold inhibitor that is US Environmental Protection Agency-registered and approved for use in occupied spaces to help keep coils clean and free of odor- and allergy-causing mold and mildew.
- Seek the best possible access. The closer you can get a cleaning wand to coils, the more effective the cleaning. If coils are difficult to access, consider the use of a flexible wand.

## Repair Damaged or Missing Insulation

Duct and especially pipe insulation inevitably gets damaged over time. For example, workers routinely climb or step on insulated pipes. The estimates as much as 20 percent to 25 percent of insulation damaged in USA and it may be around same or more in our country

Insulation is not done with adequate care in the initial stage itself leading to large waste of energy and condensation of

pipes leading to damage of false ceiling, causing molds and fungus growth.

With a damaged jacket, insulation is prone to moisture or water intrusion. Water trapped in insulation reduces insulating value, while water trapped under insulation promotes corrosion. Damaged insulation on cold systems can promote mold growth, while damaged insulation on hot systems can increase the risk of burns to people. Repairing damaged insulation can save energy and prolong pipe life.

## Reset Hot/Chilled-Water Temperature

Section 6.5.4.4 of ANSI/ASHRAE/IES Standard 90.1-2013 calls for resetting chilled and hot water temperature on systems with capacity greater than 300 MBH. That strategy can save energy by increasing chiller operating efficiency and reducing unneeded dehumidification.

Beware, however, of unintended consequences. ANSI/ASHRAE/IES Standard 90.1-2013 recognizes one, stating reset of chilled water is not required when it would compromise humidity control such as in a conference room or other densely populated interior space. The standard does not, however, recognize the potential unintended consequence of increased pump energy and increased fan energy. For a given cooling coil, higher chilled-water temperature probably will translate to higher supply-air temperature and increased airflow to loads that do not vary with outdoor temperature or other

reset parameter. Check that any increase in fan energy does not offset savings in chiller energy. Also, remember that with head-pressure control, air-cooled-chiller efficiency increases as outdoor temperature goes down so savings from chilled-water reset might be small.

Reset of hot water temperature often is a great idea for perimeter heating and other systems whose load varies with outdoor temperature or other identified reset parameter. It reduces heat loss through distribution piping and reduces pressure drop through control valves that stay open wider. Reset of hot water temperature is not a good idea for loads independent of the reset parameter.

Seasonal setting of the chilled water temperature i.e to higher level in winter saves the considerable chiller energy.

## Concurrence

These are a few low cost ways to save energy in HVAC system in buildings. Some have been around since the oil embargoes of the 1970s, when the energy conservation business got initiated. As was the case then, engineers need to evaluate energy conservation opportunities and satisfy themselves that savings are achievable without compromising performance. ■

V Shridhar

Member - ASHRAE,  
Chief Consultant at Enervac  
Engineering Consultants



## The best reason to subscribe Cooling India

- Technological updates
- Trending news from the industries
- Versatile topics covered
- Wide exposure
- Eminent writers from the industries

Print + Digital  
Contact Ms Priyanka - 27777182

www.coolingindia.in

## Advertise in Cooling India & Engage yourself in growing market

- ~ Pitch new clients
- ~ Reach nationwide
- ~ Boost sales
- ~ Increase Company visibility
- ~ Standout in industry
- ~ Be ahead in competition

For Advertising details call – Nafisa +91 22 27777199 / 9870884159

# Smart City & Green Building



Green building is an innovation and so as smart city. So, the designer should be given free hand in doing more innovation in terms of renewable energy, solar energy, water saving, geothermal air conditioning, green STPs, less polluted generator and so on. Making smart city with green building aspects is a big task but maintaining it is also very important...

**G**reen building movement in India and abroad has now made each designer think more and more about saving energy and make the buildings green. Although it has started under US Green Building Council, the concept started hundreds of years back, when buildings like Victoria Terminus Station or Hawa Mahal in Jaipur constructed where light and ventilations reach each corner of the building giving comfortable atmosphere. Similarly, Smart City Concept might have grabbed front page of newspapers now-a-days; it really started 4,000 years back when Indus civilization started. When we talk of modernization and development, these

both points, green building and Smart City comes together and as a designer we have to check both things at a time. Every smart city will have thousands of buildings. If we make every building, be it a commercial or residential a green building, it will generate opportunities for energy savings.

## Pushing Green Building Concept in Smart Cities

While considering the basic requirements of green building, we need following things to be in order before beginning of the construction:

## Sustainable Architecture & Design

While making footprint of the smart

city, we need to be very much careful about space planning for different segments of developments and how each segment is well taken care of. We need to take care that each area is self-sufficient of its needs, each zone is self-dependent and each building is self-sustained in terms of building envelope and necessary features.

## Site Selection and Planning

Before getting the approval for plan, the master planner has to make sure that the purpose of the building is matching the dream of smart city and it gives incentive to the buyer as well. All the basic amenities such as market, bank, post office, bus stop, restaurant should be very close to each building so that there is no requirement for vehicular movement and basic necessities get fulfilled within walking distance .

## Water Conservation

Both in Smart City and Green Building, water management is very important. Proper water consumption calculation and accordingly distribution is required. All the fixtures in the apartment and in the offices



should be of optimum water saving. Sensors should be used in commercial building. Beginning from the construction stage, the planner has to take care of water conservation.

### Energy Efficiency

No need to mention that, every building in a Smart City should be fitted with LED fixtures and fans & all air conditioners should be five-star rated. All street lights should be illuminated with solar power and all water pumps should have solar cell and grid back up. There has to be single tariff system for all suppliers and billing methodology should be same. Commercial and residential tariffs should be well defined and incentive should be given for night time users by dual tariff methodology. Type of AC units should be well defined as per building footprint area. High COP chillers should be used and equipment selection criteria should be published in the smart city building guidelines itself.

### Building Materials and Resources

Cement and steel along with sand brick and water are major parts of the building works in terms of cost and time. These should be procured from green sources. Almost care has to be taken so that environment does not get polluted. Glass is the next material that helps in increasing day light and reducing load on the building foundation. Proper E value glass should be used. Maximum reusable

materials should be used in the smart city and other materials should be procured within 500 kilometer distance of the smart city. Local materials and local architecture should be considered while making the design.

### Indoor Environmental Quality

People occupying the building should always get clean air. So, while selecting the building, especially, the residential ones one has to check whether any exhaust gas of any industrial outlet (of course small industry as big industry will not at all be allowed inside smart city) comes close with the building area. We have to see whether any open drainage giving foul smell passing through building area. Inside the building also, it is very important to maintain hygiene air. Indoor air purging can be done before occupying the building to clean the air.

### Innovation and Development

Green building is an innovation and so as smart city. So, the designer should be given free hand in doing more innovation in terms of renewable energy, solar energy, water saving, geothermal air conditioning, green STPs, less polluted generator and so on. Making smart city with green building aspects is a big task but maintaining it is also very important.

### Building Commissioning and Management System

In above paragraphs, we studied how

the designer conceptualizes green aspects in HVAC system which at the end reflects in indoor air quality, environmental friendly construction and saving in power consumption. The designer also does value addition in electrical design by selecting proper energy saving equipment. The designer also gives its best by providing water saving fixtures and green STPs. However, it is also compulsory to appoint a **Commissioning Authority** who has to cross check all installations, power consumption.

### Conclusion

Green Building and Smart city both are talks of the moment. But the main goal is healthy living and energy saving. India has only two percent of total water of the world and is having 17 per cent of total population. Due to global warming, the temperature is rising leading to hike in air conditioning electricity bills. Nuclear power generation is a way away and hydro power is not self-sufficient. Indian living standard is increasing and so as our expectations. Smart city and green building have to go hand in hand for the growth. ■

**Firoj Jena**  
CEO,  
Clancy Global Consulting  
Engineers, Mumbai



## Italy's Largest Hypermarket Opts for CO<sub>2</sub> Refrigeration

The use of CO<sub>2</sub> trans-critical refrigeration in warm climates has been a hot topic for many years. The tables are turning, however, and CO<sub>2</sub> refrigeration advances across Southern Europe as an efficient and viable solution. In April 2016, the largest hypermarket in Italy opened its doors in Milan. The 10,000 m<sup>2</sup> brand new Iper market is a pioneer in CO<sub>2</sub> trans-critical refrigeration system using Ejector technology to enhance efficiency in temperatures upto 38°C. The turnkey refrigeration system is supplied by Arneg...

**T**he Iper Hypermarket is part of the new Arese Shopping Center, erected on the old Alfa Romeo car production site that was formerly the cherished workplace of 40,000 workers. Building on this proud heritage, the Arese Shopping Center is the largest shopping centers in Italy and one of the largest in Europe, including 92,000 m<sup>2</sup> of Italian market style floor space with more than 200 shops, cafes and restaurants.

Sustainability is a key pillar of the building design that is LEED Gold certified, meaning that the center is designed and constructed to use less water and energy and reduce greenhouse gas emissions.

"Using CO<sub>2</sub> to power the refrigeration system is a perfect match to the intentions of LEED. CO<sub>2</sub> is a low-GWP refrigerant and an excellent choice when it comes to reducing greenhouse gas emissions. At the same time, CO<sub>2</sub> provides high performance and exceptional properties for heat reclaim," says Gabriele De Bona, Key Account Manager, Danfoss Italy.

### Why go for Trans-critical Refrigeration using Ejector Technology?

The Iper hypermarket is one of the first stores that implement the new Ejector technology in the trans-critical refrigeration

system. Convinced by the results of numerous experiments Ejectors in recent years, Arneg decided to go for the new technology in order to enhance the energy efficiency of the hypermarket.

"Electricity for refrigeration makes up 50% of the total energy consumption of the hypermarket, and our customer Iper has an ambition to cut down this consumption year by year as part of their sustainability program. Another ambition of the visionary retailer is to switch to natural refrigerants to cut the carbon footprint. In order to fulfil these goals, we proposed a trans-critical CO<sub>2</sub> solution. It is a large installation with several hundred cabinets and cold rooms operating under ambient temperatures up to 38°C", says Enrico Zambotto, Technical Support Manager from Arneg, a world leader in the production of complete refrigeration solutions for the retail industry.

### Double-digit Energy Savings in Store

Since the Iper market in Milan was only commissioned in April 2016, it is still too early to provide figures for the actual energy savings of the hypermarket. However, the experience of Danfoss from similar installations with heat recovery, intelligent control and Ejector technology points to energy savings of up to 50%





compared to more conventional installations.

“With our Smart Store solutions, we can offer energy savings up to 50% depending on the size, location, technology and ambition of the customer. The savings are achieved on all installations from power pack to evaporators and by integrated control of light, HVAC and refrigeration. Our long-term ambition is to lead the development of innovative CO<sub>2</sub> solutions and enable net-zero stores or even stores that give more than they take in terms of energy”, says Gabriele De Bona from Danfoss.

#### The components of the large turnkey refrigeration system

The turnkey refrigeration solution supplied by Arneg contains the following main components:

- 147 MT cabinets 29 LT Cabinets 25 MT Cold Rooms 1 LT Cold room Installed MT refrigeration power: 290kW
- Installed LT refrigeration power LT: 38kW The two compressor

racks consist of:

- Compressors: Dorin: 3 x CD4000 + 2XCD 4000 + 2xCD 750X
- Condenser: LU VE EHVD 1X 6226 4 fans EC
- Rack controller: Danfoss AKPC 781
- Parallel compressors controller: Danfoss AKPC 781
- Ejector: Danfoss Ejector controller: Danfoss

Danfoss took part in system design, testing of packs and commissioning.

