



Your Guide to the



2022 WINTER CONFERENCE

Jan 29-Feb 2 | AHR EXPO Jan 31-Feb 2

Technical program • Social events schedule • ALI education courses • Maps of meeting areas



January 29 – February 2, 2022 – Las Vegas, NV
ASHRAE Celebrates the Return to In-Person Events!

Table of Contents

Schedule at a Glance	2	Life Members' Lunch	35
Venue Floor Plans	8	Members' Night Out	35
Chapter and Society Officials ..	13	Companion Guide	35
General Information	15–30	Sponsor Events	36
Health and Safety	15	Tips for First Time Attendees ..	40
Hybrid Sessions, Meetings and Networking Opportunities ...	16	Awards Presentation	42
Internet Access	20	Past and Future ASHRAE Conferences	46
Conference Policies	20	Rooms and Hours	47
Technical Program Information	21	Tours	49
AHR Expo	23	ALI Courses	51–58
In Case of an Emergency	24	Full-Day Professional Development Seminars	51
Meals and Restaurants	26–27	Half-Day Short Courses	52
Things To Do in Las Vegas ...	28	Virtual Q&A Sessions	57
Family Services	29	Technical Program	59–90
Mothers' Room	30	Session Types	59
Lost and Found	30	Packages	60
Event Details	31–38	Sunday	61
Student Welcome	31	Monday	70
Plenary and Keynote Address	31	Tuesday	76
YEA and Student Mixer	32	Wednesday	84
Welcome Party	32	Committee Meetings ...	91–112
Student Program	33	Standing Committees	91
Networking Coffee Break ...	33	Technical Committees	94
YEA Hospitality Reception ...	33	Project Committees	101
Women in ASHRAE Breakfast	33	International Standards and Misc. Meetings	108
President's Lunch	34	Virtual Committee Meetings Listing	108
Fun Run 5K	34		

ASHRAE 365 App

Download **ASHRAE 365** to guide you through the conference.

- ✓ Conference notifications
- ✓ Chat with virtual attendees during live streamed sessions
- ✓ Venue floor plans
- ✓ Visit virtual sponsor kiosks and join a video chat
- ✓ Las Vegas-area information
- ✓ Participate in polls and complete speaker evaluations
- ✓ Connect with attendees.
- ✓ Customize your schedule



After the conference, ASHRAE 365 will be available year-round to provide you with the latest information and resources from ASHRAE, including new exclusive Tech Hour videos and ASHRAE Journal Podcast Episodes. Learn more at ashrae.org/365

SCHEDULE AT A GLANCE


For a full schedule of all meetings, events and sessions, download the **ASHRAE 365** app and select the **2022 ASHRAE Winter Conference**. You can build your custom schedule on your smart phone or tablet. Use the "Schedule" feature to view the full conference schedule. Filter by session/event type, track, level, day or room name.

All meetings and events are in **Conference Center** located in the **Palace Tower** on the Emperor (E), Promenade (P), or Promenade South (PS) levels at **Caesars Palace** unless noted below.

Friday, January 28

TIME	EVENT NAME	LOCATION
8:00 am–5:00 pm	Committee Meetings	Meetings rooms in Conference Center (E, P, PS)
10:00 am–5:00 pm	Registration and Bookstore	Augustus I/II (E)

Saturday, January 29

TIME	EVENT NAME	LOCATION
7:15 am–6:00 pm	Registration and Bookstore	Augustus I/II (E)
7:30 am–3:00 pm	ASHRAE Member Lounge	Entrance through Octavius 4 and 11 (PS)
7:30 am–3:00 pm	Companion Lounge	Octavius 8 (PS)
8:00 am–3:00 pm	Committee Meetings	Caesars Meeting Rooms (E, P, PS)
8:00 am–3:00 pm	ALI Professional Development Seminars <i>ticket required</i>	Pompeian I, II, III (P)
12:00 pm–3:00 pm	ALI Short Course <i>ticket required</i>	Pompeian IV (P)
1:00 pm–3:00 pm	Speakers' Lounge	Augustus I/II (E)
1:00 pm–3:00 pm	Student Welcome	Palace III (E)
2:30 pm–3:00 pm	NEW! Dedicated Sponsor Virtual Kiosk Time	<i>Find "Sponsors" in the app</i>
3:15 pm–5:30 pm	Meeting of the Members, Plenary Session* <i>Keynote sponsored by</i> 	Palace I/II (E) <i>*livestreamed session</i>
5:00 pm–6:30 pm	YEA and Student Mixer	Palace III (E)
6:30 pm–8:30 pm	Welcome Party <i>ticket required</i> <i>Dress warmly!</i> <i>Party is outdoors.</i>	Garden of the Gods Pool Oasis

Sunday, January 30

TIME	EVENT NAME	LOCATION
7:00 am-5:00 pm	Speakers' Lounge	Augustus I/II (E)
7:00 am-5:00 pm	Registration and Bookstore	Augustus I/II (E)
7:30 am-4:00 pm	ASHRAE Member Lounge and TC Collaboration Area	Entrance through Octavius 4 and 11 (PS)
7:30 am-3:00 pm	Companion Lounge	Octavius 8 (PS)
8:00 am-4:45 pm	Technical Sessions <i>*livestreamed sessions</i>	Augustus III/IV*, Augustus V/VI (E), Milano I-III, Milano V-VII (P) Neopolitan I-II, Neopolitan III-IV (P)
8:00 am-5:00 pm	Committee Meetings	Caesars Meeting Rooms (E, P, PS)
9:00 am-9:30 am	Networking Coffee Break	Milano Foyer (P)
10:00 am-2:00 pm	Student Program	Palace III (E)
1:00 – 5:00 pm	General Tour: Hoover Dam <i>ticket required</i>	Buses depart Tour Lobby entrance located in Forum Tower Casino near the Colosseum Gift Store
1:30 pm-5:30 pm	Board of Directors Meeting	Palace I/II (E)
3:00 pm-5:00 pm	Technical Tour: Resorts World Central Plant <i>ticket required</i>	Buses depart Tour Lobby entrance located in Forum Tower Casino near the Colosseum Gift Store
3:30 pm-4:00 pm	Sponsor Tech Talk <i>featuring</i>  TURNTIDE Technology for Sustainable Operations	Neopolitan I/II (P) <i>See page 37 for session details</i>
3:30 pm-6:30 pm	ALI Short Courses <i>ticket required</i>	N258, N260, N262, N264 North Hall, LVCC
4:00 pm-6:00 pm	Young Engineers in ASHRAE (YEA) Hospitality Reception <i>sponsored by</i>  Bell & Gossett <i>a xylem brand</i>	Emperors II (E)

SCHEDULE AT A GLANCE, continued

Monday, January 31

TIME	EVENT NAME	LOCATION
7:00 am-12:15pm	Speakers' Lounge	Augustus I/II (E)
7:00 am-5:00 pm	Registration and Bookstore	Augustus I/II (E)
7:00 am-8:30 am	Women in ASHRAE Breakfast <i>ticket required</i>	Palace III (E)
7:30 am-4:00 pm	ASHRAE Member Lounge and TC Collaboration Area	Entrance through Octavius 4 and 11 (PS)
7:30 am-3:00 pm	Companion Lounge	Octavius 8 (PS)
8:00 am-12:00 pm	Technical Sessions <i>*livestreamed sessions</i>	Augustus III/IV*, Augustus V/VI (E), Milano I-III, Milano V-VII (P) Neopolitan I-II, Neopolitan III-IV (P)
8:30 am-11:30 am	ALI Short Courses <i>ticket required</i>	N258, N260, N262 LVCC, North Hall
8:00 am-5:00 pm	Committee Meetings	Caesars Meeting Rooms (E, P, PS)
9:30 am-11:00 am	Meet and Greet	Octavius 9 (PS)
10:00 am-6:00 pm	AHR Expo	LVCC – North and Central Hall
12:15 pm-2:00 pm	President's Luncheon <i>ticket required</i>	Palace I/II (E)
1:30 pm-4:00 pm	Speakers' Lounge	Augustus I/II (E)
2:15 pm-3:45 pm	Technical Session	Augustus III/IV (E)
2:30 pm-4:00 pm	Technical Tour: Planet 13 Marijuana Production and Cultivation Facilities Tour 1 <i>ticket required</i>	Buses depart Tour Lobby entrance located in Forum Tower Casino near the Colosseum Gift Store
2:30 pm-5:30 pm	General Tour: Las Vegas Strip Tour <i>ticket required</i>	Buses depart Tour Lobby entrance located in Forum Tower Casino near the Colosseum Gift Store
2:45 pm-5:45 pm	ALI Short Courses <i>ticket required</i>	N258, N260, N262 LVCC, North Hall
4:00 pm-5:30 pm	Technical Tour: Planet 13 Marijuana Production and Cultivation Facilities Tour 2 <i>ticket required</i>	Buses depart Tour Lobby entrance located in Forum Tower Casino near the Colosseum Gift Store
After 5:00 p.m.	Regional Dinners <i>Sign up in advance</i>	Info posted at Registration Augustus I/II

Tuesday, February 1

TIME	EVENT NAME	LOCATION
6:30 am-7:30 am	Fun Run and Walk	Caesars Palace Main Entrance
7:00 am-5:00 pm	Speakers' Lounge	Augustus I/II (E)
7:30 am-4:30 pm	Registration and Bookstore	Augustus I/II (E)
7:30 am-4:00 pm	ASHRAE Member Lounge and TC Collaboration Area	Entrance through Octavius 4 and 11 (PS)
7:30 am-3:00 pm	Companion Lounge	Octavius 8 (PS)
8:00 am-4:45 pm	Technical Sessions <i>*livestreamed sessions</i>	Augustus III/IV*, Augustus V/VI (E), Milano I-III, Milano V-VII (P) Neopolitan I-II, Neopolitan III-IV (P)
8:00 am-5:00 pm	Committee Meetings	Caesars Meeting Rooms (E, P, PS)
9:00 am-12:00 pm	ALI Short Courses <i>ticket required</i>	N258, N260, N262 LVCC, North Hall
9:00 am-4:00 pm	ALI Professional Development Seminar <i>ticket required</i>	N264, LVCC North Hall
10:00 am-6:00 pm	AHR Expo <i>Shuttles depart at Caesars Tour Lobby</i>	LVCC North and Central Hall
11:00 am-5:15 pm	Technical Sessions at the AHR Expo	N235/N237, LVCC North Hall
12:00 pm-1:30 pm	Life Members' Lunch <i>ticket required</i>	Florentine IV (P)
1:00 pm-4:00 pm	ALI Short Course <i>ticket required</i>	N258, N260, LVCC North Hall
1:30 pm-4:30 pm	Technical Tour: SNWA's River Mountains Water Treatment Facility <i>ticket required</i>	Buses depart Tour Lobby entrance located in Forum Tower Casino near the Colosseum Gift Store
2:00 pm-5:00 pm	General Tour: Mob Museum <i>ticket required</i>	Buses depart Tour Lobby entrance located in Forum Tower Casino near the Colosseum Gift Store
6:15 pm-10:00 pm	Reception and Members Night Out <i>ticket required</i>	Palace I (E)

SCHEDULE AT A GLANCE, continued

Wednesday, February 2

TIME	EVENT NAME	LOCATION
7:00 am-1:00 pm	Speakers' Lounge	Augustus I/II (E)
7:30 am-11:00 am	Registration	Augustus I/II (E)
7:30 am-1:00 pm	Bookstore	Augustus I/II (E)
7:30 am-1:00 pm	ASHRAE Member Lounge and TC Collaboration	Entrance through Octavius 4 and 11 (PS)
7:30 am-1:00 pm	Companion Lounge	Octavius 8 (PS)
8:00 am-12:30 pm	Technical Sessions <i>*livestreamed sessions</i>	Augustus III/IV*, Augustus V/VI (E), Milano I-III, Milano V-VII (P) Neopolitan I-II, Neopolitan III-IV (P)
8:00 am-2:00 pm	Committee Meetings	Caesars Meeting Rooms (E, P, PS)
10:00 am-6:00 pm	AHR Expo <i>Shuttles depart at Caesars Tour Lobby</i>	LVCC North and Central Hall
2:00 pm-6:00 pm	Board of Directors Meeting	Roman I/III (P)

notes

VENUE FLOOR PLANS

Caesars Palace

3570 S Las Vegas Blvd, Las Vegas, NV 89109

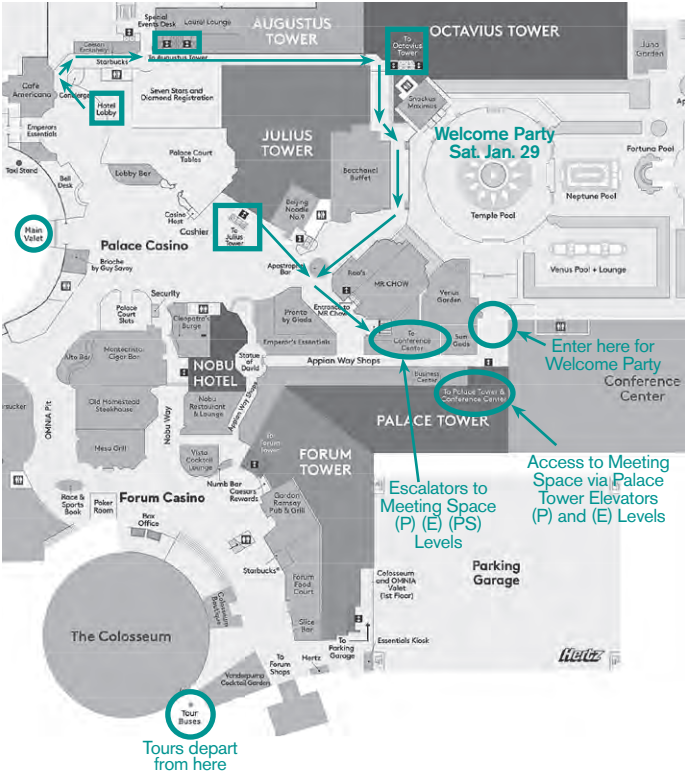
The Caesars Palace meeting space is in the Conference Center which is in the Palace Tower. Below you will find a map with the quickest, least smoky paths to the meeting space. Guests can access the Conference Center by walking through the Palace Casino past the Julius Tower and Mr. Chow restaurant. For guests staying in the Palace Tower, the meeting space is accessible via the Palace Tower elevators. The meeting space is on three floors: Promenade South (PS), the Promenade Level (P), and Emperors Level (E).

