



India Chapter

CELEBRATING  
ASHRAE 125 YEARS

# ASHRAE INDIA CHAPTER

Volume 21 Issue 3 | June 2021

Editor: Mr. Kanagaraj Ganesan, Associate Editor: Mr. Suhaas Mathur, Ms. Shruti Gupta

BULLETIN

For the  
HVAC&R  
Industry

## Presidential Message

Dear Friends,

I am pleased to address you through this newsletter at the start of the new society year of the ASHRAE India Chapter. We conducted the first BOG meeting in a hybrid format. I am happy to inform you that this team is enthusiastic and ready to deliver on this year's mandate.

Last year of AIC was good, and performance in all fields remained up to the mark even though the outdoor activities were not happening. We completed all our targets and achieved much beyond our expectations in this challenging time. This year too we will continue all our activities with increased targets in all areas.

Our main target will be to make more new members and retain the existing ones to make AIC the leading chapter in India and Region-at-Large.

We will increase the research promotion contribution as compared to the previous years.

For CTTC, we have already finalized the webinars' schedule until December 2021. Therefore, we will be starting these activities by the end of this month.

We could not conduct GAC activities last year because of lockdown, and no face-to-face meeting was allowed. However, this year we have planned to continue our work from where we left if conditions allow.

Under student activities, we have decided to bring more students from existing colleges, and further, we will target new colleges to open student chapters. This time we have planned to do some K-12 activities also.

We are also organizing a cricket match in memory of (late) Dr Prem Jain and a football match in memory of (late) Mr Nirmal C Gupta.



Our sustainable development activities will continue in villages, schools, and hospitals. We will involve more people and students in these activities for better results.

We will increase the activities under the refrigeration committee. We will try to make more members from this field and carry out more webinars on refrigeration. We will promote the interest of engineers who are working in this field.

We are planning to include more young engineers in this society year. The target will be to get young engineers from the industry and focus on converting student memberships to YEA after graduation.

Friends, it seems the pandemic is weakening, and working conditions are improving. If this trend continues, we will organize our mega event, AIC Tech & ASHRAE night, at full capacity.

I once again acknowledge the supports of the BOG & chapter members and surpass all expectations in this year of 2021-22.

Thanking you

**ABID HUSAIN**

President  
ASHRAE INDIA CHAPTER

In this Issue...

02  
**INFOCUS**

03  
**THEME ARTICLE**

06  
**ACTIVITIES**

# Message from **Mr. Dharmendra Rathore** Immediate Past President



**Mr. Dharmendra Rathore**  
Immediate Past President  
ASHRAE India Chapter 2020-21

I congratulate Mr. Abid Hussain for taking charge as ASHRAE India Chapter President. I am sure that in his presidency, AIC will reach new heights.

I take this opportunity to reflect my gratitude to my whole team of office bearers and BOG members for the year 2020-21 for letting my journey as the chapter President with the smooth division of responsibilities.

We had successfully organized 66 knowledge dissemination programs over a span of 12 months. We encouraged student activities with industry practitioners' involvement, which comprised Virtual Factory Visit and Virtual Technical Webinars. We paid tribute to my mentor Dr. P.C. Jain by organizing various events during the week of Harit Prem Mahotsav. The events included organizing inter-college cricket tournament, drawing competition and health tips camp at school.

One of the highlights was the sustainability activity, where AIC and Aircon Engineers donated -80 degree Celsius refrigerator to Hindurau Hospital.

It was a delight to work with the leadership of the Chandigarh Chapter, Rajasthan Chapter and East India Chapter. I wish them the very best for the upcoming year and promise that AIC will continue to support them for their sustainable growth.

My heartfelt gratitude to all the sponsors who stood with AIC during the difficult COVID period and supported us in conducting all the chapter activities.

I look forward to continued support and greater participation of all the student members, YEA, members and non-members in this Society Year and in times to come.