#### Ejector Technology used to Enhance Energy Efficiency

Ejector is a well-known technology and in close cooperation with SINTEF, Danfoss has devised new ways to use the Ejector technology in refrigeration application to increase the energy efficiency of parallel compression.

Today, the current experiments with this new technology return promising results proving the viability of trans-critical CO<sub>2</sub> system in warm climates. The Ejector is still in the prototype stage, but the initial trial set-ups in 15 supermarkets across Europe have shown that a simple ejector can significantly increase efficiency of the system. The energy saving potential with Ejectors compared to traditional HFC systems is about 10%. Furthermore, ejectors allow smaller and more compact compressor packs to be installed, reducing the first cost of the installation. ■



# Design & Performance of Solar Assisted Air Conditioning

The demand for indoor cooling is growing due to improvement of standard of living and increased comfort expectations, especially, in developing country like India. In the above context, the air conditioning and refrigeration requires 40% of the total electrical energy consumed in normal household systems. Hence, use of non-conventional systems, which save the electricity consumed and helps in combating environmental issues is getting a lot of attention. The utilization of renewable energy sources such as solar energy in air conditioning systems has become a way to address these problems...

## Problem in Conventional AC

The AC is a dominant energy consuming appliance and it consume approximately 40% of the total electricity consumption in comparison to lighting and other electrical appliances. Conventional cooling technologies which typically use an electrically driven compressor system that exhibits several clear disadvantages such as high energy consumption, high electricity peak loads demand. Because of high energy cost and the rise of environmental pollution, the utilization of low level renewable energy sources such as solar energy in refrigeration systems has become a way to address these problems.

## Solar Assisted AC System Selection of Working Fluids

The selection of the working fluid plays an important role in design of solar assisted air conditioning system. The size of high pressure generator unit, absorber unit, condenser and evaporator depends on the type of fluid selected.

### Ammonia and Water as Working Fluids in SAAC System

NH<sub>3</sub> water is commonly used as working fluid in SAAC system. As ammonia and water are volatility, the cycle requires a rectifier to strip away water that normally evaporates with NH<sub>3</sub>. Without a rectifier, the water would accumulate in the evaporator and affect the system performance. As ammonia toxic in nature causes health hazards and hence it is decided to replace ammonia and water with other working fluid.

### Lithium Bromide and Water as Working Fluids in SAAC System

The outstanding features of LiBr/water are non-volatility absorbent of LiBr (no need of rectifier) and extremely high heat



Today, one of the main goals of the commercial, residential, industrial building and architecture is to use the solar source for the air conditioning of buildings. Over the recent years many activities have started to develop new buildings and plant technologies oriented to energy saving by improving indoor comfort air conditioning and reducing environmental pollution emission.

Worldwide, the growing demand for conventional air-conditioning has caused a significant increase in demand for

electricity, resulting in a significant increase in peak power demand in summer, in many cases, the capacity limits of the network and causing the risk of blackouts due to increasing living standards, comfort expectations and global warming. In many countries, air-conditioning is one of the main consumers of electrical energy today. Solar air-conditioning is one of the technologies, which allow obtaining important energy savings compared to conventional air-conditioning plants by using the renewable solar source.

Table 1

Refrigerant	ODP	GWP	Boiling point	Melting point	Density	Flash point	Result
LiBr	0	0	1265°C	1552°C	3.46g/cm <sup>3</sup>	Non flammable	Not selected-Health hazard
NH <sub>3</sub>	0	0	-33.34°C	-77.3°C	7.30g/cm <sup>3</sup>	flammable	Not selected-Risk of crystallization
R22	0.05	1700	-40.91°C	-1785.42°C	3.66g/cm <sup>3</sup>	Non flammable	selected-
R410A	0.37	1100	-48.5°C	-155°C	3.0g/cm <sup>3</sup>	Non flammable	Not selected-Very High pressure

of vaporization of water (refrigerant). However, using water as a refrigerant limits the low temperature application to that above 0°C. As water is the refrigerant, the system must be operated under vacuum conditions. The driving temperature of system should be more because in this case water is a refrigerant and to vaporize water the temperature should be more than 100°C. As the absorber temperature increasing, the ability of the LiBr to absorb the refrigerant is reduced. Hence, the COP is decreased. It also presents risk of crystallization on concentrations over 68% and cannot work at refrigeration conditions.

### New Fluids for SAAC System

Even if the most common working fluids used are LiBr/Water and Water/NH<sub>3</sub>. Although LiBr/water and water/NH<sub>3</sub> have been widely used for many years and their properties are well known, much extensive research has been carried out to investigate new working fluids. Fluorocarbon refrigerant based working fluids have been studied. R22 and R21 have been widely suggested because of their favourable solubility with number of organic solvents. The two solvents, which have stood out are Diethyl Ether of Tetra ethylene Glycol (DMETEG) and Diethyl Form Amide (DMF).

### R410A and DMF

Boiling point of this fluid is -52°C, higher COP can be obtained. R410A is widely used in the present conventional air conditioning system, but operating

pressure is 50% higher than R22. The system requires the components capable of working at higher pressure and hence not preferred for this SAAC.

### R22 and DMF

R22 is often referred to by names such as Freon, hydro chlorofluoro carbon [HCFC] or Freon-22 or Di fluoro-chloromethane.

From the Table 1 the ODP and GWP of the selected refrigerant (R22) are better when compared to the conventionally used refrigerant R410A. Though R410A is theoretically superior to R22, practically the components designed for SAAC cannot handle the high pressure of the R410A refrigerant. After this detailed study on the properties of various refrigerants, the refrigerant R22 is the best suited for the proposed SAAC model.

### Refrigerants & Absorbents Volume

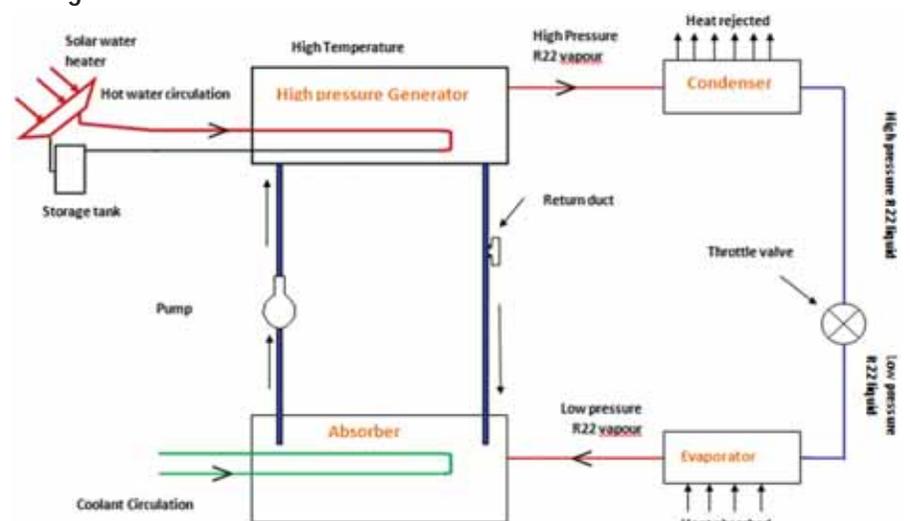


Figure 1: Block diagram of Solar Assisted Air Conditioning System

The volume calculation based on the formula:

$$\text{Volume} = \text{mass} / \text{density} \quad (1)$$

#### 1. Volume of R22 required

For 1 kg of R22

$$\text{Mass (m)} = 1\text{kg}$$

$$\text{Density of R22} = 3.66 \text{ kg/m}^3$$

From the eq. 1, we know that, density( $\rho$ ) = mass(m)/ volume(v)

$$\text{Volume} = \text{mass} / \text{density} = 1 / 3.66 = 0.273 \text{ m}^3$$

#### 2. Volume of R22 required

Mass (m) = 1kg

$$\text{Density of DMF} = 931 \text{ kg/m}^3$$

From the eq. 1, we know that, density( $\rho$ ) = mass(m)/ volume(v)

$$\text{Volume} = 1 / 931 = 0.00107 \text{ m}^3$$

$$\text{Total Volume required for working fluid} = 0.273 + 0.00107 = 0.2741 \text{ m}^3 = 0.28 \text{ m}^3$$

Therefore, from the above calculation we observe that,

$$\text{Total Volume required for working fluid} = 0.28 \text{ m}^3.$$

## Solar Assisted AC System

SAAC system commonly uses vapour absorption techniques. This systems use solar heat rather than electricity to produce refrigeration effect. In this, solar energy is used for heating of water which is stored in a tank and later it is supplied to generator unit. Solar absorption system is quite similar to vapour compression (conventional air conditioning) system because except compressor unit all the units are same and working principle of those units are also similar.

The working principle and different components of SAAC system are discussed in this context. Block diagram of Solar Assisted Air Conditioning System is shown in figure 1. The working fluid is pumped from the absorber to the generator through the pump. In generator unit, the solution gets heated up by the hot water circulation from solar water heater. Since the temperature is high in generator unit, refrigerant is vaporized with high pressure. Refrigerant changes its state to gaseous form whereas absorbent remains in liquid form because absorbent has high boiling point. The absorbent which is in liquid form returns to absorber unit with the help of throttle valve. The high pressure and temperature refrigerant vapour from generator is passed to condenser through copper tube. In condenser, as vapour boiling point is above to that of surrounding temperature, it loses the latent heat and becomes high pressure liquid. The high pressure liquid refrigerant is now passed to expansion valve. The expansion valve reduces the pressure. This low pressure refrigerant is passed to the evaporator. In evaporator as the pressure is low, the boiling point of the refrigerant is less than the surrounding temperature. Hence it absorbs the latent heat from the immediate surrounding and vaporization gives the cooling effect. When heat is absorbed from surrounding, the liquid refrigerant changes to gaseous form and then gas form moves to absorber with low pressure. In absorber, unit refrigerant is mixed with absorbent and this solution is cooled by supplying cold water through cooling coils

## Design of High Pressure Generator

Depending on the volume required for working fluid the length, width and height of the tank is selected. The volume of working fluid calculated is:

$$V=0.288 \text{ m}^3$$

In this project, a pyramid shape tank is considered for designed.

Volume of base square tank

$$\text{Length}=0.6\text{m}$$

$$\text{Height}=0.6\text{m}$$

$$\text{Width}=0.6\text{m}$$

$$\text{Volume of square tank}=\text{L} \times \text{H} \times \text{W}$$

$$V= \text{L}^3$$

$$V=0.216 \text{ m}^3$$

Volume of pyramid tank

$$\text{Length}=0.6\text{m}$$

$$\text{Height}=0.6\text{m}$$

$$\text{Volume of pyramid tank}=\text{L}^2 \times \text{h}^3$$

$$V=0.072 \text{ m}^3$$

Verifying the total volume of the working fluid:

Total volume=volume of square + volume of pyramid

$$V=0.288 \text{ m}^3$$

Tank is fabricated using stainless steel with thickness 2mm as it has to withstand the pressure of 60-80psi.