The meeting rooms are grouped by name:

Promenade South (PS)	Promenade (P)	Emperors (E)
Octavius 1-2	Anzio	Palace I/II
Octavius 3	Capri	Palace III
Octavius 4	Florentine I, II, III, IV	Sicily
Octavius 5-6	Genoa	Tarranto
Octavius 7	Roman I, II, III, IV	Venice
Octavius 8	Messina	Emperor I
Octavius 9	Livorno	Emperor II
Octavius 10	Consul Boardroom	Office 6
Octavius 11	Senate Boardroom	Augustus I/II
Octavius 12-14	Pompeian I, II, III, IV	Augustus III/IV
Octavius 15	Siena	Augustus V/VI
Octavius 16	Naples	
Octavius 17-18	Modena	
Octavius 19	Palermo	
Octavius 20	Pisa	
Octavius 21	Trevi/Turin	
Octavius 22	Verona	
Octavius 23	Imperial Boardroom	
Tuscany	Salerno	
Umbria	Sorrento	
	Milano I-III	
	Milano IV	
	Milano V-VII	
	Milano VIII	
	Neopolitan I/II	
	Neopolitan III/IV	

Caesars Palace – Resort Map

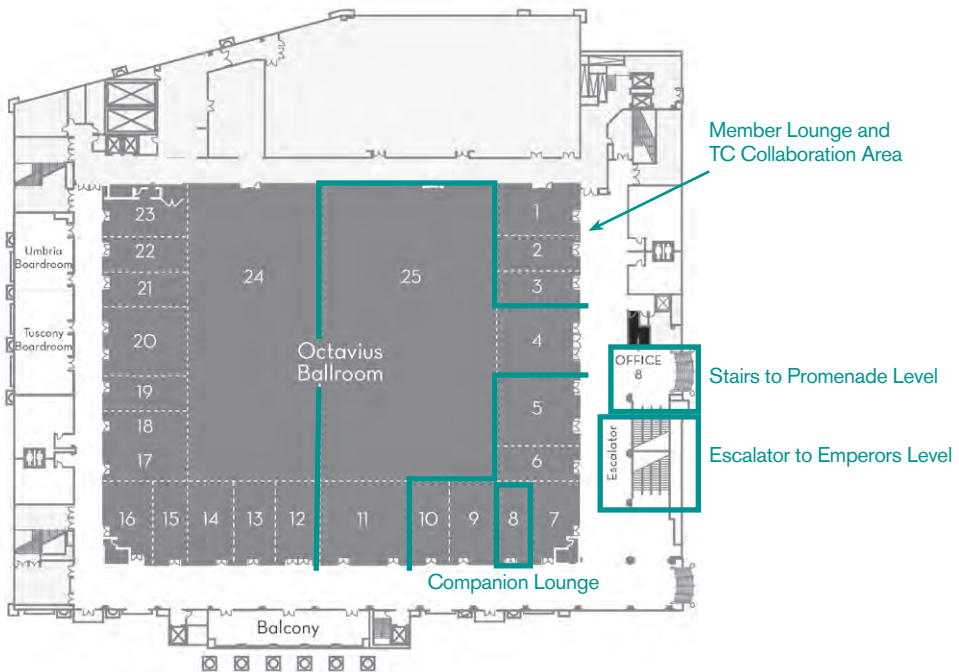
Search the “Event Logistics” section in the ASHRAE 365 app for an interactive map of Caesar’s Palace Resort to find your way around, browse shops, restaurants, and casino locations. The map below highlights important areas related to the 2022 ASHRAE Winter Conference.



Follow the → path for less-smoky walking routes from the Julius, Octavius and Augustus Towers to the meeting space in the Conference Center.

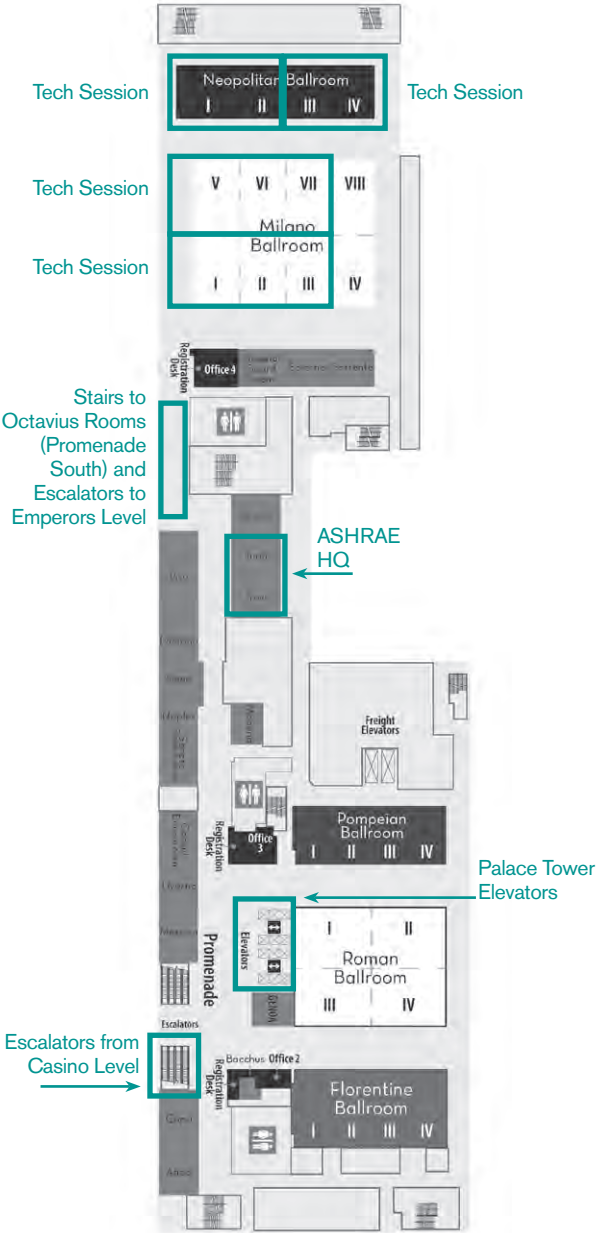
Caesars Palace – Promenade South Level (PS)

From the Promenade level, take second set of stairs up to the Promenade South



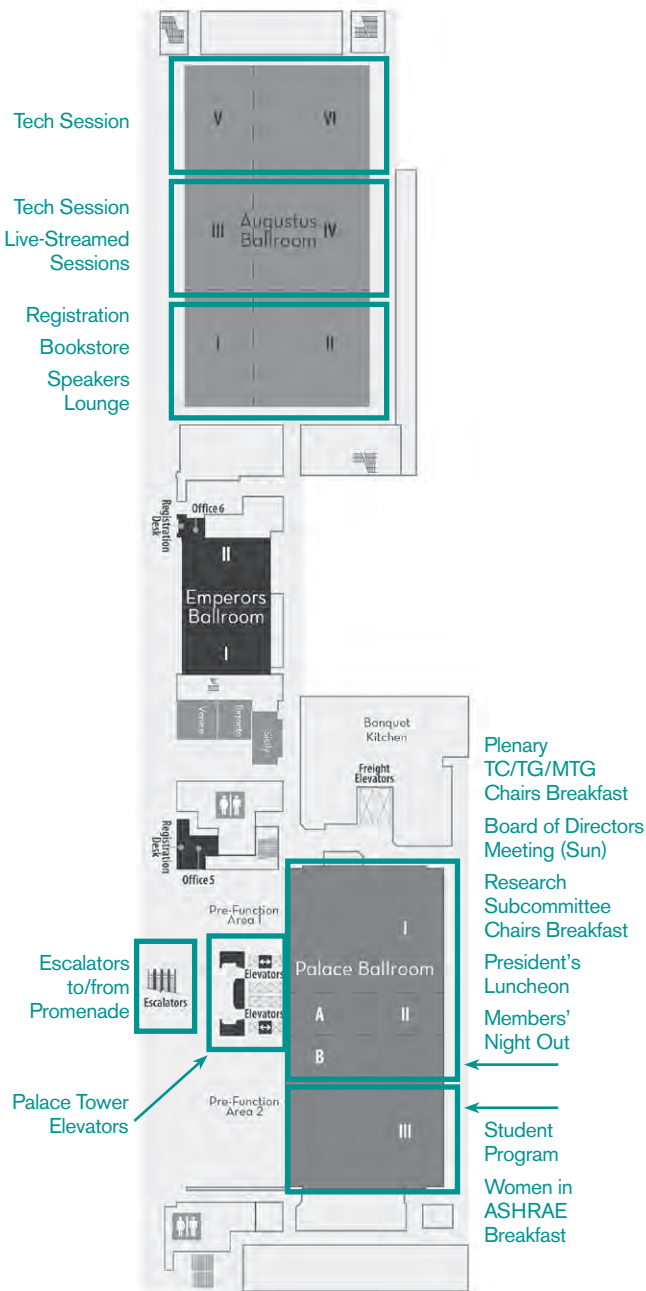
Caesars Palace – Promenade Level (P)

From the Hotel Lobby, follow signage through the Palace Casino towards the “Conference Center” located past the Julius Tower and Mr. CHOW restaurant. The Conference Center escalators to Promenade Level are located across from Pronto by Giada. The Conference Center can be accessed by the elevator for guests staying in the Palace Tower.



Caesars Palace – Emperors Level (E)

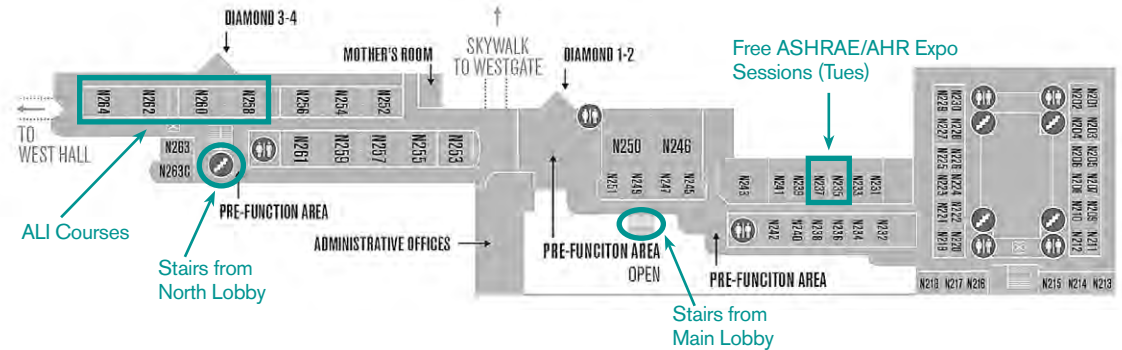
From the Promenade Level, take the escalator marked below to the Emperors Level or use the Palace Tower elevators noted below.



Las Vegas Convention Center (LVCC) – North and Central Halls

3150 Paradise Rd, Las Vegas, NV 89109

Free shuttle buses will be operating on 20-minute intervals for transportation to and from the Las Vegas Convention Center for the AHR Expo, ALI Courses and other ASHRAE events happening at the Las Vegas Convention Center. ALI Courses and free ASHRAE sessions will be in the North Hall on the second level. The ASHRAE booth is located at C2906. See page 23 for more information regarding the shuttle bus schedule Monday – Wednesday.



CHAPTER AND SOCIETY OFFICIALS

Thank You to our Volunteers

LAS VEGAS HOST COMMITTEE

General Chair: Lance Banks

Vice Chairman: Soren Peterson

Entertainment: Tracey Jumper

Tours: Jeron Hogan, Amber Aguilar, Ryan Calahan

Sessions: Matt Dolan

Sponsorships: Amanda Catania
Keaton Frerker

CONFERENCES AND EXPOSITIONS COMMITTEE

Chair: Vikrant Aute

Rupesh Iyengar

Vice Chair:

Alekhya Kaianathbhatta

Christine Reinders-Caron

Rafi Karim

Conference Chair:

Suzanne LeViseur

Raul Simonetti

Maggie Moninski

Ahmed Abdel Salam

Scott Peach

George (Billy) Austin, Jr.

Anoop Peediyakkan

Nohad Boudani

Bert Phillips

Marites Calad

Erik Sanchez

Kristen Cetin

Som Shrestha

Andrew Cochrane

Marianna Vallejo

Robert Cox

Davide Ziviani,

Gary Debes

Devin Abellon,

Brian Fronk

BOD Ex-Officio

Lina Maged Hashem

Farooq Mehboob,

Stephen Idem

Coordinating Officer

SOUTHERN NEVADA CHAPTER OFFICERS

President: Keaton Frerker

President-Elect: Soren Peterson

Secretary: John Bowman

Treasurer: Ryan Calahan

ASHRAE OFFICERS

President: Mick Schwedler

President-Elect: Farooq Mehboob

Treasurer: Ginger Scoggins

Vice President: Tim McGinn

Vice President: Don Brandt

Vice President: Sarah Maston

Vice President: Dunstan Macauley

CEC VEGAS PLANNING AD HOC

Thank you to this group of members who helped navigate the return of in-person and hybrid ASHRAE conferences and committee meetings.

CEC Chair: Vikrant Aute

CEC Vice Chair: Christine Reinders-Caron

Las Vegas Conference Chair: Raul Simonetti

CEC ExCom: Kristen Cetin

CEC ExCom: Gary Debes

CEC ExCom: Marianna Vallejo

CEC BOD Ex-Officio: Devin Abellon

TAC Representative: Larry Smith

SPLS Representative: Doug Fick

CONFERENCE SPONSORS



Engineering Air for a Cleaner World™

Keynote, On-Demand Sessions and
Know Before You Go Email Sponsor



CLIMATE CONTROL GROUP

A **NIBE** GROUP MEMBER

Livestream Sponsor



TURNTIDE

Tech Talk
Sponsor



Particle

Tech Talk
Sponsor



Bell & Gossett

a **xylem** brand

YEA Hospitality Reception Sponsor



Know Before You Go Email Sponsor

GENERAL INFORMATION

Health and Safety

The 2022 ASHRAE Winter Conference in Las Vegas will mark Society's first large in-person event since the COVID19 pandemic. ASHRAE created a Commitment to Care with the health and safety of our members and conference attendees in mind.

Visit the [Health and Safety](#) section of [ashrae.org/2022winter](#) or the [ASHRAE 365 app](#) for more information related to onsite Health and Safety protocols and guidelines.

FEELING SICK?

Dial "0" from any Caesars phone and ask for Emergency Security Assistance or dial (702) 731-7266 from a personal phone.