## ASHRAE India Chapter Officer & Committee Chairs 2021-22

**Mr. Abid Husain**  
President

**Mr. Subir Das**  
Co-Chair - GAC

**Mr. Dharmendra Rathore**  
IPP

**Mr. Priyank S. Garg**  
Co-Chair - GAC

**Mr. Kanagaraj Ganesan**  
President Elect.

**Dr. Rajinder Singh**  
Chair-Student Activity

**Mr. Rajesh Kumar Jain**  
Vice President

**Mr. Abhishek Jain**  
Co-Chair-Student Activity

**Ms. Arundhati Singh Khanna**  
Secretary

**Ms. Vandana Kapuria**  
Co-Chair-Student Activity

**Mr. Sandeep Goel**  
Treasurer

**Mr. Shrey Mahajan**  
Chair - YEA

**Mr. Rajesh Kumar Jain**  
Chair - CTTC

**Ms. Shruti Gupta**  
Co-Chair - YEA

**Mr. Anurag Bajpai**  
Co-Chair - CTTC

**Ms. Dimpy Daroch**  
Co-Chair - YEA

**Mr. Priyank S. Garg**  
Co-Chair - CTTC

**Ms. Arundhati Singh Khanna**  
Chair - Sustainability

**Mr. Sandeep Goel**  
Chair- Research Promotion

**Mr. Praveen Kumar Jha**  
Co-Chair - Sustainability

**Ms. Pooja Agarwal**  
Co- Chair - Research  
Promotion

**Mr. Priyank S. Garg**  
Co-Chair - Sustainability

**Mr. Manik Goel**  
Co-Chair - Research  
Promotion

**Mr. Sanjay Gupta**  
Chair - Refrigeration

**Mr. Indrajit Bhattacharya**  
Chair - Membership  
Promotion

**Mr. Ashish Gupta**  
Co-Chair - Refrigeration

**Mr. Rajesh Jain**  
Co-Chair - Membership  
Promotion

**Mr. Kanagaraj Ganesan**  
Chair - News Letter &  
Home Page Editor & ECC

**Ms. Vandana Kapuria**  
Co-Chair - Membership  
Promotion

**Mr. Shubhash Mathur**  
Co-Chair - News Letter &  
Home Page Editor & ECC

**Mr. Paresh Mishra**  
Chair - GGAC

**Ms. Shruti Gupta**  
Co-Chair - News Letter &  
Home Page Editor & ECC

**Dr. Om Taneja**  
Historian

## BOG Members

**Mr. Sanjay Gupta**

**Mr. Subir Das**

**Mr. Praveen Kumar Jha**

**Ms. Vandana Kapuria**

**Mr. Abhishek Jain**

**Dr. Om Taneja**

**Mr. Paresh Mishra**

**Mr. Anurag Bajpai**

# Fundamentals of Heat Transfer and Thermodynamics for Refrigeration and Air-conditioning Engineers

## 1.1 TEMPERATURE

Temperature refers to the hotness or coldness of a body.



Fig.1.1 Temperature



When a cup of hot tea is left on the table, after some time it cools off and a glass of chilled water eventually warms up. This means when a body is brought into contact with another body, which is at a different temperature (thermal potential); heat is transferred from the body at higher thermal potential to the one at lower thermal potential until both bodies attain the same temperature. At that point, the heat transfer stops, and the two bodies are said to have reached thermal equilibrium.

### 1.1.1 TEMPERATURE SCALES

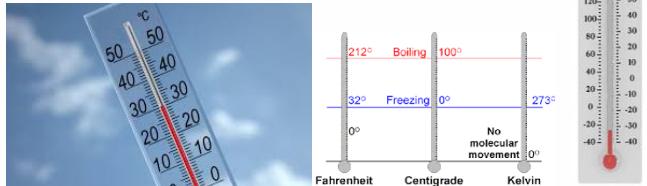


Fig.1.2 Temperature Scales

The two temperature scales used predominantly in practice are the Celsius scale and the Fahrenheit scale. On the Celsius scale, the ice and steam points are assigned the values of 0°C and 100°C, respectively. The corresponding values on the Fahrenheit scale are 32 °F and 212°F. A more useful temperature scale in thermodynamics is the absolute temperature scale. The lowest attainable temperature on this scale is absolute zero. The absolute temperature scale in the SI is the Kelvin scale

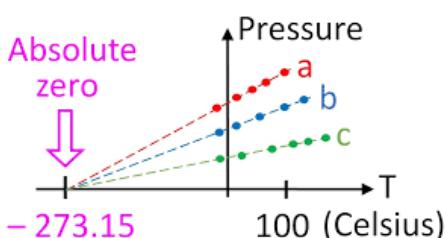


Fig.1.3 Absolute Temperature Scale (The Kelvin Scale)

which is designated by K. The reading of a thermometer with a Celsius scale, however, will approach -273.15°C. Therefore a temperature of -273.15°C corresponds to an absolute temperature of 0 K. The Kelvin scale is related to the Celsius scale by:

$$T(K) = T(^\circ C) + 273.15 \quad (1)$$

## 1.2 HEAT

Heat is a form of energy that flows due to thermal potential difference. That is, an energy interaction is heat only if it takes place because of a temperature difference (thermal potential difference). Then it follows that there cannot be any heat transfer between two systems that are at the same temperature.