## Design of Absorber

The Absorber tank is also designed on the basis of the volume required for working fluids. A cylindrical shape tank is fabricated, made up of stainless steel with thickness 2mm. A copper coil is provided for cold water circulation.

The volume of working fluid calculated is:

$$V=0.288 \text{ m}^3$$

$$\text{Volume of cylinder}=\pi \times r^2 \times h$$

Where, r = radius of cylinder and h = height of cylinder

$$\text{Radius} = 0.3\text{m}$$

$$\text{Height} = 1\text{m}$$

$$\text{Volume of cylinder}=\pi \times 0.3^2 \times 1$$

$$V=0.282 \text{ m}^3$$

A standard design for condenser, evaporator, tubes, fins and throttle valve are retained for the SAAC system.

## Advantages

- The proposed model has less power consumption as compared to the conventional AC. Since the SAAC uses



solar energy for its operation, the system uses less power from the utility grid. Thus, the conversion efficiency is high in the proposed system.

- No moving parts in SAAC system, hence the operating is essentially quite and subjected to a very little wear, so that the maintenance cost is low.
- The reduction in power consumption is achieved by SAAC system .
- Though the COP of the proposed model is less when compared the conventional AC, this model uses renewable energy source instead of the energy generated from non-renewable source of energy. This clean energy used in the SAAC helps in reducing the global carbon footprint.
- This system also reduces the peak load demand on the utility grid and hence reduces the peak load demand on the grid.

## Conclusion

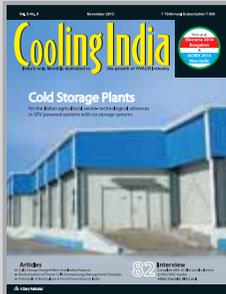
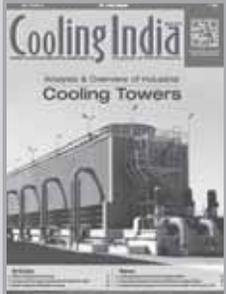
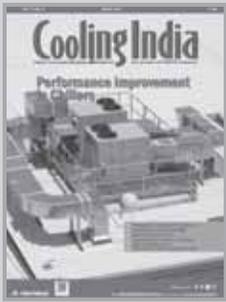
Solar cooling is possible and reliable. Exploitation of solar energy for cooling is an efficient way to use the renewable energy source to meet air conditioning needs. Solar assisted air conditioning system is an innovative, promising alternative to reduce the electrical energy consumption generated by excessive use of conventional air conditioning compressor, especially during summer months. The attractiveness of utilizing solar energy is mainly due to the demand and supply of energy coincides. In fact, cooling is required when the solar radiation is abundantly available. Furthermore, great majority of solar techniques employs harmless working fluids. ■

**Dr. M. S. Shashikala**  
Professor,  
Energy Systems and Management,  
Dept. of EEE, SJCE, Mysuru



**Nagesh N**  
Student of M.Tech in  
Energy Systems and Management,  
Dept. of EEE, SJCE, Mysuru





The Subscription In-charge  
**Cooling India**  
 Chary Publications Pvt. Ltd.  
 906, The Corporate Park, Plot No. 14 & 15,  
 Sector - 18, Vashi, Navi Mumbai - 400 703  
 Email: sub@charypublications.in

If you are already a Subscriber,  
 Enter your  
 Subscription/Order no. \_\_\_\_\_

**SUBSCRIBE / RENEW  
 ONLINE**  
**Log on to –  
 www.coolingindia.in**

Yes, I would like to subscribe **Cooling India** for \_\_\_\_\_ years  
 at ₹ \_\_\_\_\_ (US\$ \_\_\_\_\_ overseas scbscribers)

**Payment details:**

Cheque / DD No. \_\_\_\_\_ dated \_\_\_\_\_  
 drawn on bank \_\_\_\_\_ branch \_\_\_\_\_

In favour of **CHARY PUBLICATIONS PVT. LTD.**

**Bank details for Wire Transfer**

Bank Name: **Bank of India** Branch: **Chembur, Mumbai - 400 071**

IFSC Code: **BKID 000009** Bank a/c number: **000920110000322** SWIFT CODE : **BKIDINBBCHM**

Name: \_\_\_\_\_

Company: \_\_\_\_\_ Designation: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ Pin: \_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_

Signature: \_\_\_\_\_

No. of Years	Amount	US \$	Tick ✓
<input type="checkbox"/> 1 (12 Issues)	1000	300	
<input type="checkbox"/> 2 (24 Issues)	1750	560	
<input type="checkbox"/> 3 (36 Issues)	2500	720	
<input type="checkbox"/> 5 (60 Issues)	4000	1000	

SUBSCRIBE



The Subscription In-charge  
**Medical Equipment & Automation**  
 Chary Publications Pvt. Ltd.  
 906, The Corporate Park, Plot No. 14 & 15,  
 Sector - 18, Vashi, Navi Mumbai - 400 703  
 Email: sub@charypublications.in

If you are already a Subscriber,  
 Enter your  
 Subscription/Order no. \_\_\_\_\_

Yes, I would like to subscribe **Medical Equipment & Automation** for \_\_\_\_\_ years  
 at ₹ \_\_\_\_\_ (US\$ \_\_\_\_\_ overseas scbscribers)

**Payment details:**

Cheque / DD No. \_\_\_\_\_ dated \_\_\_\_\_  
 drawn on bank \_\_\_\_\_ branch \_\_\_\_\_

In favour of **CHARY PUBLICATIONS PVT. LTD.**

**Bank details for Wire Transfer**

Bank Name: **Bank of India** Branch: **Chembur, Mumbai - 400 071**

IFSC Code: **BKID 000009** Bank a/c number: **000920110000322** SWIFT CODE : **BKIDINBBCHM**

Name: \_\_\_\_\_

Company: \_\_\_\_\_ Designation: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ Pin: \_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_

Signature: \_\_\_\_\_

No. of Years	Amount	US \$	Tick ✓
<input type="checkbox"/> 1 (6 Issues)	750	150	
<input type="checkbox"/> 2 (12 Issues)	1350	275	
<input type="checkbox"/> 3 (18 Issues)	2000	400	
<input type="checkbox"/> 5 (30 Issues)	3000	600	

SUBSCRIBE

# Heating, Ventilation, Air Conditioning & Refrigeration all core subjects related to environment & life

## Who can Subscribe?

### Industries:

- Absorbers
- Air Handling Units
- Boilers
- Chemicals
- Cold Stores
- Condensers
- Contractors
- Cooling Towers & Parts
- Ducts & Accessories
- Environmental
- Exhaust
- Fans
- Freezers
- Insulated Doors
- Pumps
- Refrigerators
- Thermal Storage Systems
- Valves
- Water Treatment
- Air Distribution
- Air Conditioners
- Building Automation
- Chillers
- Compressors
- Condensing Unit
- Controls
- Dampers & Parts
- Energy Saving
- Evaporators
- Fan-Coil Units
- Fire
- Instruments
- Insulation
- Refrigerants
- Solar
- Transport Refrigeration
- Water Coolers

... and related accessories.

## Professional Readers - CI

### Industries:

- Pharmaceuticals
- Biotech
- Process Industries
- Printing & Packaging
- Hospitals
- Cold Chains
- Food Processing
- Storages
- Entertainment
- Other Allied Industries
- Institutions

### Professionals:

- Top industrialists
- Manufacturers
- Consultants
- Architects
- Interior Designers
- Process Engineers
- Importers & Exporters
- Traders

Several Others...

# Would you like to know all about the medical equipments and what they do to us...

## Who can Subscribe?

### Industries:

- Pharmaceutical Machineries
- Medical implements & implants
- Oxygen setup & Dental equipments
- Hearing aids
- Pathological equipments
- Ophthalmologic equipments, devices & solutions
- Ambulance & Air sterilization
- Surgical equipments
- Electro medical equipments / Medical technology
- Rescue & Emergency equipments
- Medical Diagnostic & hospital supplies
- Physiotherapy / Orthopedic equipments & technology
- Communication & IT
- Medical furnitures & equipments & Cardiology equipments
- Radiology & Imaging equipment technology
- Medical disposable disinfection
- Hospital utilities & supplies
- Neonatal / Pediatric equipments & patient monitoring equipments
- Electromechanical linear actuator system for hospital, beds, O.T tables, O.T lights
- Dental chairs, Blood donor coach
- Power backup systems (UPS, Inverters & SMF batteries)
- Rehabilitation aids

... and related accessories.

## Professional Readers - MEA

### Industries:

- Medical and Surgical Equipment & Supplies
- Pharmaceutical & Bulk Drugs
- Disposable Supplies
- Diagnostics & Laboratory Instruments
- Hospital Furnishing & Related computer software
- Rehab. & Therapeutic aids
- Ophthalmic Instruments
- Oral & Dental Equipment
- Optical Equipment and supplies
- Institutions & Other allied industries

### Professionals:

- Medical Professional / Doctors
- Surgeons
- Paramedical Professionals
- Hospital Administrators
- Pathologists
- Radiologists
- Physiotherapists

Several Others...

# Demand Driven Distribution: Great for More than Leaks

The Demand Driven Distribution concept has helped drive down energy consumption and maintenance costs for the Dunea water company in Holland...

Location: Dunea, Holland

Company: Grundfos Netherlands

The Demand Driven Distribution (DDD) concept has wide-ranging implications for pumping systems. In The Netherlands, for example, it has helped drive down energy consumption and maintenance costs for the Dunea water company.

## Demand Driven Distribution – Always the Best Option

Marcel van Veen from Grundfos Netherlands has no doubt, “I find that the Demand Driven Distribution concept is absolutely the way to build a pumping system, especially, where the capacity ranges are very wide. This is true even when water leakage is not a major issue, which it isn’t really in The Netherlands – for a DDD system drives down energy consumption and maintenance, which will always be important.” The DDD principles were brought into action when the Dunea water company needed a new booster station – “Booster Hillegom”. Dunea is one of the ten drinking water companies in Holland. The company’s main source of water is surface water, but they also buy drinking water from Waternet. This is where the new booster system comes in, for the water intake from Waternet was to be carried out via Booster Hillegom. The capacity range required by the station is quite unusual: Normal operation consists of between 80 – 300 m<sup>3</sup>/h, heads from 22 mwc up to 36 mwc. The average capacity requirement for the station is 140 m<sup>3</sup>/h at 23 mwc; in case of emergencies the booster station should be able to supply 700 m<sup>3</sup>/h at 36 mwc. When Dunea asked Grundfos to suggest a solution for this project, they had no specific pumps in mind – they simply described the application and its capacity and head ranges and presented Grundfos with the challenge of coming up with the best possible solution. Dunea invited five pump suppliers to meet the challenge stating that the three companies to offer the proposals would receive an official inquiry in January 2010.

## Energy-Efficient, Low-Maintenance Solution

Grundfos proposed a three-pump system consisting of NB 100-315/334 with a rated motor power of 30 kW each. All pumps were to be equipped with VFD and controlled by means of MPC controls. That solution was not the only one being considered; the Grundfos team also looked into the possibility of installing a four-pump NB system or a Hydro MPC-E solution. Overall, four different possibilities were considered by the Grundfos team: 3 x NB 125-315/336 with 37 kW 3 x NB 100-315/334 with 30 kW 4 x NB 80-160/177 with 30 kW Hydro MPC-E 5 CRNE 150-2 with 22 kW. Eventually, the team’s analyses showed that the three-pump NB system was the best alternative in terms of both energy consumption and maintenance requirements.