Please do not leave your guest room if you experience any of the following new or unexpected symptoms during the Conference:

- Fever or feeling feverish (chills, sweating)
- New cough
- Difficulty breathing
- Sore throat
- Muscle aches or body aches
- Vomiting or diarrhea
- New loss of taste or smell

If you are experiencing at least one of these symptoms and can't leave your guest room – don't worry! You can tune into conference sessions and events on your laptop, and you won't miss a beat! See the next section called "Hybrid Sessions and Meetings" for more information.

INTERNATIONAL TRAVEL

Visit [ahrexpo.com/international-travel](#) for more information about fast and convenient COVID testing available at the AHR Expo at the Las Vegas Convention Center.

Visit the Health and Safety section of [ashrae.org/2022winter](#) or the ASHRAE 365 app for more information related to local testing facilities in Las Vegas.

Hybrid Sessions, Meetings and Networking Opportunities

ASHRAE will livestream the Plenary, President's Luncheon and select Technical Sessions during the conference. Some committee meetings will also be available for both in-person and virtual attendees. All attendees, both in-person and virtual, have access to the Virtual Environment and can watch and participate in live stream sessions from anywhere: your home, your office or even your hotel room!

LIVESTREAM SESSION SCHEDULE

Livestream sponsored by



CLIMATE CONTROL GROUP

A NIBB GROUP MEMBER

The following sessions will be livestreamed to virtual attendees. In-person attendees will have access to the Virtual Environment, too! Even though you are here in Las Vegas you can still access the Virtual Environment:

- Watch live streamed session(s) from your hotel room.
- Chat with other virtual and in-person attendees during these sessions.
- Enter questions in the Q&A box for presenters during these sessions.
- Watch recordings of the live streamed sessions later, take a quiz and download a PDH certificate.

SATURDAY, JANUARY 29

TIME	EVENT NAME	Location
3:15– 5:30 pm	Meeting of the Members, Plenary Session <i>Keynote sponsored by</i>  <small>Engineering Air for a Cleaner World™</small>	Palace I/II <i>See page 31</i>

SUNDAY, JANUARY 30

TIME	EVENT NAME	Location
8:00– 9:00 am	Seminar 4: Opportunities and Barriers for Self-Powered and Integrated HVAC <i>Energy System Integration</i>	Augustus III/IV <i>See page 62 for description</i>
3:30– 4:00 pm	Sponsor Tech Talk with Turntide Technologies <i>Technology for Sustainable Operations: How Incorporating Sustainability Into Your Digitization Strategy Drives HVAC Efficiencies and Brand Value</i> <i>sponsored by</i>  TURNTIDE	Neopolitan I/II

Livestream sessions continued on next page

MONDAY, JANUARY 31

TIME	EVENT NAME	Location
8:00– 9:30 am	Seminar 18: Lubricants for New Low GWP Refrigerant Candidates <i>Refrigerants and Refrigeration</i>	See page 72
9:45– 10:45 am	Seminar 20: HVAC Design, Control and Operation of Hospitals After COVID-19 Fiasco <i>Environmental Health and IEQ in the International Arena</i>	See page 73
11:00 am– 12:00 pm	Seminar 24: The Future of Controls: Transition from Algorithmic to Predictive Control <i>HVAC&R Systems and Equipment</i>	See page 75
12:15– 2:00 pm	President's Luncheon 2021–2022 ASHARE President, Mick Schwedler	Palace I/II See page 34

TUESDAY, FEBRUARY 1

TIME	EVENT NAME	Location
8:00– 9:30 am	Seminar 28: Understanding and Applying Gas-Fired Low Intensity Infrared Radiant Heat Systems in Industrial Facilities <i>HVAC for Industrial and Commercial Purposes – Challenges and Opportunities</i>	See page 78
9:45– 10:45 am	Seminar 29: Cutting-Edge Japanese Technologies: 2021 SHASE Annual Award Winners for Buildings in Special Environments <i>HVAC&R Systems and Equipment</i>	See page 79
11:00 am– 12:30 pm	Seminar 31: High Efficiency Variable Speed Pumping Systems and Integration Challenges with Chiller Plan Design <i>Buildings at 360°</i>	See page 81

WEDNESDAY, FEBRUARY 2

TIME	EVENT NAME	Location
8:00– 9:30 am	Seminar 37: Reduced Order Modeling for HVAC&R Systems and their Components <i>HVAC&R Systems and Equipment</i>	See page 86
9:45– 10:45 am	Seminar 39: Transmission of Aerosols in Dental Treatment Rooms <i>Environmental Health and IEQ in the International Arena</i>	See page 87
11:00 am– 12:00 pm	Seminar 44: Upgrading Existing Building Control Systems for High Performance Operation <i>Buildings at 360°</i>	See page 90

HOW TO ACCESS LIVESTREAMED SESSIONS

To access using your laptop, visit ashrae.org/2022winter and click the “Virtual Environment” button at the top of the page. Login using the email address you registered with and go to the Theater to find the session you want to watch.

To access using your phone or tablet, go to schedule in the ASHRAE 365 app and click the link to watch the session. Enter your email address you registered with and use the chat box to connect with other attendees and ask questions during the presentation.

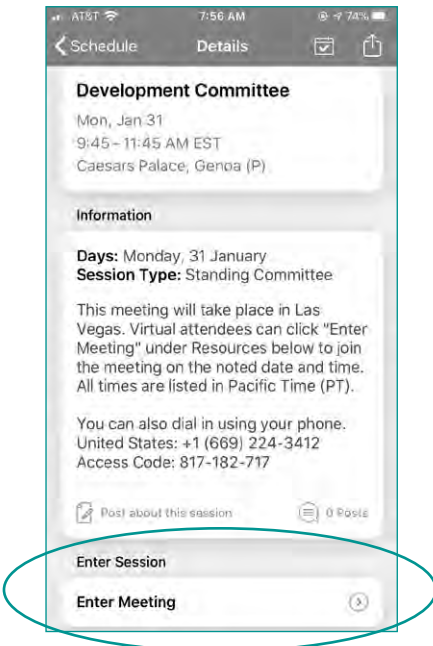
Attendees who registered and paid a conference registration fee will have access to the livestreamed sessions and Virtual Environment.

HYBRID COMMITTEE MEETINGS

Some main Standing, Technical (TC) and Project (PC) committees will also be hybrid. This means that not only will a group of members meet in-person in Las-Vegas, but remote attendees will have the opportunity to join virtually to achieve quorum.

A list of all meetings taking place at Caesars Palace are listed on pages 91-112. Meetings that have hybrid capabilities will be marked with an “(H)” and links to join these meetings are available in the ASHRAE 365 app and on the schedule posted on ashrae.org/2022winter. Simply click the meeting you want to attend and if it has hybrid capabilities you will be able to click “Enter Meeting” to join virtually.

The committee meeting schedule and applicable web meeting links are accessible to all attendees.



NETWORKING

In-Person and Virtual attendees can chat and network throughout the conference using the Virtual Environment. From your laptop, visit ashrae.org/2022winter and click the “Virtual Environment” button, enter your email address and visit the **Networking Lounge** to chat with attendees from all over the world – including ones onsite with you in Vegas! Other virtual networking opportunities include:

- Start a discussion on the Message Boards tab in the virtual Networking Lounge
- Score some points and earn Badges for prizes by clicking “Badges” on the top navigation
- Update your profile by clicking on “Tools” and “My Profile”
- Send a virtual business card, V-Card, or message to other in-person or virtual attendees while setting up your profile

ENGAGE WITH SPONSORS

From your laptop, visit ashrae.org/2022winter and click on the “Virtual Environment” button. Enter your email address and navigate to the Sponsor Hall. You will be able to see Conference Sponsor’s kiosk and learn more about their products and services.

You can also chat or video chat with sponsor representatives in their kiosks during these times:

Saturday, Jan. 29	2:30-3:00 pm
Sunday, Jan. 30	3:30-4:00 pm
Monday, Jan. 31	2:30-3:00 pm
Tuesday, Feb. 1	1:00-1:30 pm
Wednesday, Feb. 2	1:00-1:30 pm

For more information about our Conference sponsors go to page 14.

EARN BADGES AND WIN A PRIZE!

Get in the game! This is your chance to win while participating in the 2022 ASHRAE Winter Conference. ASHRAE is giving away a prize for 5 lucky winners who earn badges throughout this hybrid event. Earn a badge from the categories below and be automatically entered to win a prize. Prizes will be selected from the ASHRAE logo store. Earn the ‘Engager’ badge to be entered to win a \$100 gift card! Winners are randomly selected from each of the 4 badge categories, and another winner will be selected at random from all badge earners, for a total of 5 prizes. Winners will be contacted to confirm acceptance of prize and shipping address.

All badges are earned through participation in the conference Virtual Environment. **To access from your laptop**, visit ashrae.org/2022winter and click the “Virtual Environment” button and enter your email address to login. Navigate to the Badges section. **From your mobile device**, go to the ASHRAE 365 app and click on the Badge section and login with your email address.



Society Leader badge

Participate in the group chat in the Virtual Environment at the Meeting of the Members Plenary Session and President's Luncheon.



ASHRAE Influencer badge

Complete your profile in the Virtual Environment (including picture) and engage with your fellow in-person and virtual attendees throughout the event.



ASHRAE Master Achievement badge

This badge of distinction is awarded to those who are leaders in socializing and participation in the Virtual Environment. They have updated their profile, shared event information to their social media profiles, chatted with attendees through the Virtual Environment, and viewed at least 4 sessions for 30 minutes each.



Engager badge

This badge is earned when attendees visit the Sponsor Hall in the Virtual Environment for a minimum of 10 minutes.

Internet Access

Wireless internet will be available in all meeting rooms at Caesars Palace. Due to the number of users, please limit usage to functions that do not use excessive bandwidth such as Facebook, YouTube, streaming videos, etc.

Network: ASHRAE

Password: weareback!

For attendees staying at Caesars Palace, the resort fee includes daily use of internet available throughout the property, including your guest room and the meeting space. The front desk will provide network name and password when attendees check-in.

Conference Policies

RECORDINGS

ASHRAE regards the materials presented at these sessions to be the unique work of ASHRAE and exercises control over the dissemination and/or use of such products in the future. Accordingly, video and audio recording of this program is not allowed without ASHRAE's prior written consent.

COMPANY-SPONSORED HOSPITALITY SUITE POLICY

Hospitality suite hours must not conflict with ASHRAE meetings or social functions. Product displays, literature handouts, posting of signs in hotel lobbies or hallways and commercial advertising or recruiting are not allowed in Caesars Palace.

SALE OF MERCHANDISE

Sale of merchandise, or the solicitation to sell merchandise, of any type at the Annual and Winter Conferences will only be permitted by prior approval of the Conferences and Expositions Committee and any surplus will go to the Society.

SIGNS/DISPLAY OF AFFILIATE MEETING INFORMATION

Signs and information concerning affiliate or related organizations must be approved by the Society prior to display. No signs are to be attached to walls and all signs must be professionally printed.

PHOTO RELEASE

Photographs will be taken at the ASHRAE Winter Conference. By registering for this conference, you agree to allow ASHRAE to use your photo in any Society level communication, publication, or marketing material.

Technical Program Information



BADGE SCANNING AND SESSION EVALUATIONS

Badges must be worn for admission to the technical program. Your badge will be scanned as you enter a technical session. ASHRAE will email you a summary of all sessions attended after the conference. To complete technical program speaker and session evaluations, please access the ASHRAE 365 app. The evaluations can be accessed by clicking on each session attended within the app. If you registered as “Committee Meeting Only” you will not have access to the Technical Program. To upgrade your registration to receive access to the technical program please visit the registration desk in Augustus I/II (E).

PROFESSIONAL DEVELOPMENT HOURS (PDHS)

All of the sessions presented in the technical program are approved for professional development hours (PDHs), including State of Florida PDHs.

In addition, some sessions have been submitted for approval for the State of New York PDHs and AIA Learning Units.

Those programs are indicated with a  symbol. Others have been submitted for LEED AP credits and are indicated with a  symbol. Certain sessions may be acceptable for ASHRAE certification renewal. Send questions to certification@ashrae.org.

Sign-in sheets are available in the session room for AIA licensees. Sessions are approved for 1, or 1.5 PDHs depending on the length of the session.

CONFERENCE PAPERS

NEW! All registered conference attendees will have free access to papers presented in the paper sessions. Visit ashrae.org/2022winter and click “Virtual Environment” and enter your email address that you registered with. Visit the “Resource Center” to view and download copies of the Conference Papers. Final papers are also published in ASHRAE Transactions. All papers published between the years 1980–1997 may be searched online in the Abstract Archive Center. Access to the Abstract Archives is a member benefit. For ordering information, contact ASHRAE Customer Service at 1-800-527-4723 or cservice@ashrae.org.

WATCH SESSIONS ON-DEMAND LATER

Don't miss the state-of-the-art concepts and latest design techniques presented in the Society's technical program available on-demand after the conference. All sessions presented live in Las Vegas will be recorded and available to watch on-demand until February 2023. Attendees will be able to view presentations and to interact with an online audience through a discussion board. All registered and paid conference attendees will receive an email notification when sessions are available for viewing. To access the Vegas Technical Program on-demand visit ashrae.org/2022WinterVirtual

Access to the Vegas Technical Program On-Demand includes:

- Synced audio and PowerPoint presentations from all, paper sessions, seminars, and workshops.
- Ability to post comments and rate presentations.
- Print presentation slides in notes format.

Presentations are available online for 12 months with the ability to post questions or answers for selected sessions through Wednesday, February 16.

A full slate of technical programs will be posted daily beginning Monday, January 31 through Thursday, February 3, of the sessions that were presented the previous day.

Access to the Vegas Technical Program On-Demand is free with your paid conference registration. To register for access to recordings of the livestreamed sessions, downloadable conference papers and Vegas Technical Program sessions on-demand, register online at ashrae.org/2022winter.

\$350 ASHRAE member; \$515 non-member;
Company Packages available starting at \$1,170.

On-Demand Sessions sponsored by:



SEE NEW PRODUCTS FROM 2,000+ EXHIBITORS

Las Vegas Convention Center, North and Central Halls
3150 Paradise Rd. Las Vegas, NV 89109

If you have registered for the ASHRAE Conference, your conference badge is your admission into the expo.

If you are attending the exposition only and you did not register in advance, the fee for admission is \$30.00 and can be paid at the Las Vegas Convention Center. Registration for the AHR Expo® will be open from Noon to 4:00 p.m. on Sunday, January 30. Starting Monday, you can register one hour before the doors open.