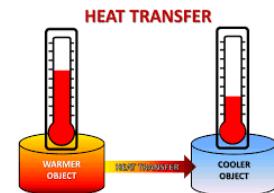


Fig.1.4 Heat

Heat has energy units kcal, kJ or Btu. The amount of heat transferred during the process between two states is denoted Q. Heat transfer per unit mass of a system is denoted q and is determined from:

$$q = Q/m \text{ kcal/kg or Btu/lb} \quad (2)$$

## TYPES OF HEAT

### 1.2.1 SENSIBLE HEAT

The amount of heat required to change the temperature of a system without changing its state (phase) is known as sensible heat.

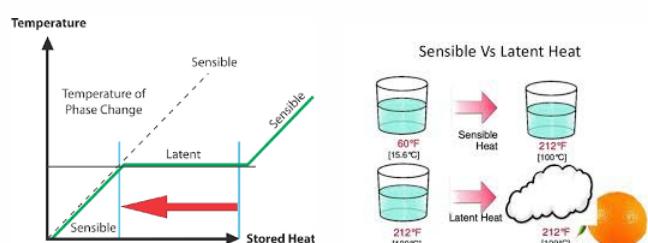


Fig.1.5 Sensible Heat

### 1.2.2 LATENT HEAT

The amount of heat required to change the state (phase) of a system without changing its temperature is known as latent heat.

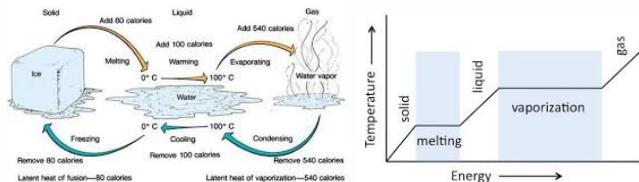


Fig.1.6 Latent Heat

## TYPES OF LATENT HEAT

### 1.2.2.1 LATENT HEAT OF VAPOURIZATION

The amount of heat required to change the state (phase) of a system from liquid to vapour without changing its temperature is known as latent heat of vapourization.



Fig.1.7 Latent Heat of Vaporization

The opposite to that is **latent heat of condensation**, change the state of a system from vapour to liquid state at constant temperature and latent heat is liberated.



Fig.1.8 Latent Heat of Condensation

### 1.2.2.2 LATENT HEAT OF SOLIDIFICATION (FREEZING)

The amount of heat removed to change the state (phase) of a system from liquid to solid without changing its temperature is known as latent heat of solidification.



Fig.1.9 Latent Heat of Solidification (Freezing)

The opposite to that is **latent heat of melting**, change the state of a system from solid to liquid state at constant temperature and latent heat is added.



Fig.1.10 Latent Heat of Melting

### 1.2.3 LATENT HEAT OF SUBLIMATION

The amount of heat required to change the state (phase) of a system from solid to directly vapour without changing its temperature is known as latent heat of sublimation. Example is Dry Ice (Solid CO<sub>2</sub>) etc.

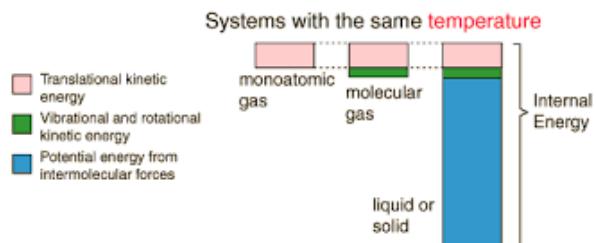


Fig.1.11 Latent Heat of Sublimation

## 1.3 INTERNAL ENERGY

The energy of a system itself is known as internal energy of that system.

Internal energy is defined above as the sum of all the microscopic forms of energy of a system. It is related to the molecular structure and the degree of molecular activity and it may be viewed as the sum of the kinetic and potential energies of the molecules. It is denoted by 'U'. The unit of Internal energy is kJ in SI system.