## Careful Studies of All Alternatives

For a while, the 4 x NB 80 alternative looked promising: it showed the highest capacities overall. But then an extra pump

would be required and the pit would need to be larger. Furthermore, an extra VFD and extra maintenance would be needed. This would have a negative effect on the total cost of ownership for the client. Therefore, Grundfos decided to go ahead with a three-pump solution and see if that could achieve what the client wanted.

The 3 x NB 125-315/336 covered the complete range, even the emergency point, without going above 50 Hz. However, efficiency could be better, so the Grundfos team came up with the option of using 3 x NB 100-315/334 or a four-pump solution, both 30 kW. These solutions would ensure better efficiency at approximately the same power consumption. However, a three-pump solution requires a smaller pit and, obviously, lower expenditure, which prompted Grundfos to make this final recommendation. As an added bonus, the NB pumps are easy to maintain and allow for a better piping layout in the pit than an in-line system does.

When they called for design ideas, Dunea had certain plans in mind, but did not show them to potential suppliers – they did not want to restrict creativity in the solutions offered. It later transpired they their own initial design planned to have suction and pressure headers on the left and right side and in between multi-stage pumps. After talks with Grundfos, however, Dunea were convinced that NB pumps were the most efficient choice for then – and that the headers could be positioned above each other, close by the wall. The system allows for a more open pump configuration, making access much easier for staff.

Dunea were favourably impressed by the design proposal and were intrigued to learn that Grundfos could offer to supply the complete booster station, including the concrete pit and electrical work. Tentative plans were drawn up by a team comprising members from Dunea, Grundfos, a constructor (Visser & Smit Hanab), and an electrical engineering group (Cegelec).

## Final Design Matched Initial Grundfos Suggestion

Eventually, the design was finalised and building on the new booster system began in June of 2010. The final design incorporated the three-pump NB system with CUE VFD’s and MPC controls exactly as they had been presented in the original plans from November 2009. The system supplied consists of:

Pumps: 3 x NB 100-315/334, 3 x 400 V - 50 Hz, 30 kW EFF1 with insulated bearing NDE, bronze impeller Pump control: 1 x Control MPC-E 3 - 30 Frequency converters:

3 x CUE 30 kW

The system – and overall building project – was completed in February 2011, and the system is now working to achieve the ambitious goals set by Dunea. ■

*Client: “fits our policies on responsible energy consumption”*

# Wet & Dry Air Receivers in Compressor House

The industry thinks daily that they are losing energy in their compressor KW / CFM. They can concentrate on the compressed air treatment at the compressor air intake pre-filter to the existing filter and at the compressor delivery air. Let us revisit to the basics of compressor & air treatment and suit this condition monitored approach towards energy saving, routinely...

The industry can concentrate on the compressed air treatment now after the compressor in the compressor house and achieve smooth, steady non-pulsating cool dry air as feed to the pneumatic actuated loads; the by-product is energy savings. The industry has adopted the compressor installation and the compressed air treatment workings in consultation with the compressor OEM, but they can now give a thought of improving compressed air parameters like pressure drops and temperature drops, before the CA header leaves the compressor house.

## Prevailing Condition in the Existing Compressor Room

Nine out of ten industries have compromised on the compressed air layout with only one receiver inside the compressor house. Some industry has gone for only wet type air receiver and some other industry has gone for only dry air receiver. This resulted in the frequent but partial choking of the water separator or filters which goes unnoticed by the user. In fact, the user assumes the frequent load and unloads are due to that process load demands. The user is not aware till date that the partly choked

water separator is also a factor to create artificial pressure drop, thus, inducing cyclic fast compressed air pressure fluctuations from the compressor.

The compressed air generation cost goes up to 5 % due to poor performance of water separators, excess pressure drops across the filters, added to this is the artificial pressure cyclic load unload fluctuations. Allow each of the compressed air treatment sub system to stand alone, breathe well and with a buffer in between in them as described in Fig 1 thro the two receivers namely the 'Wet' receiver and the 'Dry' receiver.

## Why Do We Need Two Receivers After Compressor & Dryer?

### Benefits of Wet Control Air Receiver

The wet receiver to be directly connected to the compressor post air cooler with no water separator / filter in between.

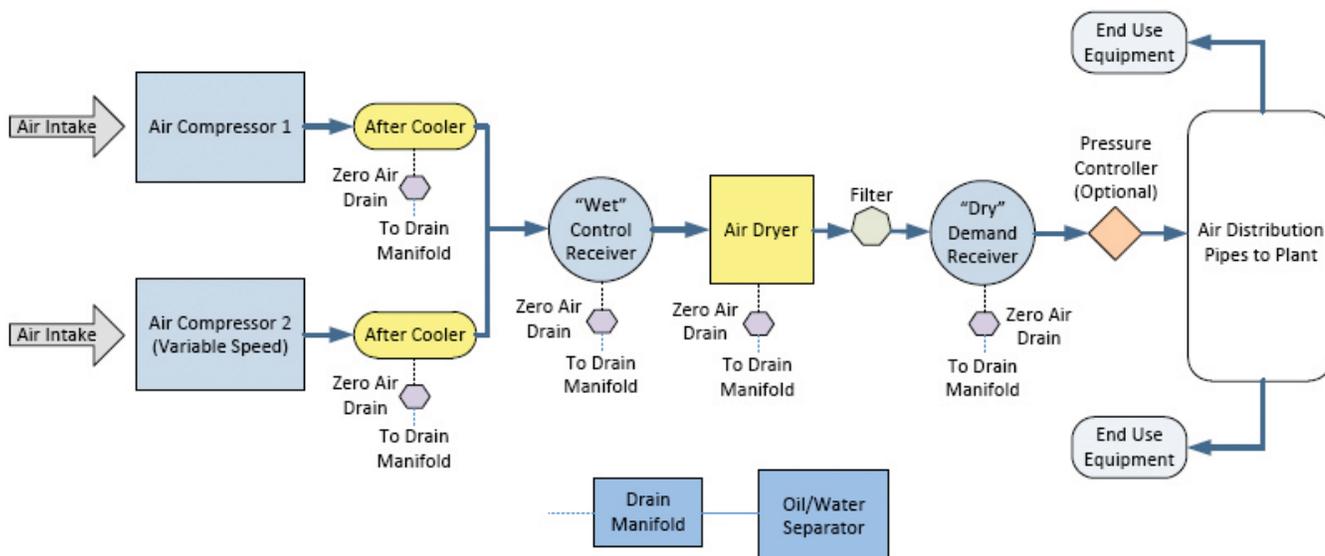


Figure 1: Compressor & compressed air treatment sub systems to stand alone with buffer as two air receivers

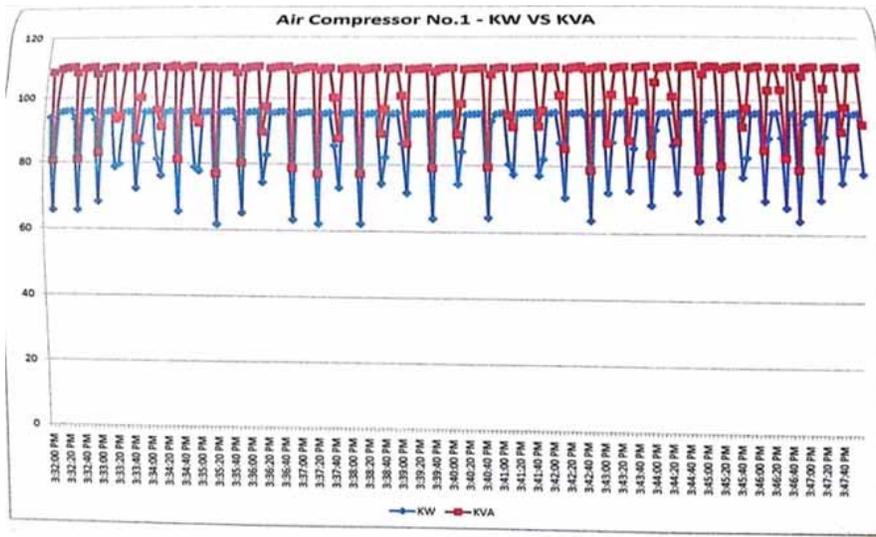


Figure 2: Chart shows compressor hunts every one minute due to load & unload due to artificial pressure drops inside

- Damping pulsations caused by the load & unload pressures in the compressor KW zigzag chart as described in the Fig 2 can be avoided.
- Providing a location for free water to settle at bottom of receiver so as to be removed by auto drain valve.
- Reducing load/unload or start or stop cycle frequencies to help compressors run more efficiently.
- Slowing system pressure changes to allow better compressor control and more stable system and header pressures.
- Performing the above, this receiver smoothens the harsh compressor loading pattern, improving the compressor systems' health and avoiding break downs inside the hood.
- This wet receiver acts as buffer to post

air cooler, aiding its slow & steady heat transfer efficiently.

- Once the temperature is reduced near to the ambient at wet receiver, the downstream dryer will not de-rate more.

**Benefits of Dry Demand Air Receiver**

- The dry receiver will act as a demand buffer between the load demands and compressor delivery pressure.
- The load unload pressure control sensor to be fixed in the dry receiver as this will take directly the user demand.
- The dryer functioning will improve as the dry receiver acts as a buffer to flatten the process demand spikes.
- To provide general pressure stability in systems with undersized / Tee connections etc in distribution piping

- The refrigerated dryer improves allowing the steady drying with minimum pressure drop across the dryer.
- Thus, ensures the safety working of dryer even catering to the highly fluctuating downstream loads.

**What Is Need For Relocation Of Water Separator After The Wet Air Receiver?**

The Figure 3 explains that WS – the water Separator + AO filter works better after the wet receiver and not in between the compressor and receiver. The compressor OEM gives the same in the package of compressor, post air cooler, water separator, and the integral refrigerated dryer. This all in one package sometimes becomes inefficient gradually in the long run, due to the poor workings of compressor downstream sub systems.