SHOW HOURS:

Monday, January 31	10:00 a.m.–6:00 p.m. (Registration opens at 8:00 a.m.)
Tuesday, February 1	10:00 a.m.–6:00 p.m. (Registration opens at 9:00 a.m.)
Wednesday, February 2	10:00 a.m.–4:00 p.m. (Registration opens at 9:00 a.m.)

You must be 18 years or older to be admitted to the show floor. Ages 16 and 17 will be admitted only if accompanied by an adult.

If you are staying at one of the AHR Expo Official Show hotels, free shuttle bus services will operate between official show hotels (or points nearby) on Show days (Monday – Wednesday). Be sure to check the schedule posted in your hotel lobby to confirm the times and exact pick-up location.

The ASHRAE Headquarters shuttle between Caesars Palace and the Las Vegas Convention Center is free to ASHRAE attendees and will run on 20-minute intervals. Shuttles depart from the Caesars Palace Tour Lobby entrance located in the Forum Casino near the Colosseum Gift Store.

AHR EXPO SHUTTLE BUS HOURS OF OPERATION:

Monday, January 31	7:00 – 11:00 a.m. and 3:30 – 7:00 p.m.
Tuesday, February 1	8:00 – 11:00 a.m. and 3:30 – 7:00 p.m.
Wednesday, February 2	8:00 – 11:00 a.m. and 2:00 – 6:00 p.m.

Masks will be required on all public transportation.

HEALTH AND SAFETY AT THE AHR EXPO

Visit ahrexpo.com/health-safety to learn more about the AHR Expo's health and safety protocols at the Las Vegas Convention Center.

IN CASE OF EMERGENCY

Plan ahead—when you reach your destination, check the location of exits. Walk to the nearest exit; learn the route, obstacles, etc.

CAESARS PALACE

Dial 0 from any hotel phone and ask the operator for Emergency Security Assistance or call (702) 731-7266 from any personal phone. If 911 is called, please also notify the hotel to assist when emergency services arrive on property. If speaking to 911 dispatch, make sure you specify the location as “Caesars Palace” as there are several Caesars properties in Las Vegas.

The address for [Caesars Palace](#) is [3570 S Las Vegas Blvd.](#)

Caesars Palace's Security Officers are CPR, Defibrillator and First Aid certified. The security dispatch room has a direct line with the Police and Fire Department, as well as Medical Emergency Services.

In the event of an emergency, the hotel or facility alarms, both visual and audible, will sound. An announcement will follow stating that the alarm you are hearing is being investigated and to remain where you are and calm until further notice. This same announcement will repeat as the alarm is being investigated. If the alarm is resolved or false, the announcement will state that the alarm has been “investigated and resolved” and to return to your normal operations. If there is credibility to the alarm, the announcement will state that the hotel or facility is being evacuated and to proceed to the nearest emergency exit detailed in our Emergency Evacuation Plan.

LVCC NORTH AND CENTRAL HALLS

In the event of an emergency, please call (702) 892-7400 or 7400 from an LVCC house phone. Las Vegas Convention Center Security should be the first point of contact for any emergency. Calling “911” by individual attendees delays response to an emergency. Las Vegas Convention Center Security should always be called first.

The LVCC Security Office is in the Central Lobby and is staffed 24 hours a day.

All Las Vegas Convention Center Security first responders are certified in CPR and AED.

North and Central Hall First Aid Stations are in the following locations and can be reached by calling (702) 892-7400.

- Near LVCC Security Office, north side of the Central Concourse between Freight Door 11 on the North and Hall C3 on the South
- Opposite Doors of North Plaza Entrance between Freight Doors 3A & 3B

EMERGENCY NUMBERS AND ADDRESSES

Hospitals

University Medical Center
(4.8 mi)
1800 W. Charleston Blvd
(702) 383-2000

Desert Springs Hospital
(2.9 mi)
2075 East Flamingo Rd
(702) 733-8800

Sunrise Hospital
(3.7 mi)
3186 S. Maryland Pkwy
(702) 961-5000

Elite Medical Center
(1.4 mi)
150 East Harmon Ave
(702) 546-0911

Police

**LVPD Convention Center
Area Command**
(2.8 mi)
750 Sierra Vista Dr
(702) 828-6430

Fire

**Clark Co. FD
Fire Station 18**
(1.6 mi)
575 E Flamingo Rd
(702) 455-7316

Pharmacy

CVS Pharmacy
(0.4 mi)
3645 Las Vegas Blvd
(702) 474-4089

SAFETY TIPS

Street Safety. The streets of any city at any time can be unsafe. When you leave your hotel to go out during the day or the evening, make sure you take off your badge. Wearing a badge is an advertisement that you are a visitor to the city and that you are probably unfamiliar with your location.

Walk “smart” when you leave the convention site —know your destination and the best way to reach it. Walk along lighted sidewalks at night and don’t walk alone. Trust your instincts—if you’re uncomfortable with a situation, get out of it.

Hotel Safety. Don’t answer the door in a hotel room without verifying who it is. If a person claims to be an employee, call the front desk and ask if a staff person is supposed to have access to your room and for what purpose. Use the hotel safe-deposit box. When you’re in your hotel room, use all the locking devices provided. Don’t reveal your room number or discuss plans for leaving the hotel within earshot of strangers.

Helpful Information

MEALS

Meals are not included in your conference registration; however, we know that sometimes you have limited time to grab a quick meal between meetings and technical sessions. Based on feedback received from the last conference at Caesars, ASHRAE has coordinated grab-and-go concessions for sale in the meeting space each day.

Concession stations will be located in the Member Lounge which can be accessed via Octavius 4 and Octavius 11 on the Promenade South (PS) level. Concession hours will be:

Saturday 10:00 am–2:00 pm
Sunday 10:00 am–2:00 pm
Monday *Not available*
Tuesday 10:00 am–2:00 pm

RESTAURANTS

Caesar's Palace also has over 15 restaurants on-property with a quick service Forum Food Hall that offers quite bites for pick up or delivery located in the Forum Casino.

STEAK & SEAFOOD

Old Homestead \$\$\$\$ D

ITALIAN

Carmine's \$\$ LD

Rao's \$\$\$\$ D

Amalfi \$\$\$

FRENCH

Restaurant Guy Savoy
\$\$\$\$ D

PROGRESSIVE AMERICAN

Bobby Flay's Mesa Grill
\$\$\$ LDBr

Gordon Ramsay
Hell's Kitchen \$\$ LD

Gordon Ramsay Pub & Grill
\$\$\$ LD

ASIAN

Beijing Noodle No. 9 \$ LD

Mr Chow \$\$\$ D

Nobu \$\$\$\$ D

LOUNGE/BAR*

Alto Bar

Cleopatra's Barge

Montecristo

Vista Lounge

BUFFETS

Bacchanal' Buffet \$\$ DBr

AMERICAN

Café Americano \$\$

CAFÉ GRAB-N-GO

Brioche by Guy Savoy \$ B

FORUM FOOD HALL

**6:00 a.m. – 12:00 p.m. 7
Days a Week**

Bobby's Burgers \$

Earl of Sandwich \$

Smoke & Sizzle \$

Diafara Pizza \$

Taco \$

The Halal Guys \$

Crepes and More \$

Starbucks \$

KEY

\$ - \$30-\$50

\$\$ - \$51-\$75

\$\$\$ - \$76-\$110

\$\$\$\$ - \$111+

B = Serving Breakfast

L = Serving Lunch

D = Serving Dinner

BR = Serving Brunch

CAESARS EATS

Order food from your favorite restaurants using your phone for room delivery or pick-up. Restaurants include:

Pronto by Giada

Daily **6:00am–3:30pm**

Delivery and Pick Up

Di Fara Pizza

Daily **11:00am–11:00pm**

Delivery and Pick Up

Taco

Friday–Sunday

11:00am–11:00pm

Delivery and Pick Up

Beijing Noodle No. 9

Daily **11:00am–9:30pm**

Delivery and Pick Up

Crepes and More

Monday–Thursday

7:00am–1:00pm

Friday–Sunday

7:00am–4:00pm

Delivery and Pick Up

Nobu

Daily **5:00pm–10:00pm**

Delivery and Pick Up

Old Homestead Steakhouse

Sunday–Thursday

5:30pm–9:30pm

Friday – Saturday

4:30pm–10:30pm

Delivery and Pick Up

In-Room Breakfast Delivery

Daily **6:00am–3:30pm**

Delivery to guest room

CAESARS REWARDS APP

Download the Caesars Rewards app and do the following from your phone or tablet:

- Order food for delivery or pick up
- Make spa appointments
- Access mobile concierge for childcare, business center, package center, boarding pass print locations
- Contact housekeeping for personal care items and extra room items
- Report a maintenance problem for your guest room
- Request a wakeup call
- Call the front desk
- Access property maps
- Dining, Show and Things to Do recommendations



LOCAL RECOMMENDATIONS FOR THINGS TO DO IN LAS VEGAS

Stop by the Host Committee desk in Augustus I/II on the Emperors level inside ASHRAE Registration and Bookstore. The Las Vegas host committee will provide “Things to Do” recommendations as well as local restaurants.

Here is a list of the Las Vegas Host Committee members’ favorite things to do, see and eat while in Vegas! Locals know best.

Restaurants

- **Delmonicao Steakhouse:** located at Venetian but amazing steaks and family size sides
- **Beer Park at the Paris:** second floor view and has picnic style seating. Location is great for beers and watching sports.
- **Nora’s Italian Kitchen:** noracuisine.com
- **Le Thai:** lethaivegas.com
- **Monzu Italian Oven:** Great pizza monzulv.com
- **Sand Dollar Lounge:** Great live music and cocktails thesanddollarlv.com

Experiences and Entertainment

- **The Mob Museum:** themobmuseum.org
(see page 50 for info on our featured tour!)
- **Immersive Van Gogh Exhibit:** vangoghvegas.com
- **Peppermill:** Old feel of Vegas but has great drinks and food. Overall experience of being somewhere different (\$\$\$)
- **Circa Hotel:** Located downtown. Sunday would be a good day to walk Fremont street, but the sports bar is the largest! This would be the place to watch all Pro Football playoff games along with sports gambling.
- **Escape Room:** The one at town square is amazing and fun.
- **Virtual Reality (VR) Experiences:** MGM Grand has a great experience through Zero Latency. There are multiple options to choose from on the gaming scenario but the zombie one is great with a group of friends.
- **Red Rock Canyon:** redrockcanyonlv.org (car needed!)

CAESARS PALACE CONCIERGE DESK

Concierge associates can assist guests with restaurant and show reservations, tour bookings, spa reservations, floral referrals, childcare referrals, car rental information, directions, etc. The Caesars Palace concierge staff is available at Hotel Registration located in the hotel lobby opposite of Hotel Registration. The staff is available seven days a week from 7:00am-9:00pm. Hours are subject to change. Please contact the Concierge Desk at (702) 731-7266.

CHILD CARE SERVICES

Caesars Palace recommends the following companies for childcare services while in Las Vegas:

Nannies & Housekeepers USA

nahusa.com • 702-451-0021

A properly licensed, bonded and fully insured agency with nannies, nurses, and professional caregivers available 24/7 in your suite bringing appropriate arts/crafts. \$45/hour 4 hour minimum – up to 3 children*

Artsy Nannies

artsynannies.com • 702-448-4352

Artsy Nannies is there to care for your family's needs 24 hours a day, 365 days per year! Your professional Las Vegas childcare resource! Nannies are equipped with a company issued bright pink bag that contains projects, games, arts and crafts! 3 Hour Minimum with 3 (children) to 1 (provider) ratio \$30 per hour plus \$10 reservation fee.

College Nannies

collegenanniesandtutors.com • 702-620-3366

College Nannies in Las Vegas offers a complete set of babysitting and on-call nanny services for families that are traveling or visiting the city. Our nanny placement manager will match you with the perfect qualified babysitter for your kids so you can enjoy hassle free childcare with no worries. CPR and First Aid Certified 24/7 Availability Licensed and Insured \$37.50/hour with a four-hour minimum*/No Reservation Fee.

DISCLAIMER: Please note, this list is being provided as a courtesy only. The providers above are not operated by or affiliated with Caesars Palace. In addition, Caesars Palace has not conducted any security screenings on these providers or their employees, making no warranty or guarantee as to the quality of their services.

ASHRAE makes no representation as to the quality or suitability of the childcare options available.

ASHRAE has done no investigation or inquiry into these options and accordingly assumes no liability for these services. All participants considering these facilities should perform their own investigation into the quality, suitability or desirability of these childcare facilities.

MOTHERS' ROOM

ASHRAE is pleased to offer a private room to nursing mothers in both locations. Please visit the Registration Desk in Augustus I/II to inquire about access.

Caesars

Office 2
Promenade level (P)

LVCC Central/North

Level 1 North Concourse
Outside N4 Entrance

LVCC North Hall

Level 2 next to N252
Across from N255

LOST AND FOUND

Items found during the conference should be turned into the staff at the following locations:

	Caesars Palace	LVCC
ASHRAE Lost and Found Venue Lost and Found	Staff Headquarters Turin/Trevi (P)	AHR Expo Show Office N250
	Hotel Security (702) 731-7262 or x7262 within hotel	

notes

EVENT DETAILS

Saturday, January 29

STUDENT WELCOME

Palace III (E) | 1:00 – 3:00 p.m.

Hear welcoming remarks from ASHRAE President Mick Schwedler followed by a keynote speaker, grant presentations and an awards ceremony.

Grant Presentation 1: Development of a Residential-Scale Compressor Load Stand to Support Compressor Research, Oklahoma State University

Grant Presentation 2: Air Conditioner Cum Air Sterilizer for Combined Application of Air Heating and Cooling, Maharaja Agrasen Institute of Technology

MEETING OF THE MEMBERS – PLENARY SESSION

Palace I/II (E) | 3:15 – 5:30 p.m.

Kick off the ASHRAE Winter Conference with the opening Plenary session. ASHRAE award winners are recognized and updates on the Society will be presented.

Doors open at 3:00 p.m.

Opening and Welcome Remarks	ASHRAE President, Mick Schwedler
Welcome to Region X	Director and Regional Chair, Devin Abellon
Secretary's Report	Executive Vice President, Jeff Littleton
Awards Presentation	See list of award winners on pages 42–45
Keynote Address	Ann Daniels, record-breaking polar explorer


Polar Explorer Ann Daniels is a world record holder and one of Britain's leading female explorers. Starting out as a mother of young triplets and without any outdoor experience whatsoever, pure hard work and belief led her to being selected from over 200 more experienced women to take part in her first North Pole expedition. From these humble beginnings, she went on to conquer the South Pole and in 2002, became the first woman in history to ski to the



North and South Poles as part of all women teams. Experiencing temperatures as low as -50C and dealing with various encounters with Polar bears, she has sledge-hauled over 2000 miles, in the most inhospitable environments in the world, completing over 10 polar expeditions and surviving over 400 days on the ice. She understands the importance of good planning, hard work and a positive attitude in the most difficult circumstances. As a Polar guide and the only leader of all 3 Catlin Arctic surveys she is living proof that good leadership, teamwork and believing in yourself does make a difference.

