Maharaja Agrasen Institute of Technology, Delhi

PSP Area, Plot No. 1, Sector-22, Rohini, Delhi-110086

Department of Mechanical Engineering

EVENT REPORT

One day Workshop on Radiant Cooling

Activity Date: 19th September, 2024

No. of Participants: 36 + Faculty Member of Department

Resource persons:

1. Mr Devin Abellon, P.E, Vice President-ASHRAE, DL Director of Engineered Solutions, Pac West Sales, Portland, USA
2. Mr Gaurav Mathur, CTTC, ASHRAE India Chapter Sales Head, Grundfos Pumps Pvt. Ltd.
3. Mr Vikram Bansal, Co-Chair, SA, ASHRAE India Chapter Owner, Nirvay Solutions Pvt. Ltd.

Brief Description of the Activity:

On 19 September 2024, the department of Mechanical Engineering (ME) at Maharaja Agrasen Institute of Technology (MAIT), in collaboration with the ASHRAE MAIT student branch, and in support of ASHRAE India Chapter and ISHRAE Delhi Chapter organized an informative workshop focusing on one of the most efficient and sustainable cooling technologies—Radiant Cooling Systems. The workshop was led by the distinguished speaker, Devin Abellon, P.E., an expert in the field of heating, ventilation, and air conditioning (HVAC) systems, who shared his profound knowledge and insights into this cutting-edge technology.

The event attracted a significant number of attendees, including students, faculty, and professionals from various disciplines, all eager to understand how Radiant Cooling Systems are reshaping the way we think about building comfort and energy efficiency. As climate change continues to intensify, the need for innovative and energy-efficient cooling solutions has become more pressing than ever, making this workshop not only relevant but also timely. This event successfully integrated key Mechanical Engineering academic curriculum topics, providing students with a practical understanding of Heat Transfer, Refrigeration and Air Conditioning, Fluid Mechanics and Thermodynamics.

Introduction to Radiant Cooling Systems

The workshop began with an introduction to the basic principles of radiant cooling, a technology that has been gaining momentum as a viable alternative to traditional air conditioning systems. Devin Abellon, P.E., laid the groundwork by explaining the fundamental concept of radiant cooling, which differs significantly from conventional forced-air systems. Rather than cooling air and circulating it throughout a space, radiant cooling systems work by absorbing heat from the occupants and objects in a room through chilled surfaces such as ceilings, floors, or walls.

Radiant cooling operates on the principle of thermal radiation, which is the transfer of heat through infrared radiation. As Mr. Abellon explained, this technology can maintain indoor comfort while using significantly less energy compared to traditional air-conditioning systems. This is because radiant cooling addresses heat transfer directly at the human body level, offering a more natural and efficient way to control temperature in a space.

System Design and Components

One of the key sections of the workshop focused on the design and components of a radiant cooling system. Devin Abellon described how chilled water is typically circulated through embedded pipes in a building's ceilings, floors, or walls. As the chilled surfaces come into contact with heat emitted from occupants and equipment, they absorb the heat, thereby cooling the room. Since water has a higher heat capacity than air, radiant systems can provide the same level of cooling with less energy.

The components of a typical radiant cooling system, as discussed by Mr. Abellon, include:

a. Chilled Water Distribution: The primary medium for heat exchange in radiant systems is water, which is cooled by a chiller or other cooling source. The chilled water is then distributed through piping embedded in the building's structure.
b. Radiant Panels: These panels often located in ceilings, floors, or walls, are the surfaces that emit radiant energy. They can be made of various materials, including gypsum or metal, and are designed to maximize heat absorption.
c. Control Systems: Modern radiant cooling systems incorporate sophisticated control mechanisms to regulate the flow of chilled water and ensure that temperature and humidity levels are maintained within a comfortable range.

Benefits of Radiant Cooling Systems

Throughout the workshop, Devin Abellon emphasized the numerous benefits that radiant cooling systems offer over conventional HVAC solutions. Some of the primary advantages discussed include:

a. Energy Efficiency: Radiant cooling uses less energy than traditional air-conditioning systems because it leverages water as a more efficient medium for heat transfer. Water has a higher thermal capacity than air, meaning that radiant cooling can achieve the same cooling effect with a fraction of the energy.
b. Improved Indoor Air Quality (IAQ): Since radiant cooling does not rely on air movement to cool a space, it reduces the amount of dust, allergens, and other pollutants that can be circulated by traditional air-conditioning systems. This can lead to healthier indoor environments, especially in areas where air quality is a concern.
c. Enhanced Thermal Comfort: Radiant cooling provides a more consistent and uniform temperature throughout a space. Traditional forced-air systems can create drafts and uneven temperature distribution, whereas radiant cooling ensures that occupants feel comfortable without the fluctuations in temperature.
d. Silent Operation: Without the need for large air-handling units and ductwork, radiant cooling systems operate much more quietly than their air-based counterparts, contributing to a more peaceful and conducive indoor environment.
e. Architectural Flexibility: Radiant systems offer greater flexibility in building design. Since the system's cooling components are embedded in the building structure, there is

no need for bulky air ducts or vents, allowing for more open and aesthetically pleasing spaces.

Challenges and Considerations

While radiant cooling systems offer significant advantages, Mr. Abellon also highlighted some of the challenges and considerations that come with implementing this technology. One of the primary concerns is humidity control. Since radiant cooling relies on cool surfaces absorbing heat from the surrounding environment, if humidity levels are too high, condensation can form on the chilled surfaces. This can be a serious problem, especially in climates with high humidity, leading to water damage or Mold growth.

To address this, it is essential to have dehumidification systems in place when using radiant cooling, especially in areas with high humidity. Mr. Abellon also explained the importance of proper building insulation to maximize the effectiveness of radiant cooling. Poor insulation can lead to excessive heat gain or loss, undermining the system's efficiency. Moreover, installation costs for radiant cooling systems can be higher than traditional systems, especially in retrofit projects. However, the long-term energy savings and enhanced occupant comfort often justify the initial investment.

Practical Applications and Case Studies

During the workshop, Devin Abellon shared several case studies and real-world applications of radiant cooling systems. One notable example was a high-performance office building in a hot and arid climate that successfully implemented a radiant cooling system to achieve substantial energy savings while maintaining occupant comfort. The case study highlighted the system's ability to integrate seamlessly with other sustainable building technologies, such as solar energy and natural ventilation, further enhancing its energy efficiency.

Mr. Abellon also discussed the growing adoption of radiant cooling in commercial buildings, hospitals, and educational institutions, where maintaining a comfortable and healthy indoor environment is paramount. The participants were particularly interested in learning how radiant cooling could be applied to different building types and climates, and the discussion provided valuable insights into how this technology could be adapted to various design challenges.

Conclusions

The workshop concluded with a dynamic Q&A session, where students and faculty had the opportunity to ask Devin Abellon, P.E., in-depth questions about radiant cooling systems and their future in the global HVAC market. Mr. Abellon expressed optimism about the increasing demand for energy-efficient and sustainable building solutions and encouraged students to continue exploring innovations in HVAC technology.

In summary

The workshop on Radiant Cooling Systems provided attendees with a comprehensive understanding of this energy-efficient technology, its benefits, and the challenges involved in its implementation. The event, organized by ASHRAE MAIT, served as an excellent platform for students and professionals alike to deepen their knowledge and engage in meaningful discussions about the future of cooling technologies in sustainable building design.

This workshop not only enhanced the participants' technical knowledge but also underscored the importance of developing innovative solutions to tackle the energy challenges of tomorrow.

Event Photos