#### Energy Equation for Stationary Closed Systems

$$Q - W = \Delta U \quad [\text{kJ}]$$

where: Q is the Heat Transferred to the System  
W is the Work Done by the System  
 $\Delta U$  is the Change of Internal Energy

Dividing each term by the system mass m [kg], we obtain the specific form of the Energy Equation:

$$\frac{q}{m} - \frac{w}{m} = \frac{\Delta u}{m} \quad \left[ \frac{\text{kJ}}{\text{kg}} \right]$$

Fig.1.12 Internal energy of a system

## 1.4 ENTHALPY

Enthalpy is defined as the total energy of a system i.e. sum of internal energy and flow (work) energy. It is denoted by 'H'.

$$H = U + pV \quad (3)$$

Where, U = Internal energy of the system

The unit of enthalpy is kJ in SI system.

The specific enthalpy is denoted by 'h', it is the enthalpy per unit mass and is determined from:

$$h = H/m \text{ (kJ/kg)} \quad (4)$$

## 1.5 ENTROPY

Entropy is the measurement of disorderness (randomness) of a system. It increases when heat is added, it decreases when heat is removed and it remains constant when no heat is added or removed. It is denoted by change in entropy:

$$dS = dQ/T \quad (5)$$

Where T = Temperature

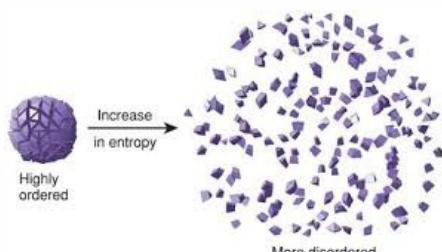


Fig.1.13 Entropy

The unit of entropy in SI system is kJ/kgK.

## 1.6 MODES OF HEAT TRANSFER

There are three modes of heat transfer:

### 1.6.1 CONDUCTION MODE OF HEAT TRANSFER

Thermal conduction is a mechanism of heat flow from a region of high temperature to a region of low temperature within medium due to inter molecular activity; this is more predominant in solids. In this case medium is metal itself.



Fig.1.14 Conduction Mode of Heat Transfer

### 1.6.2 CONVECTION MODE OF HEAT TRANSFER

Convection is the mode of heat transfer between fluid flowing relative to solid surface. In this case medium is fluid. For example air flowing through ducts in air-conditioning applications.

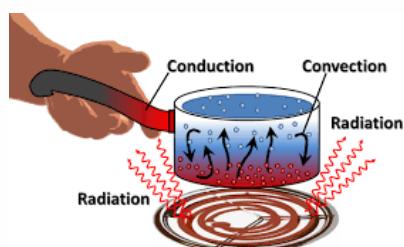


Fig.1.15 Convection Mode of Heat Transfer

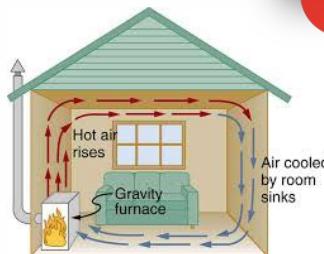


Fig.1.16 Natural Convection Mode of Heat Transfer

**Convection mode of heat transfer is of two types:**

#### 1.6.2.1 FREE OR NATURAL CONVECTION

If the fluid motion is set up by buoyancy effects resulting from the density variation caused by the temperature difference in the fluid, heat transfer is said free or natural convection.

#### 1.6.2.2 FORCED CONVECTION

If the fluid motion is artificially caused by means of an external agency like blower or fan. The heat transfer in this case is termed as forced convection.

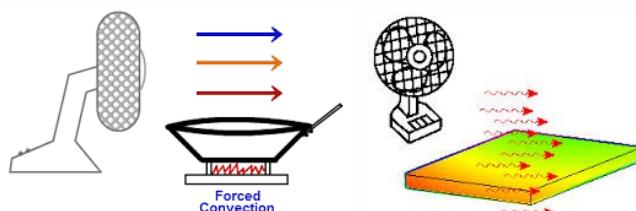


Fig.1.17 Natural Convection Mode of Heat Transfer

### 1.6.3 RADIATION MODE OF HEAT TRANSFER

Radiation is an electromagnetic wave phenomenon and no medium is required for its propagation. Energy transfer by radiation is maximum when two bodies exchanging energy are separated by a perfect vacuum. The radiations depend upon the temperature and on the optical properties of the emitter.