Her most recent expeditions in 2017 and 2018 saw Ann working with NASA and the European Space Agency to help scientists understand what is happening in the fragile polar ice cap. She has some exciting projects coming up soon including two major expeditions and a TV drama documentary series.

Her achievements have been recognized by many bodies including the Guinness Book of Records, The Pride of Britain Awards, The Foreign Office and the Women of the Year Awards. She has appeared on TV and radio and along with bringing up her four children is currently working on her next North Pole venture.

Keynote sponsored by: 
Engineering Air for a Cleaner World™

This session will be live streamed to virtual attendees. If for some reason you are not able to attend the Meeting of the Members Plenary session you may watch the session live from your laptop or mobile device. Visit ashrae.org/2022winter and click the "Virtual Environment" button and login with your email address.

Livestream sponsored by 
CLIMATE CONTROL GROUP
A NIBB GROUP MEMBER

YEA AND STUDENT MIXER

Palace III (E) | 5:00 – 6:30 p.m.

Students are invited to mix and mingle with Young Engineers in ASHRAE (YEA) and Technical Committee members. Meet new friends, win prizes in our group poker run activity, and enjoy free food and drinks.

WELCOME PARTY

Garden of the Gods Pool at Caesars Palace

6:30 – 8:30 p.m. | \$75

Welcome to your paradise. Prepare to relax, unwind and catch up with old friends and make new ones at the iconic Caesars Palace Garden of the Gods Pool Oasis surrounded by statues and fountains worthy of the gods. Join us in the fresh air for food and drinks. **Make sure to wear warm clothes!** This event will take place outdoors to allow for natural air flow and distancing.

Tickets may be purchased at Registration in Augustus I/II.

Your ticket includes (2) drink tickets.

Sunday, January 30

TECHNICAL PROGRAM

Emperors Level (E): Augustus III/IV*, Augustus V/VI

Promenade Level (P): Milano I-III, Milano V-VII,
Neopolitan I/II and Neopolitan III/IV

8:00 am – 3:00 pm | *Live streamed sessions

Check out pages 61-69 for Sunday’s presentation schedule.

Tracks include:

HVAC&R Systems and Equipment	Energy System Integration
Fundamentals and Applications	Refrigerants and Refrigeration
Environmental Health and IEQ in the International Arena	HVAC for Industrial and Commercial Purposes – Challenges and Opportunities
Buildings at 360°	

STUDENT PROGRAM

Palace III (E) | 10:00 am – 2:00 pm

The program will feature a career panel and Q&A session, a group activity and roundtable discussions over lunch.

NETWORKING COFFEE BREAK

Milano Ballroom Foyer (P) | 9:00 am – 9:30 am

Join your fellow conference-goers over a cup of joe between the first and second Technical Program sessions.

YOUNG ENGINEERS IN ASHAE (YEA) HOSPITALITY RECEPTION

Emperors II (E) | 4:00 – 6:00 p.m.

Attendees age 35 and younger are invited to visit the YEA Hospitality Reception, offering social and networking opportunities. Light refreshments will be available.

Sponsored by:  **Bell & Gossett**
a xylem brand

Monday, January 31

WOMEN IN ASHRAE BREAKFAST

Palace III (E) | 7:00 – 8:30 a.m. | \$40

Come and listen to a panel of industry leaders at the Women in ASHRAE Breakfast.

Panelists include:

- Rachel Romero, PE, National Renewable Energy Laboratory (NREL)
- Marwa Zaatari, D ZINE Partners
- Stephanie H. Taylor MD, M Architecture, CIC, FRSPH(UK), Taylor Healthcare Consulting, Inc.

- Ginger Scoggins, PE, CEM, CxA, FASHRAE, Engineered Designs, Inc.
- Pam Duffy, PE, Spark One Solutions

Everyone is welcome, coffee and breakfast will be served!
Ticket purchase required.

TECHNICAL PROGRAM

Emperors Level (E): Augustus III/IV*, Augustus V/VI

Promenade Level (P): Milano I-III, Milano V-VII, Neopolitan I/II and Neopolitan III/IV

8:00 am – 12:00 pm | *Live streamed sessions

Check out pages 70-76 for Monday's presentation schedule.

PRESIDENT'S LUNCH

Palace I/II | 12:15 – 2:00 pm. | \$70

2021–2022 ASHRAE President Mick Schwedler provides an update on his presidential theme, Feed the Roots.

Major contributors to the ASHRAE RP Campaign also are recognized. *Ticket purchase required.*

This session will be live streamed for virtual attendees.

Tuesday, February 1

FUN RUN 5K

Meet at Caesar's Front Entrance | 6:30 am

This fun run is organized by members, for members! Meet up at the front of the conference hotel for a casual run/walk down the Las Vegas strip with some of your closest ASHRAE friends before the Technical Program starts at 8:00 a.m. Multiple course distance options will be offered from 1 to 5 miles. All paces are welcome. The courses will be marked in chalk and/or flour and maps will be available the morning of the event.

TECHNICAL PROGRAM

Emperors Level (E): Augustus III/IV*, Augustus V/VI

Promenade Level (P): Milano I-III, Milano V-VII, Neopolitan I/II and Neopolitan III/IV

8:00 am – 12:30 pm | *Live streamed sessions

Check out pages 76-84 for Tuesdays' presentation schedule.

TECHNICAL SESSIONS AT THE AHR EXPO

N235/N237 | 11:00 am – 5:30 pm

Check out pages 82-84 for Tuesday's presentations at the AHR Expo. Presentations are part of the Refrigerants and Refrigeration track and the Buildings at 360° track.

LIFE MEMBERS' LUNCHEON

Florentine IV (P) | 12:00 – 1:30 pm | \$35

Enjoy lunch, share ideas about the future of technology and swap memories of the Society while dining with Life Members. This member grade is for members who have completed 30 years of continuous membership and are at least 65 years of age. Ticket purchase required.

MEMBERS' NIGHT OUT

Palace I (E) | Reception and Cash Bar 6:15 p.m.

Dinner and Entertainment 7:15 p.m. | \$75

The Las Vegas Host Committee and the Southern Nevada Chapter have an exciting night planned for you! Did you know that Las Vegas is considered Hawaii's "Ninth Island"? Ask any Vegas (or Hawaiian) local! Don your finest tiki wear and join us for dinner and a luau featuring an island band, luau games and a short performance from the island dancers. Ticket purchase required.

Wednesday, February 2

TECHNICAL PROGRAM

Emperors Level (E): Augustus III/IV*, Augustus V/VI

Promenade Level (P): Milano I-III, Milano V-VII, Neopolitan I/II and Neopolitan III/IV

8:00 am – 12:30 pm | *Live streamed sessions

Check out pages 84-90 for Wednesday's presentation schedule.

COMPANION GUIDE

COMPANION LOUNGE

Octavius 8 | Promenade South (PS) level | Caesars Palace

The Companion Lounge is open daily with light refreshments available in the morning and beverages available all day. The lounge is open to all registered companions and is a great place to meet others.

Saturday, Jan. 29	7:30 a.m. – 3:00 p.m.
Sunday, Jan. 30	7:30 a.m. – 3:00 p.m.
Monday, Jan. 31	7:30 a.m. – 3:00 p.m.
Tuesday, Feb. 1	7:30 a.m. – 3:00 p.m.
Wednesday, Feb. 2.....	7:30 a.m. – 1:00 p.m.

MEET AND GREET

Octavius 9 (PS) | Monday, Jan. 31 | 9:30 – 11:00 a.m.

The Meet and Greet, open to all registered companions and guests, gives companions an opportunity to meet with old friends and greet new ones.

Visit the ASHRAE 365 app to find out more details related to the Meet and Greet event. Light refreshments will be served.

SPONSOR EVENTS: Top Industry Suppliers Share Knowledge

Check out the many ways to engage in-person and virtually with ASHRAE Winter Conference Sponsors!



Connect with Sponsors in Virtual Kiosks

Each Conference Sponsor has their own kiosk in the Conference's Virtual Environment. Visit the Sponsor Hall and click on the kiosk you want to visit. You can video or text chat with a sponsor representative, watch sponsor videos, view brochures and more!

From your laptop, go to ashrae.org/2022winter and click the "Virtual Environment" button at the top of the screen. Login using your email address and navigate to the Sponsor Hall to visit all sponsor kiosks.

From your mobile device, go to the ASHRAE 365 app and click on the sponsor section to navigate to the kiosk. You may be asked to login using your email address.

Sponsor representatives will be available in their kiosks to chat live via text or video on these dates and times:

Saturday, Jan. 29	2:30-3:00 pm
Sunday, Jan. 30	3:30-4:00 pm
Monday, Jan. 31	2:30-3:00 pm
Tuesday, Feb. 1	1:00-1:30 pm
Wednesday, Feb. 2	1:00-1:30 pm



Earn a digital ASHRAE Engager Badge when you visit the Sponsor Hall for a **minimum of 10 minutes** during the Conference.

Connect with Sponsors In-Person

MEET AND GREET WITH KEYNOTE SPONSOR REPRESENTATIVES

Palace Ballroom Pre-Function Area | Saturday, January 29
2:45 – 3:15 pm



Engineering Air for a Cleaner World™

Stop by and meet representatives of GPS, the keynote sponsor, thirty minutes before the plenary kicks off at 3:15 p.m.

SPONSOR TECH TALK WITH TURNTIDE TECHNOLOGIES

Neopolitan I/II (P) | Sunday, January 30 | 3:30 – 4:00 pm



TURNTIDE

TECHNOLOGY FOR SUSTAINABLE OPERATIONS: HOW INCORPORATING SUSTAINABILITY INTO YOUR DIGITIZATION STRATEGY DRIVES HVAC EFFICIENCIES AND BRAND VALUE

The definition of sustainability is changing – from a compliance requirement to a means of creating long-term strategic value within an organization. The operation of commercial and industrial buildings account for 40 percent of electricity consumed globally, and 20 percent of greenhouse gas emissions (GHG). HVAC alone can represent over 30% of this consumption. Incorporating sustainability into a building's digitization strategy gives the ability to not only manage and reduce the energy consumption of HVAC systems but to create operational efficiencies and business resilience and agility. This presentation discusses strategies to attack waste at every level within a building, and how sustainability and digitization can be a driving force to improving P&L.

YOUNG ENGINEERS IN ASHAE (YEA) HOSPITALITY RECEPTION

Emperors II (E) | Sunday, January 30 | 4:00 – 6:00 p.m.

Sponsored by:



Bell & Gossett

a xylem brand

Attendees age 35 and younger are invited to visit the YEA Hospitality Reception, offering social and networking opportunities. Light refreshments will be available.

Stop by and meet representatives of Bell & Gossett, the YEA Hospitality Reception sponsor, thirty minutes before the reception begins at 4:00 pm.

AHR EXPO

LVCC North and Central Hall

Monday, Jan. 31 – Tuesday, Feb. 1 | 10:00 am – 6:00 pm

LVCC North and Central Hall

Wednesday, Feb. 2 | 10:00 am – 4:00 pm

Visit all of the ASHRAE Winter Conference sponsors at the AHR Expo. See page 23 for details on how to get to the AHR Expo from Caesars Palace.



Engineering Air for a Cleaner World™

Global Plasma Solutions

Booth Number N8741



CLIMATE CONTROL GROUP

A **NIBE** GROUP MEMBER

**ClimateMaster, ClimaCool Corp., ClimateCraft
and International Environmental Corporation**

Booth Number: C1121



TURNTIDE

Turntide Technologies

Booth Number N8535



Particle

Particle Industries

Booth Number N7309



Bell & Gossett

a **xylem** brand

Bell & Gossett a Xylem brand

Booth Number N9509



LENOX/DEWALT

Booth Number N9941

Interested in Sponsoring an Upcoming ASHRAE Conference?

Take advantage of the pent-up demand for attendees to meet face-to-face by creating your company's presence at a future ASHRAE conference. Reach a worldwide virtual audience through livestreamed and on-demand sessions and events through the hybrid format. Tap into attendees' high interest in new products, technology, and technical information by becoming a Conference Sponsor.

Sponsorship opportunities are available for the upcoming ASHRAE Conferences:

ASHRAE Winter and Annual Conferences	ASHRAE Topical Conferences
2022 ASHRAE Annual Conference* Toronto, Ontario, Canada June 25–29	IAQ 2020: Indoor Environmental Quality Performance Approaches Athens, Greece, May 4–6, 2022
2023 ASHRAE Winter Conference Atlanta, GA February 4–8	Ventilation 2022: 13th International Industrial Ventilation Conference for Contaminant Control* Toronto, Ontario, Canada June 22–24
	2022 Building Performance Analysis Conference and SimBuild Co-organized by ASHRAE and IBPSA-USA Chicago, IL September 14–16
	The Fifth International Conference on Efficient Building Design Beirut, Lebanon October 20–21, 2022
	Buildings XV Conference Clearwater Beach, FL December 5–8, 2022
	ASHRAE and SCANVAC HVAC Cold Climate Conference 2023 Anchorage, Alaska March 6–8, 2023
To sponsor visit ashrae.org/sponsorships or contact Greg Martin a gmartin@ashrae.org	To sponsor visit ashrae.org/conferences/topical-conferences/ or contact Staci Loeffler at sloeffler@ashrae.org

**Dual sponsorships available*

TIPS FOR FIRST TIME ATTENDEES

ASHRAE conferences provide opportunities for you to learn about the latest technology in the HVAC&R industry, express your opinion about controversial issues, explore new applications for fundamental ideas, to meet the people behind those ideas and to help shape the Society that serves your profession.

If this is your first time attending, you may have questions about what is available to registered attendees. Here are a few tips to help you navigate the conference.

Technical Program

The technical program for the ASHRAE Conference includes paper sessions, seminars, panels, workshops and forums. Check the program book or ASHRAE 365 app to see what you want to attend. You can jump between sessions if you want to hear one specific presentation in each session. Volunteers will be at the door checking and scanning badges.

See page 59 for descriptions of the different types of sessions available within the Technical Program.