So, it is better to physically isolate the post air cooler from the compressor, shift the water separator from entry point of wet receiver to the exit of receiver and before the refrigerated dryer for healthy sub systems workings. The discharge air from compressor, immediately after the compression, gets cooled instantly at the post air cooler. Here the wet receiver after the post cooler will act as a buffer and allow the discharge to stabilize first before entering water separator. Presently, water separator at current location just outside post air cooler or after the hood, is prone to choke often inducing artificial pressure drops. The same is explained in the case

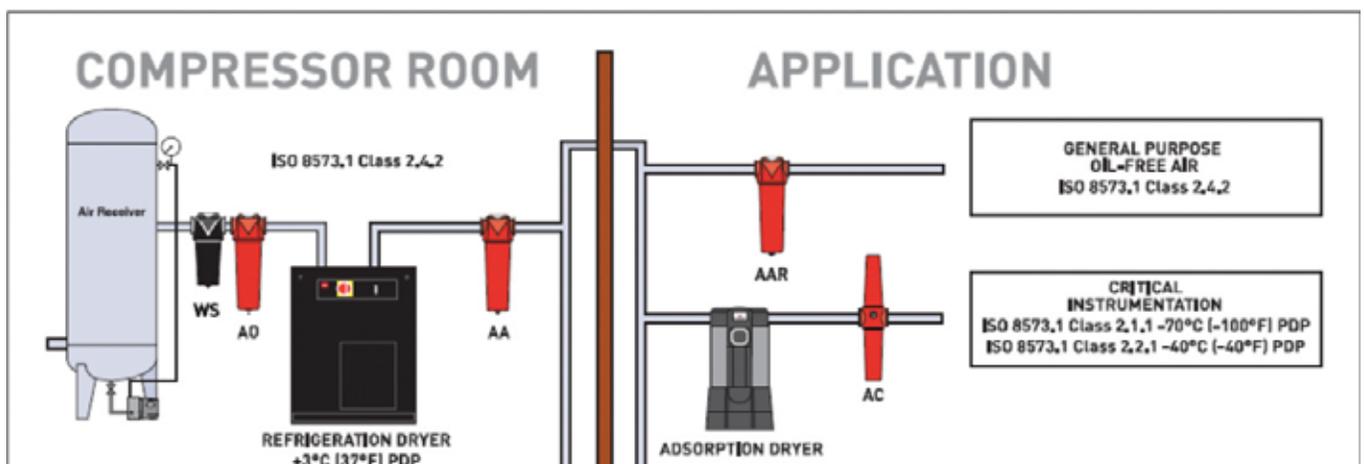


Figure 3: Location of WS after the wet receiver & before Dryer - Reference Parker compressed air treatment manual

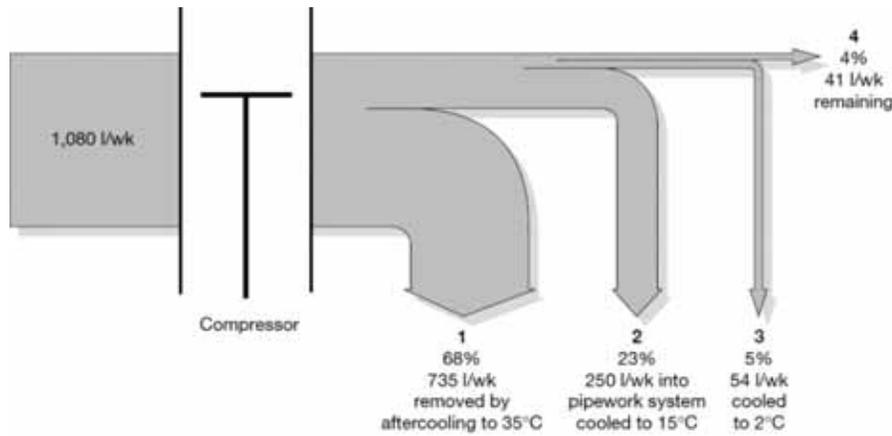


Figure 4: Ref – Good Practice Guide 216 – Energy saving in Drying of compressed Air – 68 % water removal in Air cooler

study in an Indian Textile Group Mill group as elaborated in the hyperlink, <http://knowledgeplatform.in/portfolio/textile/>

Workshop on Knowledge Exchange Platform reference the site [www.Knowledgeplatform.in](http://www.Knowledgeplatform.in) – Energy Efficiency Best Practices by Raymonds, India in the year 2015. This company achieved a lot of savings in energy due to the uniform loading of six compressors because of this repositioning of microfilters from the location in between the compressor & receiver to the location of receiver outlet as common filter bank. Here too, instead of putting multiple small filters in each sub header say six in number, to put duplex & sized filters as one main and other as standby suiting to more-than-rated cfm of compressors. One big sized filter instead of multiple small filters gives minimum pressure drop and the operating efficiency is better here. The oversized filter or fridge dryer at the time of installation of compressors leads to minimum pressure drops in compressor house.

### Is The Post Air Cooler Working Ok Inside The Compressor Hood?

The post air cooler functioning is very much important for the health and safety of compressor, as this reduces the load and pressure drop across the refrigerated dryer. In a 160 KW 1000 cfm rated screw compressor, around 1000 liters of water is sucked inside over 48 hours running weekly. Out of which post air cooler

removes 68 % of water say 735 liters at 35 degree C. The % values may vary from place to place but the % removal of say around 70 % removal is done by the Air cooler. But inside a compressor hood, the HX poorly transfers the heat as it sucks only the hotter air from the compressor sub systems inside the hood.

The compressor OEM & user to discuss on this aspect to decide about laterally shifting the heat exchanger position say by 200 to 300 mm away from the compressor hood and connect to the other subsystems by extended piping. By this, we see to it that we provide abundant ambient air supply surrounding the compressor hood to effect better heat transfer and heat exchange at the air cooler.

Water removal each week from 500 l/ sec of 7 bar(g) air. Since ambient air contains 12.5 g of water vapour for each m3 of free saturated air at 15°C, a 500 l/s (1,000 cfm) compressor will inhale 1,080 litres of water vapour as mentioned in Figure 4 per 48-hour week. This quantity is still present in the air at terminal pressure and discharge temperature. The vapour will begin to condense as the air temperature is cooled to, or below, that of the pipe work downstream of the compressor.

### What Compressor Oem Needs To Guide User In Installation?

Practically, we understand that the compressor OEM has to ship the compressor-in-hood as package. But the

OEM can instruct his site team or a knowledgeable buyer & user to partially knock down the sub systems and protrude the air intake filter, keep out the post air cooler HX, remotely shift the pressure control sensor to the dry receiver so that the compressor obeys to the process pressure needs through pressure commands. The compressor can suck cool dry outer air in the compressor house instead of starving on hot harsh air inside.

1. The post air cooler inhales and exhales better now outside the hood instead of poor heat transfer inside.
2. The remote pressure sensing gives steady process air pressure input to the compressor load & unload logic and not the pulsating pressures as measured now, since it is now inside the compressor hood before the after cooler.
3. In fact, stand alone post air cooler will be more efficient than an inbuilt post air cooler inside the dryer. This leads to ease of maintenance, monitor routinely the pressure drop & the temperature drop across the air cooler. Efficiency is visualized with higher the temperature drop and lower the pressure drop across the post air cooler.

### Conclusion

The industry thinks daily that they are losing energy in their compressor KW / CFM. They can concentrate on the compressed air treatment at the compressor air intake pre- filter to the existing filter, and at the compressor delivery air. Let us revisit to the basics of compressor & air treatment and suit this condition monitored approach towards energy saving, routinely. Give attention to the OEM guidelines to each of the compressor sub systems and to the compressed air treatment and ask them to update you, to enhance energy efficiency in your existing system, bought few years back. ■

**Ashok Sethuraman**  
BEE Accredited Energy Auditor,  
Coimbatore



# Cold Storage Warehouse for Onion at Nashik

The cold storage is being set up on CSR model by CONCOR at a cost of Rs. 5 crores. The cold storage will be maintained by M/s Lasalgaon Vibhag Sahakari Kharedi Vikri Sangh Ltd. Railways is a major transporter for onion and plays a key role in timely transportation of onion to various consumer market from producer states...

**S**uresh Prabhu, Minister of Railways and Devendra Fadnavis, Chief Minister of Maharashtra laid the foundation stone for the cold storage recently at Lasalgaon near Nashik in Maharashtra. Indian Railways' PSU CONCOR (Container Corporation of India Ltd) is developing a cold store at Lasalgaon near Nashik for storage of onions and other perishable produce. This cold storage will have a total capacity of 2500 MT out of which 1500 MT will be exclusively utilised for onion storage and remaining for other perishable commodities such as fruits & vegetables like onion, pomegranate, grapes, banana, tomato, citrus. Indian Railways has now steered into the areas of providing storage facility to the farmers and the cold storage at Lasalgaon will be a boon to the farmers of not only Nashik & Lasalgaon, but also of nearby areas of Jalgaon, Manmad, Dhule etc. The cold storage is being set up on CSR model by CONCOR at a cost of Rs 5 crore. The cold storage will be maintained by M/s Lasalgaon Vibhag Sahakari Kharedi Vikri Sangh Ltd. Railways is a major transporter for onion and plays a key role in timely transportation of onion to various consumer market from producer states. To reduce the spoilages, Indian Railways allots the rakes or wagons on priority basis wherever possible for carriage of onion.

The climatic conditions largely affect the onion growing areas, thereby, leading to fluctuations in farm produce. The bumper production needs to be properly stored to stabilise supply during scarcity. The conventional methods lead to losses exceeding 35% depending on the weather conditions. The losses are, thus, national loss as the input cost increases. The cold storage will help in increasing the post storage life of onions & they can be even sent to remote locations. The labour cost is reduced to a great extent as there is no need for turning around the onions as

required in conventional storage. There is direct saving of material cost and farming cost due to saving in weight and spoilage losses. Maharashtra being 33% contributor to the national onion production needs quality storage options.

## Perishable Cargo Centres (PCCs) Set up by CONCOR

### Perishable Cargo Centre (PCC) at Ghazipur, UP

CONCOR has set up Perishable Cargo Centre (PCC) at Ghazipur Ghat Railway station in Ghazipur, Uttar Pradesh for transportation and storage of fruits and vegetables under CONCOR CSR initiatives. The facility has been constructed on Railway land leased out to CONCOR on 2500 sqms area having facilities for ripening and storage of fruits and vegetables. The facility is catering to the storage needs of farmers of the adjoining areas, thereby, saving vegetables and agriculture produce from getting perished.

### Perishable Cargo Centre (PCC) at Rajatalab, Varanasi, UP

Similar facility is also being constructed at Rajatalab Varanasi, Uttar Pradesh for storage of fruits and vegetables of local farmers of adjoining areas. Its foundation stone was laid by Prime Minister. It is likely to be commissioned by November end.

### Centre for Perishable cargo Azadpur, Delhi

CONCOR has set up a Centre for Perishable Cargo (CPC) at Azadpur, Delhi. The facility is equipped with state-of-the-art ripening chambers for banana with auto control for temperature relative humidity and ethylene concentration. Facility is also equipped for pre-ripening processing of banana and other fruits like washing, de-sapping, sorting, grading, and packing etc. It has got cold storage facilities for storage of fruits and vegetables.

### Perishable Cargo Centre (PCC) at Singur, Hooghly

CONCOR has set up Perishable Cargo Centre (PCC) at Singur, Hooghly district, of West Bengal. Singur Perishable Cargo Centre has been built using the state-of-the-Art CIPC technology to provide higher value addition to grower of potatoes. This has helped storage of potatoes at optimal temperature, thereby increasing its value.

### Up-gradation of Mango Pack House at Sindhudurg

CONCOR has taken up the work of Up- gradation of Mango Pack House at Deogad Tehsil, Sindhudurg, Maharashtra in order to provide better facilities to mango grower farmers exporting mangoes.



# Indian Food Processing Industry: A Sunrise Sector

The Indian food industry is poised for huge growth, increasing its contribution to world food trade every year. In India, the food sector has emerged as a high-growth and high-profit sector due to its immense potential for value addition, particularly, within the food processing industry.



Accounting for about 32 per cent of the country's total food market, the Government of India has been instrumental in the growth and development of the food processing industry. The government through the Ministry of Food Processing Industries (MoFPI) is making all efforts to encourage investments in the business. It has approved proposals for joint ventures (JV), foreign collaborations, industrial licenses, and 100 per cent export oriented units.