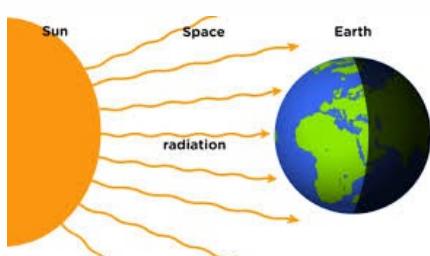


Fig.1.18 Radiation Mode of Heat Transfer

#### Dr. Rajinder Singh's Classroom Series



Dr. Rajinder Singh

Past President (2015-2016) & Chair Refrigeration,  
Co-chair student Activities-ASHRAE India Chapter  
DL ASHRAE USA  
Professor-Pusa Institute of Technology

This classroom is started in view to strengthen the theoretical knowledge of Engineers from Industries in Refrigeration & Air- Conditioning field. This will also be helpful for the students interested in this field. This will be continuing in our quarterly Newsletter issue. We are starting with some fundamentals of heat transfer and thermodynamics.



# ASHRAE India Chapter

# ACTIVITIES

## 22nd January, 2021

Webinar on RAL Programme was held on 22nd January-2021, The Programme was attended by 120 participants. Mr. Subramaniam C Presented lecture on 'Building Automation, Chiller Plant Management Systems and Data Analytics'. The event was appreciated by the participants and well attended.

## 25th January, 2021

Painting competition on Sustainable Environment held on 25th Jan., 2021 at Hira Lal Jain Sr.Sec. School, Sadar Bazar, Delhi-110006. 120 students participated in the competition. The students were from Class-6 to Class-12. Various prizes were distributed at the end of the competition to the winners.



## 27th December, 2020

Inter College Quiz Competition  
ASHRAE Student Quiz Competition held on 27th December, 2020.

## 25th January, 2021

A webinar was organized on 25th Jan., 2021 where Ms. Vandana Kapuria presented motivational speech on "Success by Design". The programme was attended by 150 participants.

## 29th January, 2021

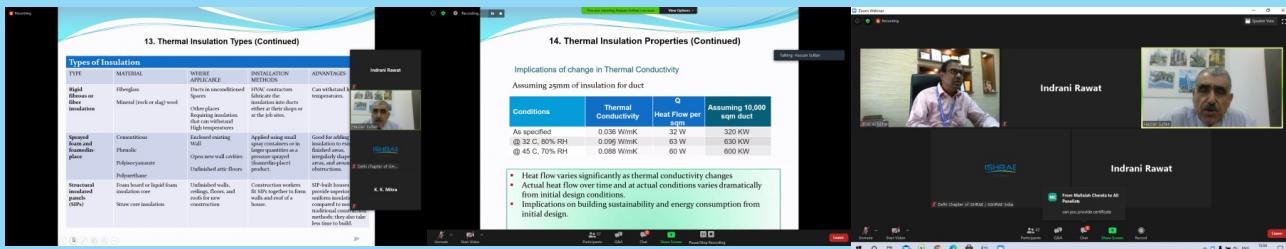


Health checkup camp was organized on 29th Jan., 2021 at Shree Thakurdwara Balika Vidyalaya Sr. Sec. School, Ghaziabad, Uttar Pradesh. The health checkup camp was conducted by Dr. Indra Taneja – M.D, FAAP, IAP. Talk on safety tips and precautions to be taken in our day-to- day life.

# ACTIVITIES

22nd February, 2021

Webinar on RAL programme was held on 22nd Feb-2021, The programme was attended by 80 participants. Mr. Hussain presented lecture on “The Best Thermal Insulation Material for Building Energy Conservation”. The event was appreciated by the participants and was well attended.



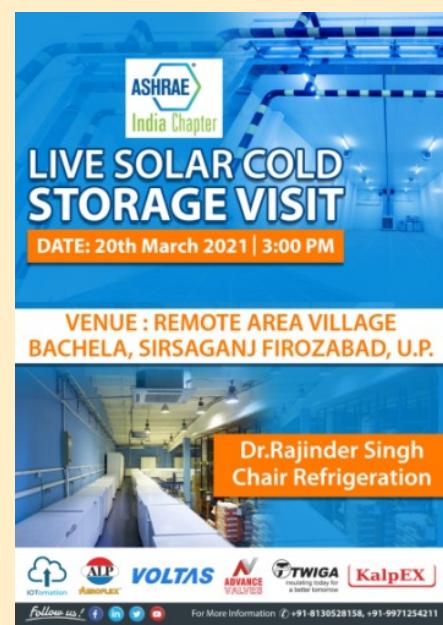
22nd February, 2021

AIC Sustainable activity was successfully done at North DMC Medical College & Hindu Rao Hospital, in presence of North Delhi Mayor Shri Jai Prakash and Ms. Radhika Abrol Fogat Councilor SDMC. Among our BOG Members, Mr. KD Singh Chair – Sustainability, Ms. Arundhati Singh Khanna, Mr. Priyank Garg Chair- GAC, along with DCI members attended the event.