All registered attendees receive access to the Virtual Environment that includes recordings of the live streamed sessions with the ability to take a quiz and download a PDH certificate. The Virtual Environment includes downloadable copies of the Conference Papers and links to the On-Demand Sessions which are PowerPoint presentations with audio descriptions of all sessions that were presented during the conference.

Each hour attended in a session equals one PDH. For forums and other one-hour sessions, you must be present for the entire 50-minute program to earn a PDH. State PDHs, AIA LUs and LEED AP credits are awarded for select sessions. Sign-in sheets for attendees to complete to be awarded AIA credit in approved sessions will be available. Also, certain sessions may be acceptable for ASHRAE certification renewal. Send questions to certification@ashrae.org. Your badge will be scanned as you enter the session and a summary of sessions attended will be emailed to you upon conclusion of the conference.

See pages 16 for more information about the Technical Program and Hybrid opportunities.

Advancing the Industry: Committee Meetings

The technical expertise of ASHRAE is concentrated in its technical committees, task groups, technical resource groups and multidisciplinary task groups, which are responsible for preparing the ASHRAE Handbook volumes, initiating and supervising Society research projects, presenting programs at ASHRAE conferences, reviewing technical papers and evaluating the need for standards.

To be a member of a technical committee (TC), you must be active in the field addressed by the committee. You do not have to be an ASHRAE member to participate in a technical committee, nor do you have to be a member of a technical committee to attend committee meetings.

Standards project committees (SPCs) and Guideline project committees (GPCs) are appointed specifically by the Standards Committee to develop and revise standards and guidelines to reflect technical advances in the areas that they cover. To qualify for membership in a committee, you should be knowledgeable in the discipline of the proposed standard and need to apply to the committee.

A schedule of all meetings is included in the conference program on pages 91-112 and the ASHRAE 365 app. Attendance at TC, SPC, and GPC meetings is open to any interested party.

Support Services

The ASHRAE Bookstore and membership booth are set up on site to offer conference participants the latest information about the industry and to answer questions concerning ASHRAE membership.

ASHRAE publications, including books and standards are available for sale in the ASHRAE Bookstore. Located in the registration area, the bookstore features publications devoted entirely to the HVAC&R industry. Selected titles from ASHRAE's publications catalog, as well as a variety of new publications and books from allied organizations are on display. You can browse and purchase publications on site, or you may wish to order several items and have them shipped to you at a later date. If you prefer, you can examine publications in the store and then use the online bookstore at ashrae.org/bookstore to order print and/or digital editions.

The Membership Desk is located in the registration area. Membership applications are available, as well as brochures about the HVAC&R industry and information on student membership. Conference registrants paying the non-member registration fee receive an automatic complimentary year of Society membership.

Networking: Get Involved

ASHRAE conferences and meetings provide an international setting for attendees to gather and exchange ideas. Opportunities to get involved range from presenting a paper to participating in a seminar or attending committee meetings. By reviewing your program and planning ahead, you can ensure that the conference will be a success instead of a series of missed opportunities. Attend events to get to know other members and attendees. *Event details are on pages 31-38.*

See page 16 for more information about networking opportunities with virtual attendees using the Virtual Environment.

SOCIETY AWARDS

MEETING OF THE MEMBERS PLENARY SESSION AWARDS PRESENTATION

Palace I/II (E) | 3:15 – 5:30 p.m.

At the Meeting of the Members Plenary session, the Honors and Awards Program recognizes dedicated ASHRAE members who voluntarily give freely of their time and expertise to “serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration and their allied fields.”

Student Design Project Competition

Given in recognition of outstanding student research and design projects.

FIRST PLACE: HVAC SYSTEM SELECTION

Ferris State University

**Evan Eldred, Cole Quinlan, Nick Schramski,
Brian Van Schepen, Cole Weber, Jordanny T. Williams**

FIRST PLACE: HVAC DESIGN CALCULATIONS

University of British Columbia

**Brandon Jung, Arin Lee, Lukengo Miguel,
Kyle Vanderhorst and Taewoong (Jeff) Yoon**

FIRST PLACE: INTEGRATED SUSTAINABLE BUILDING DESIGN

Pennsylvania State University

**Andre Cosini, Xinyan Liu, Christopher Maitski, Andrew
McGrail, Roumany C. Phan, Christopher Unis**

FIRST PLACE: THE SETTY FAMILY FOUNDATION APPLIED ENGINEERING CHALLENGE

California Polytechnic State University

Adam Bessey, Ryan Salazar, Matthew Malonzo

Technology Awards

Given in recognition of innovative designs that comply with ASHRAE standards for indoor air quality and energy efficiency.

FIRST PLACE AND AWARD OF ENGINEERING EXCELLENCE

Given in recognition of a first-place winner of the Technology Award competition for an outstanding application of innovative design and effective energy utilization. The recipient of the Award of Engineering Excellence has demonstrated the best overall compliance with the judging criteria.

Category I – Commercial Buildings – New

**Shiro Tsukami, P.E., Kitaro Mizuide, Ph.D., P.E., and
Hirotaka Kubo, P.E. for the DaiyaGate Ikebukuro Building
Owner Representative, Ryuichi Sato, Seibu Properties Inc.**

FIRST PLACE

Recognizing the first place ASHRAE Technology Award project which demonstrates the most outstanding achievement in the design and operation of energy efficient buildings

Category I – Commercial Buildings – Existing

Hermes Silva Flores for the Hotel Mandarin Oriental

Owner Representative, Claudio Leyton, Hotel Mandarin Oriental Santiago

Category II – Educational Facilities – New

Donald R. Hartdegen, Jr., P.E., Asfandiyar Khan, P.E., HBDP, Sudesh Saraf, P.E. for Adlai E. Stevenson High School East Building

Owner Representative, Sean Carney, Adlai Stevenson High School District 125

Category II – Educational Facilities – Existing

Lincoln Pearce, P.E., BEAP for Marston Hall Renovation

Iowa State University – Facilities, Planning & Management

Category II – Educational Facilities – EBCx

Jason Volz, P.E., Matt Branham, P.E., Brian Duvall, P.E., and Braydi McPherson-Hathaway for Kentucky Community and Technical College System

Owner Representative, James Mink, Kentucky Community and Technical College System

Category III – Health Care Facilities – New

Nicholas Rogers, P.E., Tracy Steward and David Mayer for Norton Novak Center for Children's Health

Owner Representative, Jeff Carty, Norton Healthcare

Category IV – Industrial Facilities or Processes – Existing

Dennis C. McKale, P.E. and Brad Herbeck for Stellaris – Sterling Heights Assembly Plant

Owner Representatives, Eric Goedel and Madhu Rao, Stellantis

Category IV – Industrial Facilities or Processes – New

Shana Scheiber, P.E. and Rick Flock, P.E. for Exact Sciences Lab

Owner Representative, Jeff Bartels, Exact Sciences

Category V – Public Assembly – New

Leighton Deer, P.E., HBDP and Brad Grubb, P.E. for Westwood Hills Nature Center

Owner Representative, Brian Hoffman, City of St. Louis Park

Category VI – Residential

Dustin Langille, BEMP, HBDP and Donald McLauchlan for 3833 North Broadway

Owner Representative, David Gassman, 3817-45 N. Broadway Inc.

ASHRAE Honorary Member

Given to recognize notable persons of preeminent professional distinction.

William “Bill” Nye, CEO, The Planetary Society,
Pasadena, California

E.K. Campbell Award of Merit

Given in recognition of outstanding service and achievement in teaching.

Thomas M. Lawrence, Ph.D., P.E., Fellow Member ASHRAE,
Professor of Practice, Mechanical Engineering Program Lead,
University of Georgia, Athens, Georgia

ASHRAE Award for Distinguished Public Service

Given to recognize members who have performed outstanding public service in their community and, in doing so, have helped to improve the public image of the engineer.

Steven J. Williams, Mechanical Project Manager, James
Posey Associates, Owings Mills, Maryland

John F. James International Award

Given to an ASHRAE member who has done the most to enhance the Society's International activities.

Karine Leblanc, Sales Engineer, US Air Conditioning
Distributors, City of Industry, California

YEA Inspirational Leader Award

Given to a YEA ASHRAE member who has gone above and beyond to make considerable contributions to the industry and community.

Badri Patel, BEAP, Commercial Market Account Executive,
Johnson Controls Canada, Toronto, Ontario, Canada

ASHRAE Fellow

Given in recognition of distinction in the arts and sciences of heating, refrigeration, air conditioning and ventilation.

Edward A. Arens, Ph.D., Life Member ASHRAE,
Berkeley, California

Robert Bean, Calgary, Alberta, Canada

Don Brandt, Life Member ASHRAE, Phoenix, Arizona

James F. Butler, Boston, Massachusetts

Pieter De Wilde, Plymouth, United Kingdom

Titu R. Doctor, Life Member ASHRAE, Marietta, Georgia

W. Stuart Dols, Gaithersburg, Maryland

Brian A. Fricke, Ph.D., Oak Ridge, Tennessee

Shih-Cheng Hu, Ph.D., Taipei, Taiwan

Joe Huang, BEMP, Moraga, California

Luke C. H. Leung, P.E., P.Eng., BEMP, Chicago, Illinois
Igor Y. Maevski, Ph.D., P.E., New York, New York
Hugh Magande, Atlanta, Georgia
Tim McGinn, P.Eng., HBDP, Calgary, Alberta, Canada
Janice K. Means, P.E., Life Member ASHRAE,
Southfield, Michigan
Amy V. Musser, Ph.D., P.E., BEMP, Asheville, North Carolina
Zheng O'Neill, Ph.D., P.E., College Station, Texas
Ryozo Ooka, Tokyo, Japan
Chun-cheng Piao, Ph.D., Santa Clara, California
Lee Riback, Life Member ASHRAE, Dallas, Texas
Charles Roos, CPEng, Auckland, New Zealand
William A. Ryan, Ph.D., P.E., Chicago, Illinois
Roger R. Schmidt, Syracuse, New York
Celso Cardoso Simões Alexandre, Life Member ASHRAE,
São Paulo, Brazil
Filza H. Walters, College Station, Texas

ASHRAE Hall of Fame

Given to honor deceased members who have made milestone contributions to the growth of ASHRAE-related technology.

Raymond G. Alvine, P.E., Fellow Life Member ASHRAE,
1926–2005

Alwin B. Newton, Fellow Member ASHRAE, 1907–1985

F. Paul Anderson Award

Given in recognition of notable achievement, outstanding work, or service in any field of the Society.

James E. Braun, Ph.D., Fellow Life Member ASHRAE

notes

ASHRAE CONFERENCES: PAST AND FUTURE

Upcoming Topical Conferences

IAQ 2020: Indoor Environmental Quality Performance

Approaches May 4–6, 2022 | Athens, Greece | ashrae.org/IAQ2020

Ventilation 2022: 13th International Industrial Ventilation Conference for Contaminant Control

**Co-located with the 2022*

ASHRAE Annual Conference in same hotel June 22–24, 2022 | Toronto, Ontario, Canada | ashrae.org/ventilation2022

2022 Building Performance Analysis Conference and SimBuild Co-organized by ASHRAE and IBPSA-USA

Sept. 14–16, 2022 | Chicago, IL | ashrae.org/buildperform2022

The Fifth International Conference on Efficient Building Design – Materials and HVAC Equipment Technologies

Oct. 20–21, 2022 | Beirut, Lebanon | ashrae.org/Beirut2022

Buildings XV Conference

Dec. 5–8, 2022 | Clearwater, FL | ashrae.org/buildingsXV

ASHRAE and SCANVAC – HVAC Cold Climate Conference 2023

March 6–8, 2023 | Anchorage, AK | ashrae.org/2023HVACColdClimate

Upcoming Winter and Annual Conferences

Year	Winter	Annual
2022	Las Vegas, NOW!	Toronto, ON, June 25–29
2023	Atlanta, GA, Feb. 4–8	Tampa, FL, June 24–28
2024	Chicago, IL, Jan. 20–24	Indianapolis, IN, June 22–26
2025	Orlando, FL, Feb. 8–12	Phoenix, AZ, June 26–30

Past Winter and Annual Conferences

Year	Winter	Annual	Year	Winter	Annual
1980	Los Angeles	Denver	2001	Atlanta	Cincinnati
1981	Chicago	Cincinnati	2002	Atlantic City	Honolulu
1982	Houston	Toronto	2003	Chicago	Kansas City
1983	Atlantic City	Washington	2004	Anaheim	Nashville
1984	Atlanta	Kansas City	2005	Orlando	Denver
1985	Chicago	Honolulu	2006	Chicago	Quebec City
1986	San Francisco	Portland	2007	Dallas	Long Beach
1987	New York	Nashville	2008	New York	Salt Lake City
1988	Dallas	Ottawa	2009	Chicago	Louisville
1989	Chicago	Vancouver	2010	Orlando	Albuquerque
1990	Atlanta	St. Louis	2011	Las Vegas	Montreal
1991	New York	Indianapolis	2012	Chicago	San Antonio
1992	Anaheim	Baltimore	2013	Dallas	Denver
1993	Chicago	Denver	2014	New York	Seattle
1994	New Orleans	Orlando	2015	Chicago	Atlanta
1995	Chicago	San Diego	2016	Orlando	St. Louis
1996	Atlanta	San Antonio	2017	Las Vegas	Long Beach
1997	Philadelphia	Boston	2018	Chicago	Houston
1998	San Francisco	Toronto	2019	Atlanta	Kansas City
1999	Chicago	Seattle	2020	Orlando	Virtual (Austin)
2000	Dallas	Minneapolis	2021	Virtual (Chicago)	Virtual (Phoenix)

ROOMS AND HOURS

Registration and ASHRAE Bookstore and Logo Store

Augustus I/II | Emperors (E) Level | Caesars Palace

Registration is required for all conference participants. Official badges must be worn at all functions and for admission into the technical sessions. More than 300 books and other recent publications will be available for purchase in the ASHRAE Bookstore. The bookstore provides HVAC&R technical literature from ASHRAE and other publishers and ASHRAE logo items.

Friday, Jan. 28.....	10:00 a.m. – 5:00 p.m.
Saturday, Jan. 29	7:15 a.m. – 6:00 p.m.
Sunday, Jan. 30	7:00 a.m. – 5:00 p.m.
Monday, Feb. 1	7:00 a.m. – 5:00 p.m.
Tuesday, Feb. 2	7:30 a.m. – 4:30 p.m.
Wednesday, Feb. 3.....	7:30 a.m. – 11:00 a.m.