## Market Size

The Indian food and grocery market is the world's sixth largest, with retail contributing 70 per cent of the sales. The Indian food processing industry accounts for 32 per cent of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth. It contributes around 8.80 and 8.39 per cent of Gross Value Added (GVA) in manufacturing and agriculture respectively, 13 per cent of India's exports and six per cent of total industrial investment. The Indian gourmet food market is currently valued at USD 1.3 billion and is growing at a Compound Annual Growth Rate (CAGR) of 20 per cent. India's organic food market is expected to increase by three times by 2020.

The online food ordering business in India is at its nascent stage, but witnessing exponential growth. With online food delivery players like FoodPanda, Zomato, TinyOwl and Swiggy building scale through partnerships, the organised food business has a huge potential and a promising future. The online food delivery industry grew at 150 per cent year-on-year with an estimated

Gross Merchandise Value (GMV) of USD 300 million in 2016.

## Investments

According to the data provided by the Department of Industrial Policies and Promotion (DIPP), the food processing sector in India has received around USD 7.54 billion worth of Foreign Direct Investment (FDI) during the period April 2000-March 2017. The Confederation of Indian Industry (CII) estimates that the food processing sectors have the potential to attract as much as USD 33 billion of investment over the next 10 years and also to generate employment of nine million person-days.

**Some of the major investments in this sector in the recent past are:**

- Global e-commerce giant, Amazon is planning to enter the Indian food retailing sector by investing USD 515 million in the next five years, as per Harsimrat Kaur Badal, Minister of Food Processing Industries, and Government of India.
- Parle Agro Pvt Ltd is launching Frooti Fizz, a succession of the original Mango Frooti, which will be retailed across 1.2 million outlets in the country as it targets increasing its annual revenue from Rs 2800 crore (USD 0.42 billion) to Rs 5000 crore (USD 0.75 billion) by 2018.
- US-based food company Cargill Inc, aims to double its branded consumer business in India by 2020, by doubling its retail reach to about 800,000 outlets and increase market share to become national leader in the sunflower oil category which will help the company be among the top three leading brands in India.



- Mad Over Donuts (MoD), outlined plans of expanding its operations in India by opening nine new MOD stores by March 2017.
- Danone SA plans to focus on nutrition business in India, its fastest growing market in South Asia, by launching 10 new products in 2017,

and aiming to double its revenue in India by 2020.

- Uber Technologies Inc plans to launch UberEATS, its food delivery service to India, with investments made across multiple cities and regions.

### Government Initiatives

Some of the major initiatives taken by the Government of India to improve the food processing sector in India are as follows:

- The Government of India aims to boost growth in the food processing sector by leveraging reforms such as 100 per cent Foreign Direct investment (FDI) in marketing of food products and various incentives at central and state government level along with a strong focus on supply chain infrastructure.
- In Union Budget 2017-18, the Government of India has set up a dairy processing infra fund worth Rs 8,000 crore (USD 1.2 billion).
- The Government of India has relaxed foreign direct investment (FDI) norms for the sector, allowing up to 100 per cent FDI in food product e-commerce through automatic route.
- The Food Safety and Standards Authority of India (FSSAI) plans to invest around Rs 482 crore (USD 72.3 million) to strengthen the food testing infrastructure in India, by upgrading 59 existing food testing laboratories and setting up 62 new mobile testing labs across the country.
- The Indian Council for Fertilizer and Nutrient Research (ICFNR) will adopt international best practices for research in fertiliser sector, which will enable farmers to get good quality fertilisers at affordable rates and thereby, achieve food security for the common man.

The Ministry of Food Processing Industries announced a scheme for Human Resource Development (HRD) in the food processing sector. The HRD scheme is being implemented through State Governments under the National Mission on Food Processing. The scheme has the following four components:

- Creation of infrastructure facilities for degree/diploma courses in food processing sector
- Entrepreneurship Development Programme (EDP)
- Food Processing Training Centres (FPTC)
- Training at recognised institutions at State/National level

### Road Ahead

Going forward, the adoption of food safety and quality

assurance mechanisms such as Total Quality Management (TQM) including ISO 9000, ISO 22000, Hazard Analysis and Critical Control Points (HACCP), Good Manufacturing Practices (GMP) and Good Hygienic Practices (GHP) by the food processing industry offers several benefits. It would enable adherence to stringent quality and hygiene norms and thereby protect consumer health, prepare the industry to face global competition, enhance product acceptance by overseas buyers and keep the industry technologically abreast of international best practices.

### Exports of Processed Food & Related Products

- During FY11–16, India’s exports of processed food and related products (inclusive of animal products) grew at a CAGR of 11.74 per cent, reaching US\$ 16.2 billion.
- Main export destinations for food products have been the Middle East and Southeast Asia.
- In FY17\* India’s exports stood at USD 1.3 billion.

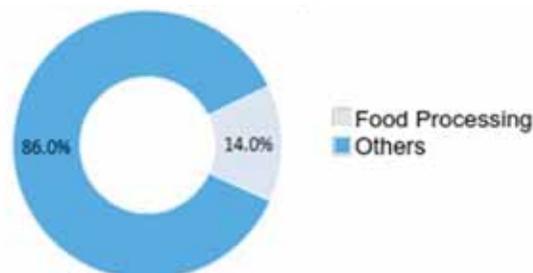


Source: Agricultural & Processed Food Products Export Development Authority (APEDA), DGCIS, TechSci Research. Notes: FY - Indian Financial Year (April-March FY 17\*. Data for April 2016

### Food Processing & its Segments

- The food processing industry is one of the largest industries in India and ranks fifth in terms of production, consumption and exports. As per the latest data available, food processing sector is expected to reach US\$ 258 billion in FY15.
- In FY16\* (till December 2015), food processing industry constituted 14 per cent to India’s GDP through manufacturing.

### Food Processing industry’s contribution to India’s GDP through manufacturing (FY16\*)



Source: Ministry of Food Processing Industries (MOFPI), TechSci Research Notes: \*- Till December 2015, As per latest data available

Source
IBEF

# DairyTech India: Taking Food Sector Forward

Variety of products and services heightened the industry's future scenario...

**S**eventh DairyTech with its parallel shows, 9th AgriTech India and India Foodex as well as 6th International Poultry & Livestock Expo and 4th MeatTech Asia, was inaugurated on 28th August 2017 by the Chief Guest Vajubhai Rudabhai Vala, Governor of Karnataka. Enhancing the show the Governor remarked on the raised awareness level about the availability of technological solutions and knowledge to take food sector forward in India.

This annual three day expo held at BIEC, Bangalore (India), concluded on 30th August 2017. Over the years, the series have gained huge popularity amid the leading international players of the sector and provide with the opportunity to promising players to make their mark in the industry. This year, more than 500 exhibitors displayed their products at the show receiving a footfall of over 35,000 trade visitors.

The inaugural ceremony saw the presence of several high-profile dignitaries. To add the essence of patriotism the ceremony was commenced with the National Anthem and a presentation of parade in honor of the Governor, welcoming him to the grand exposition. The Governor was immensely impressed by the technologically best displays of the pavilions while taking a tour during the exhibition. He said, "We need to address the challenges and make food and dairy industry competitive utilizing the modern techniques as well as application of business principles. Our technological knowledge will be able to produce more as well as improve the quality of the production."

## State's Growth Prospects

Karnataka has many advantages and offers ample opportunities for the growth of

food sector. The state is a leader in knowledge based, technology driven, industries like information technology, biotechnology, electronics, telecommunication, aerospace and other industries etc. The state is distinguished as the knowledge hub of Asia and the state also has the largest number of R & D Centers in India. Food Industry also requires support of several fields and cannot be limited to farm operation only. Post Harvest technology is required to reduce the wastage as well as improving the quality and delivering the food safely to the consumers. This involves handling of the produce, transportation, packaging, storage, cold chain management, labeling etc.

As dairy sector share a correlation because of the commonly linked inputs and outputs, it is essential to move towards holistic growth. It is important to establish efficient feeding methods and feeds, encourage commercialization and



DairyTech India offered an impressive show of products like dairy machinery and equipment manufacturer or exporters, dairy products manufacturer or exporter or traders.

mechanization of dairy farms, develop networks to endorse processed food and beverages based on milk, have well managed cold chain facilities to minimize wastage and organize the sector.

Always willing to contribute and promote the objectives of these initiatives by ensuring the all-round development of the Indian dairy industry, Media Today Group organized DairyTech India 2017 exhibition. This surely strengthened the bonding among various stakeholders of this segment. DairyTech India, offered an impressive show of products like dairy machinery and equipment manufacturer or exporters, dairy products manufacturer or exporter or traders, ghee making machines, mixer, feeders & grinders, packaging machinery, equipment & materials, feed manufacturing machinery. feed storage & transport equipment, cooling, fermentation & freezing systems, fermented milk, ice cream & milk powder, butter, butter oil, cheese, condensed milk, disinfectants for dairy industry, and many more directly and indirectly products & services suppliers etc in food & beverage industry.

### From Practice to Productive Business

Dairy activities have by tradition been connected to India's pastoral economy and it's no wonder the country ranks as the world's largest producer and consumer of



Cooling India at DairyTech India 2017, Bangalore.

dairy products. The demand for milk is remarkable and is growing not only in cities but also in small towns and rural areas. Over the past two decades, dairy farming has progressed in the direction of becoming an organized industry that encompasses not only increased production of milk and milk products, but also the breeding of higher yielding cattle, scientific nurture of animals and feed production. Dairy farming in India is now evolving from just an agrarian way of existence to a professionally managed industry.

Transformation of this sector is being

induced by such optimistic factors like newfound interest on the part of the organized sector, new markets, simple credit facilities, dairy friendly policies by the government, etc. The government and other stakeholders are increasingly approaching forward to help the growth of the sector. Ministry of Agriculture and Farmers' Welfare as well as Ministry of Food Processing Industries have initiated several steps to encourage escalation of dairy farming and production of dairy products.

One emerging trend in Indian dairy industry is the growing figure of the commercial dairy farms in the urban and peri-urban areas of the metros and big cities. These dairies mainly cater to the needs of the urban consumers. Realizing the growing importance of commercialization, the livestock sector needs to meet the challenges of globalization, in terms of organized production and marketing.

Many States' Dairy Development Departments, cooperatives like Amul and private sector dairy players are giving an impetus to setting up hi-tech commercial dairy farms leading to fresh milk production. Owing to conventional dietary habits of Indian households, about 60 percent of milk produced is consumed in the liquid form and the remaining is consumed in the form of butter, clarified



Cooling India team giving a glimpse of its products to a client at DairyTech India 2017, Bangalore.



Bry-Air displaying its solutions at DairyTech 2017, Bangalore.

butter (desi ghee), cheese, curd, paneer, ice cream, dairy whiteners in addition to traditional sweets. There is enormous scope intended for the industry in the field of value-added products including desserts, beverages, yoghurt and so on. It is expected that the demand for processed along with packaged dairy produce will witness a phenomenal growth within urban centres due to growing population with higher disposable profits and greater health consciousness.

### Showcase

At inauguration, the Governor highlighted the urgency of the need to mechanize farms in India. Mechanization is the only solution that can solve the labour shortage problem as well as reduce the production cost. The Governor also praised the remarkable achievements in technologies by visiting stalls and communicating with the delegates, complementing them for the grand display.