20th March, 2021

Webinar programme was held on 20th March, 2021. The programme was attended by 80 participants. Dr. Rajinder Singh presented on “Live Solar Cold Storage Visit at Remote area Village Bachela, UP”





# ASHRAE India Chapter

## ACTIVITIES

**27th March, 2021**

ASHRAE India Chapter organized the 2nd Dr. Prem C. Jain Memorial Cricket Tournament on 27.03.2021 at PGDAV College, Ring Road, Nehru Nagar, New Delhi-110065. Daikin sponsored the event.

AIC Senior members Mr. Ashish Rakheja, Mr. Abid Husain & BOG members Mr. Rajinder Singh, Mr. K.K. Mitra, Mr. Dharmendra Rathore, Dr. Varun Jain,

Ms. Arundhati Singh Khanna, Ms. Vandana Kapuria, Ms. Priyanka Jain, all sponsors were present. Ms. Payal Jain grace the occasion.

She was the initiator of this event. Mr. Kanwaljit Jawa – M.D. Daikin inaugurated the tournament by playing first Match between AIC BOG Members & Corporate members. Other members present from Daikin were Gaurav Bakshi- AGM- Branch Operations Head & Mr. K. Virmani. The tournament was attended by 4 nos. Ashrae student chapters. The finalist were Pusa Institute and Amity University. The tournament was won by Pusa Institute. Prizes were distributed to the Winner, Runners up, Best bowler, Best Batsman and man of the match. A medal was provided to all participating players. Ball to ball commentary was provided by Ms. Indrani Rawat.

**Big Thanks to our sponsors : Platinum -** Daikin Airconditioning India Pvt. Ltd., **Gold -** Xylem Water Solutions, **Team Name -** Enmax Smart Systemz, **Prize Money -** Empire Tubewells Pvt.Ltd., **Kits -** Pioneer Duct., **Refreshment -** Solidum and Stars Guild LLP, **Advertising Logo -** Systemair India Pvt. Ltd., Jay & Co India Pvt Ltd. & Ribus Trading Solutions.



# ASHRAE INDIA CHAPTER INVITES YOU TO JOIN ASHRAE



## TECHNICAL RESOURCES

Access the world's largest library of HVACR related technical information,  
Members get:

- ASHRAE Journal
- HPB Magazine
- ASHRAE Handbook (for Member and Associate grade members)
- ASHRAE Technology Portal
- Science and Technology for the Built Environment
- Discounts in the Bookstore
- Building EQ Portal
- 90.1 Portal

## PROFESSIONAL NETWORK

Grow your network at the local, regional, and international level, both in-person and online.

- 187 Chapters within 15 Regions keep members connected at the local level through meetings and events.
- Society Conferences and Chapter Regional Conferences provide networking and unparalleled learning opportunities.
- Connect with members across the globe on social media.

## CAREER & PROFESSIONAL DEVELOPMENT RESOURCES

Develop personally and professionally with continuing education, certification and leadership programs.

- ASHRAE Learning Institute & eLearning
- Free PDHs from Annual Webcast
- YEA Leadership Programs
- ASHRAE Jobs
- Certifications



## MEMBERSHIP FEE TO JOIN ➤

**Mr. Indrajit Bhattacharya**

Membership Chair  
+91-9818353616

**Mr. Rajesh Jain**

Membership Co-Chair  
+91-9958091036

**Ms. Vandana Kapuria**

Membership Co-Chair  
+91-9312025457

Login at : [join.ashrae.org](http://join.ashrae.org),  
to become a member instantly.  
**Secretariat Help :** +91-8130528158  
+91-9971254211

Website and contact information: [www.ashraeindia.org](http://www.ashraeindia.org) | Email : [ashraeic@gmail.com](mailto:ashraeic@gmail.com)



## Reader Feedback

ASHRAE India Chapter Bulletin Newsletter wants ideas from readers on what you would like to see in future newsletters.

**Tell us what you think.**

Members interested to send their technical articles are requested to send the same at [ashraeindia6@gmail.com](mailto:ashraeindia6@gmail.com)