**Bookstore closes at 1:00 p.m.*

E-LEARNING

ASHRAE's eLearning system, from the ASHRAE Learning Institute, will be demonstrated at the bookstore. Take a hands-on demonstration and learn more about new ways to earn PDHs/CEUs, on demand, online.

Speakers' Lounge

Augustus I/II | Emperors (E) Level | Caesars Palace

Saturday, Jan. 29	1:00 p.m. – 3:00 p.m.
Sunday, Jan. 30	7:00 a.m. – 5:00 p.m.
Monday, Jan. 31	7:00 a.m. – 12:15 p.m. 1:30 p.m. – 5:00 p.m.
Tuesday, Feb. 1	7:00 a.m. – 5:00 p.m.
Wednesday, Feb. 2.....	7:00 a.m. – 1:00 p.m.

Membership Desk

Augustus I/II | Emperors (E) Level | Caesars Palace

The membership information desk is available for paying dues, applying for membership, updating membership information. This desk is open during the same hours as registration, so feel free to stop by if you have any questions concerning your ASHRAE membership.

Headquarters Office

Turin/Trevi | Promenade (P) Level | Caesars Palace

The ASHRAE Headquarter office offers members complimentary copying and access to printers for laptop computers.

Friday, Jan. 28.....	12:00 p.m. – 5:00 p.m.
Saturday, Jan. 29	8:00 a.m. – 5:00 p.m.
Sunday, Jan. 30	8:00 a.m. – 5:00 p.m.
Monday, Jan. 31	8:00 a.m. – 5:00 p.m.
Tuesday, Feb. 1	8:00 a.m. – 5:00 p.m.
Wednesday, Feb. 2	8:00 a.m. – 1:00 p.m.

Lounges

MEMBER LOUNGE

Entrances through Octavius 4 and Octavius 11
Promenade South (PS) | Caesars Palace

Lounge is open to all registered attendees.

Saturday, Jan. 29	7:30 a.m. – 3:00 p.m.
Sunday, Jan. 30	7:30 a.m. – 4:00 p.m.
Monday, Jan. 31	7:30 a.m. – 4:00 p.m.
Tuesday, Feb. 1	7:30 a.m. – 4:00 p.m.
Wednesday, Feb. 2	7:30 a.m. – 1:00 p.m.

COMPANION LOUNGE

Octavius 8 | Promenade South (PS) | Caesars Palace

Lounge is open to all registered companions.

See page 35 for more information.

Saturday, Jan. 29	7:30 a.m. – 3:00 p.m.
Sunday, Jan. 30	7:30 a.m. – 3:00 p.m.
Monday, Jan. 31	7:30 a.m. – 3:00 p.m.
Tuesday, Feb. 1	7:30 a.m. – 3:00 p.m.
Wednesday, Feb. 2	7:30 a.m. – 1:00 p.m.

TC COLLABORATION AREA

Entrances through Octavius 4 and Octavius 11
Promenade South (PS) | Caesars Palace

NEW! The TC Collaboration Area is a new space designed to provide an informal and collaborative meeting space for TC subcommittee meetings or other small meetings throughout the conference.

Sunday, Jan. 30	7:30 a.m. – 4:00 p.m.
Monday, Jan. 31	7:30 a.m. – 4:00 p.m.
Tuesday, Feb. 1	7:30 a.m. – 4:00 p.m.
Wednesday, Feb. 2	7:30 a.m. – 1:00 p.m.

Las Vegas Host Desk

Augustus I/II | Emperors (E) Level | Caesars Palace

Stop by the Las Vegas Host Committee desk to receive information about local Las Vegas recommendations and discounts on dining, retail and entertainment.

TOURS

Stand-by tour tickets will be distributed at ASHRAE registration after a tour sells out. Stand-by tickets are provided to ensure that a tour is filled in the event of last-minute cancellations. If you have a stand-by ticket, please be prepared to pay by credit card or exact cash at the bus.

All tours depart from the Colosseum Tour Bus entrance located in the Forum Casino near the Colosseum Gift Store. See page 8 for a map of Caesars Palace. Please arrive at least 10 minutes before the tour is scheduled to depart.

Masks are required for all attendees on tour buses and all indoor facilities.

Technical Tours

RESORTS WORLD CENTRAL PLANT

Sunday, January 30 | 3:00 – 5:00 pm | \$35

Join ASHRAE for a technical tour of The Resorts World central utility plant. The plant has an interesting history. It started its life in 2007 as part of the failed Echelon construction project. Due to the Great Recession, the planned low-rise hotel tower construction was stopped at the foundation after the central plant was 80% constructed with major equipment in place. Fast-forward to 2016 when the property was bought, and the preliminary plans were in place. The questions to the new Engineer of Record were:

1. Is the 24,000-ton central plant large enough for the planned Resorts World project?
2. Will the equipment be functional after sitting idle for more than a decade?

Join this tour to learn the answers to the two key questions and view the completed Resorts central utility plant.

PLANET 13 MARIJUANA PRODUCTION AND CULTIVATION FACILITIES

Monday, January 31

Tour 1: 2:30 – 4:00 pm | Tour 2: 4:00 – 5:30 pm | \$35

Enjoy a behind the scenes tour of the world's largest marijuana dispensary and entertainment complex featuring the world's first marijuana production display kitchen. Discover how the marijuana industry utilizes C1D1 rated systems to provide Butane and Ethanol THC Extraction and Distillation, infusion technology including brewery/beverage creation and packaging, gummy candy kettle use and chocolate bar molding and cooling tunnels. Be prepared to suit up in laboratory gown, foot booties and a hair net to experience a GMP facility with the master scientist behind it all. Tour capacity is limited.

SNWA'S RIVER MOUNTAINS WATER TREATMENT FACILITY

Tuesday, February 1 | 1:30 – 4:30 pm | \$35

The River Mountains Water Treatment Facility began delivering treated Colorado River water from Lake Mead to the Las Vegas valley in 2002. Currently, the facility can treat up to 300 million gallons of water per day but was designed to expand to meet Southern Nevada's needs.

This technical tour of the Southern Nevada Water Authority's River Mountains Water Treatment Facility includes a Treatment Tour, a tour of the Water Quality Lab and the Research and Development Lab.

Tour attendees will be required to provide copies of drivers licenses or passports for security clearance one week prior to the visit.

General Tours

HOOVER DAM TOUR

Sunday, January 30 | 1:00 – 5:00 pm | \$75

Dedicated and opened in 1935, the Hoover Dam is an engineering feat that powers three states with its hydroelectric power. Over 1 million visitors each year tour its enormous facilities. Learn the history of how it came to be, how many men built it, and how it is continually maintained and operated on this tour. Guests will also experience a guided tour of the powerplant* and passageways within the dam itself. Perfect for intimate group sizes that are looking to get away from the Strip and try something new with their time in Las Vegas.

** The experience may not include in the powerplant tour pending Covid19 regulations at the time of the conference. Updates will be posted on ashrae.org/2022winter.*

LAS VEGAS STRIP TOUR

Monday, January 31 | 2:30 – 5:30 pm | \$65

Explore Las Vegas in style! See the sights and enjoy trivia with your entertaining and informative guide. Be at the center of it all with great views and pleasant desert setting.

Highlights include:

- Learn about Las Vegas's history, myths and legends as you cruise The Strip
- Learn about the historic "Welcome to Fabulous Las Vegas" sign and pose for photos
- Ride the world's largest observation wheel while your guide shares landmarks from 550 feet up

MOB MUSEUM

Tuesday, February 1 | 2:00 – 5:00 pm | \$70

What happens in Vegas, stays in Vegas. Experience one of the most unique museums in Downtown Las Vegas. The Mob Museum provides a world-class, interactive journey through true stories. From the birth of the Mob, to today's headlines. Shadows and whispers. G-Men and Made Men. Located steps from Fremont Street, the Museum provides an experience unlike any other.

Full-Day Professional Development Seminars

Registration fees: \$544 (\$435 ASHRAE Member)

Each seminar earns 6 PDHs/AIA LUs. Check with your state for their continuing education credit requirements. Please bring to the course all identification numbers (AIA, NY, NC) to ensure you receive proper credit.

SATURDAY – JANUARY 29, 2022

8:00 a.m. – 3:00 p.m.

Updated! Commercial Building Energy Audits (code 60)

Pompeian I (P), Caesars Palace

This seminar provides guidance on how to perform commercial building energy audits. Best practices and other information relevant for building owners, managers and government entities are covered. The seminar includes a summary of materials essential for performing ASHRAE Level 1, 2, and 3 audits, time-saving tips for every auditor, how to hire an auditor, what to ask for in a comprehensive audit report and how to build a successful energy efficiency retrofit team.

Instructor: Jim Kelsey, P.E., Member ASHRAE, BEAP, LEED® AP

Commissioning Process in New and Existing Buildings (code 61)

Pompeian II (P), Caesars Palace

This introductory seminar focuses on how the building commissioning process can be applied cost-effectively to new construction and to existing facilities, with a strong emphasis on existing facilities applications. The seminar discusses how the application of the commissioning process in existing facilities differs from new construction. Attend this session to take away compelling information and case studies that demonstrates the value of investing in the commissioning process.

Instructor: Richard Casault, P.E., Member ASHRAE

Energy Modeling Best Practices and Applications (code 62)

Pompeian III (P), Caesars Palace

This seminar covers the fundamentals of building energy modeling and explains how to use modeling to guide design decisions, with an emphasis on HVAC. The seminar explains modeling principles and provides modeling tips related to the building envelope, plug loads, lighting systems and HVAC systems.

Instructors: Drury B. Crawley, Ph.D., AIA, Fellow ASHRAE, BEMP; and Erik Kolderup, P.E., BEMP, Member ASHRAE, LEED® AP

TUESDAY – FEBRUARY 1, 2022

9:00 a.m. – 4:00 p.m.

Healthcare Facilities: Best Practices for HVAC Design and Operation (code 74)

N264, Las Vegas Convention Center

Based on the ASHRAE book HVAC Design Manual for Hospitals and Clinics, this course introduces many unique and up-to-date healthcare design considerations and applications. The course covers Chapters 1-4, 6-11, and 13-16.

Instructors: Don Burroughs, P.E., Member ASHRAE, CEM, CEA; and Pavel Likhonin, P.E., Member ASHRAE

Half-Day Short Courses

Registration fees: \$214 (\$159 ASHRAE Member)

Each course earns 3 PDHs/AIA LUs. Check with your state for their continuing education credits requirements. Please bring to the course all identification numbers (AIA, NY, NC) to ensure you receive proper credit.

SATURDAY – JANUARY 29, 2022

12:00 p.m. – 3:00 p.m.

Updated! Air-to-Air Energy Recovery Applications: Best Practices (code 63)

Pompeian IV (P), Caesars Palace

Air-to-air energy recovery provides one of the most cost-effective and efficient ways to recycle waste energy and create superior indoor environments. This course reviews real-world examples of where and how air-to-air energy recovery technologies are integrated into some of the most common, commercially available systems.

Instructor: Paul Pieper, Eng., Member ASHRAE

SUNDAY – JANUARY 30, 2022 – 3:30 P.M. – 6:30 P.M.



Advanced High-Performance Building Designs: Key Concepts for Lifelong Building Sustainability (code 64)

N258, Las Vegas Convention Center

This course provides designers (and operators) with an approach to design that incorporates a creative mindset and encourages designers to keep current with rapidly changing industry developments. Case studies, key concepts and latest developments are incorporated throughout the presentation.

Instructor: Jeff Ross-Bain, P.E., Member ASHRAE, BEMP, LEED® AP

Updated! Laboratory Design: The Basics and Beyond (code 65)

N262, Las Vegas Convention Center

This course focuses on the essential elements of the design process that are unique to laboratory HVAC systems. Topics

include planning steps; risk assessment; determining exhaust/supply requirements; load calculation; pressure mapping; evaluating system options; layout of ducts and rooms; sizing primary air systems; designing exhaust stacks; sustainability in laboratories and control strategies. Example problems and case studies are presented.

Instructor: John Varley, P.E., Member ASHRAE, HBDP, LEED® AP

Variable Refrigerant Flow Systems: Design and Application (code 66)

N260, Las Vegas Convention Center

This course provides non-manufacturer-specific concepts of how to apply VRF systems to buildings. The course supplements the fundamental technology presented in the 2020 ASHRAE Handbook—HVAC Systems and Equipment, offering consulting engineers who already have a basic knowledge of VRF technology comprehensive system design and application guidance using building-specific scenarios.

Instructors: Brian Bogdan, Member ASHRAE; and Pushpinder Rana, P.Eng., Member ASHRAE, LEED® AP



V in HVAC – What, Why, Where, How and How Much (Includes Basic Requirements of Standard 62.1-2019) (code 67)

N264, Las Vegas Convention Center

This course focuses on the basic requirements of ASHRAE Standard 62.1-2019 and covers the scope, application and multiple compliance paths available in the standard, including the ventilation rate procedure, indoor air quality procedure and natural ventilation procedure. Topics will include minimum requirements for cleaning outdoor air, designing HVAC systems, determining the ventilation rate quantity, commissioning and operations and maintenance.

Instructor: Hoy Bohanon, P.E., Member ASHRAE, BEAP, LEED® AP

MONDAY – JANUARY 31, 2022

8:30 a.m. – 11:30 a.m.

Updated! Laboratory Exhaust Stacks: Safe and Energy-Efficient Design (code 68)

N258, Las Vegas Convention Center

This course provides designers and operators of laboratories with wet lab exhaust systems with the proper methodology to ensure safe systems operation. This course walks students through the entire design process. Training topics include how to properly locate air intakes and exhaust stacks and the various methods for applying variable-air-volume control to minimize energy usage while avoiding adversely impacting the air quality.

Instructor: Brad Cochran, P.E., Member ASHRAE



Best Practices for Installing DDC Systems (code 69)

N260, Las Vegas Convention Center

This course covers best installation practices of direct digital controls (DDC) systems. A facility's DDC form a living, breathing system that an owner will use throughout the life of the building. If standardized and quality installations are promoted, the short- and long-term success of control systems will be greatly improved. This course provides tools to ensure uniformity for consultants, contractors and code officials and will specifically benefit consulting engineers, DDC design integration engineers, commissioning authorities and contractors who install DDC systems.

Instructor: Larry Fisher, P.E., Life Member ASHRAE

Solar PV and Thermal System Analysis and Design (code 70)

N262, Las Vegas Convention Center

This course is designed to introduce the HVAC community (engineers, architects, building owners, facility managers, plus others) to sustainable design principles and provide the knowledge necessary to evaluate and implement cost-effective solar applications for commercial facilities. The purpose is to provide attendees with the knowledge and skills required for the development, evaluation, procurement and installation of commercial solar projects.