The popular expo hosted stalls showcasing tools and technologies from almost the entire dairy sector. The show offered immense opportunities to the exhibitors as well as the visitors. Foreign visitors, embassies, delegates incalculably appreciated the expo series which offered a valuable B2B business meetings, knowledge exchange, global exposure to

the initiates, networking for the stakeholders, and a lot more. The show promoted technological up-gradation and helped in familiarizing with the benefits of using latest technologies.

To all these thorough efforts, a rewarding achievement for the organizers as well as the business delegates was the talks of future co-operation planned by Korean Government. Further, DD Kisan and DD Chandana both channels broadcasted the expo offering more exposure. Also CIFTCI from Turkey took a

live coverage. Huseyin Dogancukuru, media person of CIFTCI greatly appreciated the expo and highlighted the potential need of the Indo-Turkish co-operation.

Over the three days of the expo, potential clients managed to meet many leading companies from all over the world that got an overwhelming response. A wide range of participants made their presence felt at the exhibition. The highlights of the exhibition were the presence of many national and international exhibitors with the participation of various companies for joint venture opportunities and technical tie-ups. It proved as an ideal platform for interaction among manufacturers, retailers, cattle and farming consultants, quality-certification agencies, veterinary health care products manufacturers, various dairy services providers and exporters of dairy-based food, packaging machinery, value-added milk products and storage system.

In view of the above scenario, it offered good opportunity for the business community from all segments of Dairy sector from all over the world that provided further momentum to their business.

### Paving Way for Start-ups

One road to realize the Prime Minister's agenda of 'Make in India' is through foreign investments and another of course is through innovations and efforts within



Hydronix-Jaycee Technologies Pvt Ltd displaying its products at DairyTech 2017, Bangalore.

the country. India Foodex series has helped in promoting both these approaches. Furthermore, it has also helped them in exploring possibilities of joint-ventures with foreign companies.

Many foreign exhibitors from more than 30 countries, included South Africa, Switzerland, Holland, UAE, Korea, Nigeria, Japan, Canada, Thailand, Nepal, Algeria, Qatar, New Zealand, Turkey, Malaysia, Ukraine, Russia, Iraq, Bangladesh Oman and Sri Lanka established many considerable players and start-ups. Many leading Brands like Big Basket, ITC, Swiggy, Franchise Connect, UNIBIC, Foodex Press, Himalaya, Mandi Bazar, Maiyas, Future Consumer, Britannia and a lot more visited with great enthusiasm in AgriTech India. Many top ranking professionals from universities namely Amity University and Jain University, catering and hospitality sectors visited and viewed it as the best that has great latent potential waiting to be tapped in the right way and through right means.

DairyTech India 2017 concurrent with India Foodex 2017 successfully brought together all the agrarian business stakeholders under one umbrella. It covered all facets of the industry. The event series has been consistently helping to bring together the stakeholders from



Frick India Team exhibiting its products during DairyTech 2017 at Bangalore.

each stage of production, to processing and packaging companies and retailers. The unique platform has contributed a great deal to the evolution of the industry.

### Pillars of Support

The number of exhibitors and visitors has been increasing annually. It has been actively supported, sponsored and guided by Union Ministry of Agriculture, National Meat & Poultry Processing Board, National Agricultural Cooperative Marketing Federation of India Ltd.

(NAFED), Agricultural & Processed Food Products Export Development Authority (APEDA), National Small Industries Corporation (NSIC), Tamil Nadu Veterinary and Animal Sciences University, National Center for Cold-chain Development (NCCD), CLFMA of India, Karnataka Milk Federation, Progressive Dairy Farmers' Association and Food Processing and Packaging Machinery Industry Association (FPPMIA)

Apart from these, DairyTech India also has strong support from the members of prominent Indian agricultural and food organizations, who visit the show and facilitate meaningful discussions and business deals, adding strength and value to the event.

Notable exhibitors included Buhler India, Hilda Automation, Husqvarna (Platinum Sponsor), Vansun Technologies, Frascold India Pvt Ltd., Bitzer India Pvt Ltd.,

Benny Impex Pvt Ltd. Sonalika, Mahindra & Mahindra, Alapala, Reliance industries, Selis, MySilo, Unomac, Bry-Air (Asia) Pvt. Ltd., Ghodawat Group, AgriPlast Tech India Pvt. Ltd., Greentech India, Essen Multipack Limited, Flour Tech Engineers Pvt. Ltd., India Factory, Frick India Limited along with organizations like Director of Horticulture & Plantation Crops (Tamil Nadu) and APEDA. The organizers announced the dates for the next issue i.e. 31<sup>st</sup> August to 2<sup>nd</sup> September, 2018, Bangalore. ■



One of the exhibitors showcasing its products during DairyTech India Exhibition.

# INDIAN EXPORT OF AGRO FOOD PRODUCTS

## Product Group Report/Country Wise

Product: Floriculture

Quantity in MT, Value in Rs. Lacs

Country	2014-15		2015-16		2016-17	
	Qty	Value	Qty	Value	Qty	Value
United States	5,490.00	9,813.61	5,185.09	9,679.11	3,764.94	9,917.01
United Kingdom	2,557.24	5,947.56	2,197.52	5,597.00	2,473.07	6,878.26
Germany	2,240.04	5,547.21	2,336.20	5,692.88	2,443.70	6,250.06
Netherland	2,060.74	5,125.10	1,883.90	5,567.55	1,811.07	5,803.41
United Arab Emirates	1,582.65	2,204.17	1,499.63	2,699.31	1,441.43	3,444.53
Canada	856.16	1,538.45	945.88	1,736.13	748.53	1,793.18
Singapore	916.94	1,067.92	1,092.47	1,337.17	1,313.94	1,610.41
Italy	561.65	1,207.84	444.91	1,135.73	555.10	1,609.93
Japan	608.91	1,467.35	421.97	1,596.52	365.66	1,481.75
Australia	474.72	1,458.86	380.96	1,330.67	285.39	1,381.21
China	379.42	851.95	334.52	1,082.84	495.45	1,267.18
Malaysia	297.28	736.72	392.55	810.00	507.89	1,182.76
Poland	280.12	606.16	382.85	807.92	328.56	902.71
Saudi Arabia	220.08	407.93	407.02	641.90	529.57	753.19
Spain	397.41	522.42	175.03	395.41	186.31	660.82
Belgium	241.28	551.90	180.05	490.45	297.79	655.87
Qatar	139.81	255.89	132.68	335.86	155.28	580.45
France	377.38	495.50	255.47	377.62	227.33	559.45
New Zealand	104.00	522.67	114.69	477.53	152.33	528.72
Greece	78.26	168.06	95.18	138.18	227.26	507.92
Switzerland	131.12	180.37	114.53	177.77	193.08	442.00
South Africa	396.83	280.03	421.63	438.45	496.40	439.66
Lebanon	91.18	357.88	114.78	454.70	99.46	425.90
Austria	139.76	298.45	194.66	479.26	171.27	405.70
Korea Republic	25.92	209.76	19.14	226.78	51.80	282.40
Mexico	40.49	121.28	29.72	105.56	46.37	177.90
Thailand	86.76	94.91	127.36	292.54	104.16	174.35
Hong Kong	18.41	30.99	20.69	43.90	22.11	167.64
Sweden	19.58	45.70	20.66	47.36	82.72	152.48
Sri Lanka	109.56	81.41	56.82	81.12	83.63	100.26
Czech Republic	49.57	85.07	70.98	113.33	45.27	96.46
Bangladesh	272.08	52.80	299.00	155.25	78.58	94.26
Nepal	20.89	29.59	67.65	109.02	69.97	85.81
Denmark	14.24	34.26	39.42	33.43	37.17	77.41
Ireland	37.59	57.30	27.59	59.65	45.71	74.59

Country	2014-15		2015-16		2016-17	
	Qty	Value	Qty	Value	Qty	Value
Portugal	18.25	91.45	228.52	102.54	171.36	73.83
Slovenia	77.13	106.05	52.20	100.84	29.63	71.78
Egypt Arab Republic	86.97	91.49	42.35	56.56	78.59	70.86
Brazil	20.39	55.84	64.73	39.46	33.41	70.73
Philippines	27.48	62.27	22.08	62.44	20.36	66.47
Israel	17.18	46.83	21.57	43.28	19.31	60.92
Ecuador	28.44	47.69	1.55	67.72	1.13	60.13
Lithuania	31.20	26.72	50.33	44.77	24.10	49.16
Argentina	15.83	50.04	11.50	37.79	9.42	46.72
Slovak Republic	58.09	57.46	44.97	29.05	24.80	45.17
Croatia	28.76	38.22	38.49	39.76	24.13	44.77
Russia	2.68	8.13	21.43	45.14	20.94	38.51
Costa Rica	91.95	111.95	0.13	6.71	13.57	36.82
Panama Republic	26.86	48.73	26.83	54.25	5.10	17.52
Norway	18.08	12.45	12.85	12.01	8.46	11.14
Uruguay	24.88	34.94	24.06	18.18	4.02	10.27
Romania	10.03	10.42	0.00	0.00	9.23	10.03
Bulgaria	43.45	274.79	12.50	26.09	3.09	6.55
Seychelles	4.36	3.87	1.00	3.07	1.38	4.92
Afghanistan	4.32	6.13	1.35	3.44	2.05	4.32
Zimbabwe	0.05	0.18	0.00	0.00	0.25	3.71
Kyrgyzstan	1.30	1.77	1.30	2.03	1.40	3.57
Yemen Republic	5.70	5.51	0.00	0.00	4.00	3.49
El Salvador	0.00	0.00	0.00	0.00	1.18	3.24
Tanzania Republic	0.18	28.17	0.24	4.32	0.10	2.90
Tajikistan	1.72	2.78	2.08	3.18	1.38	2.78
Brunei	0.00	0.00	0.01	0.10	0.04	2.77
Benin	0.00	0.00	0.00	0.00	0.10	1.91
Angola	0.00	0.00	3.22	3.74	0.11	1.80
Grenada	0.00	0.00	0.00	0.00	0.08	1.46
Trinidad and Tobago	0.14	0.05	0.02	0.03	0.40	0.91
Kazakhstan	0.00	0.00	0.41	0.40	0.11	0.77
Bahamas	0.00	0.00	0.00	0.00	0.28	0.55
Nicaragua	0.00	0.00	0.00	0.00	0.03	0.13
Swaziland	0.00	0.00	0.00	0.00	0.05	0.07
Bhutan	22.00	38.05	3.00	5.71	0.03	0.04
Dominica	0.00	0.00	0.08	0.05	0.05	0.02
Uganda	0.02	0.09	0.51	1.33	0.01	0.02
Albania	0.00	0.00	0.01	0.10	0.00	0.00
Azerbaijan	0.40	4.18	2.17	9.67	0.00	0.00
Bosnia-Hrztgovina	1.63	3.46	0.00	0.00	0.00	0.00

## Emerson Launches Fractional Horsepower Scroll Compressors

**E**merson announced it has launched fractional horsepower low-temperature Copeland Scroll™ compressors that utilize liquid-injection technology to cool discharge temperatures and reduce compressor stress while also meeting upcoming federal regulatory requirements.

The Environmental Protection Agency (EPA) will be phasing out the use of R-404A in new remote condensing units for walk-in coolers and freezers (WICF) in 2018. Additionally, the Department of Energy (DOE) has



proposed the enforcement of its new WICF efficiency mandate in 2020, as measured by the annual walk-in efficiency (AWEF) standard. The new Copeland Scroll ZF\*KA compressor line simultaneously addresses the need for compatibility with new refrigerants, tougher energy standards and highly reliable, smaller-capacity systems. "In addition to achieving compliance with DOE and EPA requirements in low temperatures, the new ZF\*KA fractional horsepower compressors are rated for use with new refrigerant alternatives

R-448A/449A and existing lower-GWP HFCs such as R-407A," said Allen Wicher, Director of Marketing, foodservice, Emerson. "Compared to its hermetic reciprocating counterparts, Copeland Scroll is also simpler for the OEM to incorporate into new designs without additional engineering, development and additional component costs."

The ZF\*KA compressors are designed for walk-in freezers relying on outdoor condensing units that will require compressors that can mitigate the higher discharge temperatures produced when using new refrigerant alternatives in low-temperature applications. The liquid injection technology allows the compressor to cool the discharge temperature while also delivering high efficiencies and reliable performance. ■

Website: [www.emerson.com](http://www.emerson.com)

## YORK® VRF Gen II Heat Recovery (HR) Outdoor Units 208/230V

**H**eat recovery systems can heat and cool spaces simultaneously. YORK VRF heat recovery systems offer an extended operating temperature range: outdoor ambient temperature as low as -4° F (-20° C) in the cooling mode with a low ambient kit

and as low as -13° F (-26° C) in the heating mode.

- Single chassis units in 6, 8, 10, 12, 14 and 16 tons enable system designs with fewer units and system sizes up to 36 tons
- Impressive operating ranges and high capacities at low and high ambient temperatures to meet diverse application requirements
- Long refrigerant piping lengths provide design flexibility – up to 3,281 feet total pipe run and a vertical lift of 360 feet when the Outdoor Unit(s) is above the Indoor Unit(s)

- Redesigned inverter scroll compressors deliver optimum efficiency at partial load conditions
- Dual inverter compressors are standard in 8, 10, 12, 14, and 16 ton units for increased efficiency
- Connection ratios up to 150% provides more design options
- Advanced defrost cycle operation in the heating mode
- Power-saving demand control for reduced peak load and energy savings
- Automatic judgement system for Refrigerant Amount to verify refrigerant charge is correct. Diagnostics and malfunction codes available at push of a control panel button. ■

Website: [www.johnsoncontrols.com](http://www.johnsoncontrols.com)



**Now  
Subscribe/Renew  
Online**

Just Log on to: [www.coolingindia.in](http://www.coolingindia.in)

**Cooling India**

# Forthcoming Events At A Glance

## Green Building Congress 2017

**Venue:** Chennai Trade Centre, Chennai  
**Date:** 3<sup>rd</sup> to 7<sup>th</sup> October 2017  
**Website:** www.cii.in

## India Cold Chain Show 2017

**Venue:** Bombay Exhibition Centre, Goregaon, Mumbai  
**Date:** 12<sup>th</sup> to 14<sup>th</sup> December 2017  
**Website:** www.indiacoldchainshow.com

## 2018 AHR Expo

**Venue:** Chicago  
**Date:** 22<sup>nd</sup> to 24<sup>th</sup> January 2018  
**Website:** ashrae.org/AHRExpo2018

## ACREX 2018

**Venue:** BIEC, Bengaluru  
**Date:** 22<sup>nd</sup> to 24<sup>th</sup> February 2018  
**Website:** www.acrex.in

## FoodTech Pune 2018

**Venue:** Pune  
**Date:** 23<sup>rd</sup> to 25<sup>th</sup> February 2018  
**Website:** http://foodtechpune.com

## Global Logistics show

**Venue:** Bombay Exhibition Centre, Mumbai  
**Date:** 22<sup>nd</sup> to 24<sup>th</sup> February 2018  
**Website:** http://globallogisticsshow.com

## index to advertisers

Company Name	Page No.
ALM engineering & Intrumentation Pvt Ltd	IFC
Air Master Fire Safety Equipments	11
AMNYK India	23
ASHRAE India Chapter	IBC
Belimo Actuators India Pvt. Ltd.	9
Danfoss	7
Desiccant Rotors International Pvt. Ltd.	31
Emersons Electric Co. (India) Pvt. Ltd.	17
Ensavior Technologies Pvt. Ltd.	BC
FLIR Systems India Pvt. Ltd.	13
GAPS Engineering	19
Hira Technologies Pvt. Ltd.	21
India Cold Chain	29
Lubi Industries LLP	3
Mist Resonance Engineering Pvt. Ltd.	5
Russ Air	33
Technical Solutions & Engineers	15

If you feel that the industry need to know your experiences and that will help conserve a lot of efforts and time, its time you write us and our team will guide you on the various topics we cover in each and every issue.

**Think no further just e-mail your interest to [editorial@charypublications.in](mailto:editorial@charypublications.in)**

We would love your involvement in your favourite magazine!



Cooling India invites HVACR professionals and industry experts to write articles on their area of expertise and interest.

## Hyatt Regency Delhi Receives Historic Environmental Designation

**H**yatt Regency Delhi has become one of the few hotels in Delhi to earn LEED platinum certification. "With this, Hyatt Regency Delhi establishes itself as one of the few global leaders for energy and environment design," said Aseem Kapoor, General Manager for Hyatt Regency Delhi. As a LEED platinum five-star hotel, Hyatt Regency Delhi is now recognized on the basis of excellence in sustainable design, water efficiency, energy and atmosphere, material and resources, indoor environmental quality and innovation in operations, reports the Pioneer. The property is also committed to reduce light pollution.

All facade, external and landscape lights are selected and mounted in a way that lets minimal light into the sky. The building envelope was also designed in a manner that does not let excessive indoor light outside. The vernacular architecture emphasized the usage of local materials, which were easily



available and suitable for a particular region. "Market transformation happens one building at a time. Hyatt understands the value of LEED and has exemplified extraordinary leadership in reshaping their sector," said Mahesh Ramanujam, President and CEO of the US Green Building Council, the creators of LEED and GBCI. ■

## Energy Efficient Appliances in Central Govt Buildings

**C**onsidering the fact that majority of the government buildings consume large amount of energy, the Ministry of Finance has issued guidelines for mandatory installation of energy efficient appliances in all Central Government buildings. The Ministry, in a statement, has directed that usage of LED based lightings and energy efficient cooling equipment such as fans and air conditioners in government buildings will lead to savings in the long run through reduction in energy consumption. To implement this, Department of Expenditure under Ministry of Finance has decided to take up services of Energy Efficiency Services Limited (EESL), a joint



venture of PSUs under the Ministry of Power, on nomination basis to assist various ministries and departments to retrofit energy efficient appliances in all their premises across the country.

Under the programme, EESL intends to bring in investment of around 1000 crore covering more than 10,000 large government/private buildings by 2020. It is estimated that about one crore LED lights, 15 lakh energy efficient ceiling fans, and 1.5 lakh energy efficient ACs will be retrofitted by EESL in these buildings. Apart from retrofitting, EESL also aims to widen its services in areas like centralized AC system, Energy Audits, and New Generation Energy Management System in buildings. ■

## World's Tallest Environment-Friendly Wooden Building

**W**hen completed in March 2019, Mjøsa Tower in the Norwegian town of Brumunddal will be the world's tallest wooden building. The construction, which started in early April this year, is an example of how wood can be substituted for concrete, which is considerably heavier and less environmentally friendly. The building will stand over 80 metres tall, and its 18 storeys will house offices, a hotel and apartments. Wooden buildings are the solution to the high demand for new housing and offices, urban densification, and stringent environmental demands. Using wood as the main building material produces lightweight and cost-effective buildings that are



quick to build and have minimal environmental impact. This also applies to load-bearing elements. This high-rise is being built using glulam, CLT, and Metsä Wood's Kerto LVL (laminated veneer lumber). To ensure the required load-bearing capacity, cross-bonded veneer panels called Kerto-Q LVL will be used for the flooring between the storeys. The panels are extremely strong and durable. Wood is an environmentally friendly building material. As a raw material, it is renewable and abundantly available in the Nordic countries. The material absorbs more carbon dioxide as the tree grows than the quantities emitted in the manufacture of this construction material. ■



# Second ASHRAE Developing Economies

November 10-11, 2017, Le Meridien Hotel, New Delhi, India

## Trends, Opportunities and Challenges for the Built Environment in Developing Economies

For the first time, ASHRAE is hosting a conference in India. The conference brings together speakers from around the world on one platform sharing insights on various topics.

REGISTRATIONS ARE OPEN

[www.ashrae.org](http://www.ashrae.org) [www.ashraeindia.org](http://www.ashraeindia.org)

Fee: USD 50 / INR 3500

Supported by



HITACHI



In Partnership with



If you have any queries, feel free to get in touch at  
T: +91 9136531422 E: [ashraeic@airtelmail.in](mailto:ashraeic@airtelmail.in)



## ... A Green Approach To Energy Efficiency & Sustainability In HVAC Systems

### xylem Let's Solve Water

#### Pumps & Package Pumping System on Variable & Constant Speed

- **Bell & Gossett:** HVAC (Primary - Secondary, Tertiary, Condenser Water Variable Speed Pumping).
- **Lowara:** Water & Waste water pumps (Hydro-pneumatic Booster, Submersible, Drainage Pumps).
- **Flygt:** Submersible Pumps, Mixers and Mechanical Aeration equipment.
- **AC Fire Pump:** UL/FM approved Fire Pumps and skids.



### FlowCon international

#### PICV & Automatic Balancing Valves

##### Key Features

- Continuous Display of Flow Rate
- LCD Display
- Optional Fail-Safe Power Storage Feature
- Communication with BMS thru RS-485
- BACnet Compatible
- 51 Different Maximum Flow Rate Settings
- 100% Valve Authority

- ◆ Pressure Independent Control Valves
- ◆ Adjustable Cartridge Automatic Balancing Valves
- ◆ Pre-set Automatic Balancing Valves
- ◆ Temperature Control Valves
- ◆ 3 Way By-Pass Modules
- ◆ Externally Adjustable Automatic Balancing Valves
- ◆ Pre-set Automatic Balancing Valves
- ◆ Thermostatic Control Valves



### ESPAIR™



#### Electrostatic Precipitation System

##### Key Features

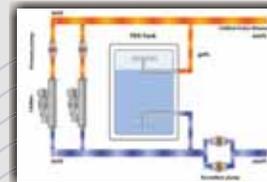
- Removal of grease and smoke from commercial kitchens
- Removal of smoke, fumes and oil/coolant mist from industrial processes
- Higher efficiency, upward of 90-95% in single stage, more than 99% in multi stage
- Very low pressure drop in comparison to media and cartridge filters

### GREYSTONE ENERGY SYSTEMS INC

#### HVAC Sensors and Transducers for Building Automation Management Systems.



### FT EnE, Inc.



#### Chilled Water Thermal Energy Storage System

Utilizes only the sensible heat of water for cooling energy storage in a chilled water storage tank and discharges the stored coldness for air-conditioning.

Suitable for District Cooling and backup of chilled water for mission critical facilities like Data Centers and High Tech Manufacturing.

### aeropure™

#### Aeropure UV Systems

#### Ultra Violet Germicidal Irradiation (UVGI) For cooling coil in HVAC System

- Energy Savings
- Maintenance Savings
- Improved Indoor Air Quality
- Faster Return on investment