Instructors: Khalid Nagidi, Member ASHRAE, LEED® AP; and Svein Morner, Ph.D., Member ASHRAE

MONDAY – JANUARY 31, 2022

2:45 p.m. – 5:45 p.m.

Save 40% by Complying with Standard 90.1-2019 (code 71)

N262, Las Vegas Convention Center

The 2019 update of *ASHRAE/IES Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings*, is a major revision, containing more than 100 changes from the 2016 version. This course is designed to give participants a good understanding of how to satisfy the standard's requirements.

Instructors: McHenry Wallace, P.E., Member ASHRAE, LEED® AP; and Joseph Deringer, AIA, Life Member ASHRAE, LEED® AP



Principles of Building Commissioning: ASHRAE Guideline 0 and Standard 202 (code 72)

N260, Las Vegas Convention Center

This course explores the implications of employing the ASHRAE commissioning process during the acquisition of a building. Emphasis is placed on the importance of initiating the commissioning process during pre-design so that the owner's project requirements document can guide the verification of

success across the design, construction, and operation phases of a building project.

Instructor: Walter Grondzik, P.E., Fellow/Life Member ASHRAE, LEED® AP

Updated! Latest in High-Performance Dedicated Outdoor Air Systems (code 73)

N258, Las Vegas Convention Center

The dedicated outdoor air system (DOAS) has become a very popular means to provide ventilation for buildings, particularly for low-energy, max tech and zero energy buildings. This course covers the latest in DOAS application, design and control. The instruction is best suited for those seeking basic to intermediate discussions on DOAS, including an overall introduction to the concept.

Instructor: Art Hallstrom, P.E., Fellow/Life Member ASHRAE, BEMP

TUESDAY – FEBRUARY 1, 2022

9:00 a.m. – 12:00 p.m.

Humidity Control I: Design Tips and Traps (code 75)

N258, Las Vegas Convention Center

In commercial buildings, excess humidity and moisture promotes mold, mildew and uncomfortable conditions for occupants. This course helps the designer achieve true control of humidity, rather than just its moderation. Topics covered include how to understand and easily estimate the major humidity loads that must govern the design of the system and how to make decisions about equipment size and configuration.

Instructor: Mark Nunnelly, P.E., Member ASHRAE, CxA, LEED® AP

Virtual: Guideline 36: Best in Class HVAC Control Sequences (code 76)

This virtual course introduces the current version of ASHRAE Guideline 36, which focuses on variable-air-volume systems. In this course, attendees learn about the ASHRAE Guideline 36 sequences and how they improve energy efficiency, thermal comfort and indoor air quality, and they learn how to specify sequences for this guideline. Attendees registered for the course can access it through ASHRAE's Virtual Environment on your laptop, phone or tablet.

Instructor: Steve Taylor, P.E., Fellow/Life Member ASHRAE

Updated! Introduction to BACnet® (code 77)

N260, Las Vegas Convention Center

This course helps students understand some of the elements required to successfully plan for BACnet® and complex issues that must be addressed to achieve interoperability. Students learn that interoperability covers a wide range of possible options, and how to simplify interoperability by defining specific areas where interoperability is required.

Instructor: Grant Wichenko P.Eng., Member ASHRAE

TUESDAY – FEBRUARY 1, 2022

1:00 p.m. – 4:00 p.m.



Changing Environments and Loads for Data Centers (High Density, Liquid Cooling, Edge Computing) (code 78)

N258, Las Vegas Convention Center

This course describes the data center design considerations to meet current IT equipment changes. The course explores the challenges of designing, deploying and maintaining small data centers that are surrounded by semi-controlled, or even uncontrolled, external environments.

Instructors: Don Beaty, P.E., Fellow ASHRAE; and Roger Schmidt, Ph.D., P.E., Member ASHRAE

2-Hour Short Course

Registration fees: \$149 (\$119 ASHRAE Member)

Each course earns 2 PDHs/AIA LUs. Check with your state for their continuing education credits requirements. Please bring to the course all identification numbers (AIA, NY, NC) to ensure you receive proper credit.

TUESDAY – FEBRUARY 1, 2022 --1:00 P.M. – 3:00 P.M.



Health Impacts of Indoor Air Extraction, Ventilation and Filtration: Same or Different (code 79)

N260, Las Vegas Convention Center

At least once a week during the summer of 2020 there was a recommendation in the news to increase ventilation in buildings as a good practice for reducing the spread of viruses. When faced with airborne health issues such as viral infections, are all systems the same? What can we do for better design of future systems using these proven tools that have been available for decades? What are the most cost-effective HVAC operational changes or system modifications to improve your existing indoor environments?

Instructor: Hoy Bohanon, P.E., Member ASHRAE, BEAP, LEED® AP

notes _____

Virtual Live Q&A Sessions

On-demand viewing of the Conference Paper Presentations labeled as Live Q&A are available in ASHRAE's Technology Portal online and include video files synched with audio and PDF files of the presentations. Authors will gather for three live Q&A sessions to give the audience a live overview of their on-demand presentation and answer questions. Live Q&A sessions can be accessed through the Virtual Environment using your laptop, phone or tablet.

SUNDAY, JANUARY 30, 3:15 PM - 4:15 PM

Live Q&A Session 1: Improving Operational and Energy Efficiency of Building Heating and Cooling

1. A Framework for a Multi-Sourced, Data-Driven Building Energy Management Toolkit

Andre Markus, Student Member, Brodie Hobson, Student Member, Burak Gunay, Ph.D., Associate Member and Scott Bucking, Ph.D., Associate Member, Carleton University, Ottawa, ON, Canada

2. Potential Energy Savings By Switching Residential Electric Water Heaters to Electric Heat Pumps Water Heaters in Saudi Arabia

Ayman Youssef, P.E., Member and Ghadah Alamer, Saudi Aramco, Dhahran, Saudi Arabia

3. Performance Analysis of Novel Thermal Storage Integrated Heat Pump System in a Residential Building for Demand Flexibility

Liang Shi, Student Member¹, Xiaobing Liu, Ph.D., Member², Ming Qu, Ph.D., Associate Member¹ and Bo Shen, Ph.D., Member², (1) Purdue University, West Lafayette, IN, (2) Oak Ridge National Laboratory, Oak Ridge, TN

4. Real-Time Search for Optimum Operation Parameters of Air Conditioning System in the Data Center by Using Regression Prediction and Deep Reinforcement Learning on CFD Analysis Data

Hiroki Tsukamoto¹, Yuki Sogawa¹, Kazuhiro Matsuda¹, Morito Matsuoka¹, Keisuke Otani² and Kazunari Momose², (1)Osaka University, Osaka, Japan, (2)Advanced Knowledge Laboratory Inc., Tokyo, Japan

MONDAY, JANUARY 31, 2:15 PM - 3:15 PM

Live Q&A Session 2: BEM, and Hygiene-related HVAC Design

1. Macro-Level Changes and the Influence on the Danish Building Industry

Nanna B. Overgård and Amalie Palme, Technical University of Denmark, Kongens Lyngby, Denmark

2. Standard Environmental Aerosol Risk of Common HVAC Options in Dentistry

Travis R. English, P.E., Member, Kaiser Permanente, Oakland, CA

3. Five Years Later: A Building Energy Modeling Fleet's Second Round Institutional Energy Retrofit Analysis

Daniel Villa, P.E., Member¹, Mark Adams², Gerald Gallegos, P.E.³ and Aaron Garrett, Ph.D.², (1) Sandia National Laboratories, Alamo, TX, (2) Tunation, LLC, Knoxville, TN, (3) Sandia National Laboratories, Albuquerque, NM

4. Hygienic Design of HVAC Systems for Hospitals

Faisal Ahmed, Affiliate and William R. Shultes, Upstate Parts and Supply, Inc, Syracuse, NY

5. Towards Post-Pandemic City Management: Prediction of Occupancy Profiles of Commercial Buildings in New York City (LV-22-C041)

Aya Doma, Student Member¹, Ahmed Zaalouk¹, Hamidreza Karimian², Mohamed Osman³, Mazdak Nik-Bakht⁴ and Mohamed Ouf, Associate Member⁴ Concordia University, Montréal, QC, Canada

TUESDAY, FEBRUARY 1, 1:00 PM - 2:00 PM

Live Q&A Session 3: Energy Efficiency and Energy Recovery Solutions

1. Performance Assessment of Integrated Building Envelopes Using Thermoelectric Modules for Temperature Regulation

Xiaoli Liu, Student Member, Ming Qu, Ph.D., Associate Member and Kazuaki Yazawa, Ph.D., Purdue University, West Lafayette, IN

2. Analysis of Heat Exchanging Performance of Rotary Thermal Wheels

M. Anusha Wijewardane, Ph.D., R.A., Chathura Prasad Ranasinghe, Ph.D., H.M. Dinuka P. Herath, M.D. Anuradha Wickramasinghe and A.M. Chandani K. Polgolla, University of Moratuwa, Moratuwa, Sri Lanka

3. Evaluation of an Intelligent Venetian Blind System for Building Energy Saving in Canada

Yue Zhao, Yousef Alipouri, Ph.D., Nathan Wieczorek, Derek Weiler, Owen Wilson, Ray Liu, Zhenyu Zhang, Ph.D., P.E. and **Lexuan Zhong, Ph.D., P.E., Member**, University of Alberta, Edmonton, AB, Canada

4. Experimental Study on Energy Efficiency of DC Distribution System Under Varied Load Conditions

Gucheng Zhao, Sze Ting Chan and Yi Zhang, Future Human Habitats Division, Tsinghua University, Shenzhen, China

5. Characterizing the Energy Flexibility Capacity of DC Electric Appliances Based on an Experimental Study

Sze Ting Chan, Gucheng Zhao and Yi Zhang, Future Human Habitats Division, Tsinghua University, Shenzhen, China

2022 WINTER CONFERENCE TECHNICAL PROGRAM

Earn professional development hour (PDH) credits by attending sessions listed in the Technical Program. Each hour attended in a session equals one PDH. For forums and other one-hour sessions, you must be present for the entire 50-minute program to earn a PDH. Sign in sheets will be available in all session rooms for attendees to complete. State PDHs, AIA LUs and LEED AP credits are awarded for select sessions.

Types of Sessions Presented

Paper Sessions. These sessions present both technical and conference papers. Conference papers are written on current applications or procedures, as well as papers reporting on research in process. These papers differ from technical papers in that they are shorter in length and undergo a much less stringent peer review. Technical papers cover current applications or procedures, as well as papers resulting from research on fundamental concepts and basic theory. Papers presented in these sessions have successfully completed a rigorous peer review. You are invited to comment on these papers. Comments may be submitted via an online form on ashrae.org/2022Winter. PowerPoint presentations with audio descriptions of the presentations are posted online in the Virtual Conference. Preprints of the papers are available to all attendees who have purchased a conference registration.

Forums. Forums are “off-the-record” discussions held to promote a free exchange of ideas. Reporting of forums is limited to allow individuals to speak confidentially without concern of criticism. There are no papers attached to these forums.

Panels. Panel discussions can feature a broad range of subjects and explore different perspectives on issues in the industry. A panel may feature discussions about integrated project delivery among designers, builders and facility management professionals.

Seminars. Seminars feature presentations on subjects of current interest. Papers are not available from the Society; however, seminar PowerPoint presentations with audio descriptions of the presentations are posted online in the Virtual Conference. Access is free for attendees who purchase a conference registration. Seminars are available as a collection via subscription to the Technology Portal online and include video files synched with audio, audio files and PDF files of the presentations.

Workshops. Workshops enable technical committees and other ASHRAE committees to provide a series of short presentations on a topic requiring specific expertise. These short presentations are provided with an increased emphasis on audience participation and training in a specific set of skills. PowerPoint presentations with audio descriptions are posted online in the Virtual Conference.



Conference–Papers subscription in Technology Portal (includes Conference Papers, Technical Papers, and Extended Abstracts) – \$79



Conference–Seminars subscription in Technology Portal – \$119



Preprints of Conference Papers, Technical Papers and Extended Abstracts (individual papers, in print) – \$6 each



ASHRAE Transactions (print volume) – \$99



Submitted for approval for New York State Professional Development Hours (PDHs) and American Institute of Architects Learning Units (LUs)



Submitted for approval for GBCI LEED AP CE Credits

Packages

1. 2022 ASHRAE Winter Conference

Conference–Papers subscription and Conference–Seminars subscription,
\$164

2. 2022 ASHRAE Winter Conference

Conference–Papers subscription and *ASHRAE Transactions*,
\$129

3. Complete Winter Conference Content Package, 2022 ASHRAE Winter Conference

Conference–Papers subscription, Conference–Seminars subscription, and *ASHRAE Transactions*,
\$179

All prices are special conference-only prices.

Sunday, January 30

8:00 AM – 9:00 AM

Virtual: Paper Session 1



Effect of Occupant Behavior and Occupancy Schedules on Buildings Energy Use and Consumption

Track: Buildings at 360°

Room: ASHRAE's Virtual Environment

Chair: Ahmed Abdelsalam, Amazon, Dublin, Ireland

1. How Household Characteristics Affect District Occupancy Schedules? A Case Study Using Canadian Time Use Survey Data (LV-22-C002)

Mohamed Osman¹ and Mohamed Ouf, Associate Member², Concordia University, Montréal, QC, Canada

2. Developing an Automated Workflow for Non-Residential Building Retrofit as a Function of Usage and Occupancy Behavior (LV-22-C003)

Mostafa M. Saad, Sanam Dabirian, Kartikay Sharma and Ursula Eicker, Concordia University, Montreal, QC, Canada

8:00 AM – 9:00 AM

Seminar 1 (Basic)



Codes and Design Standards for Motors and Motor Control Technology

Track: HVAC&R Systems and Equipment

Room: Milano V-VII, Caesars Palace

Sponsor: 1.11 Electric Motors and Motor Control, 2.7 Seismic and Wind Resistant Design, TC 1.9 Electric Systems

Chair: Nicolas S. Rosner, P.E., Member, Eaton, City of Industry, CA

1. UL 508A Industrial Control Panels and Code Requirements of NFPA70/79/70E

John Ross, Eaton, Cleveland, OH

2. Seismic Certification of Motors

John Giuliano, P.E., Member, Vibration Mountings & Controls, Bloomington, NJ

8:00 AM – 9:00 AM

Seminar 2 (Basic)



Designing Control Systems for Net-Zero Energy Buildings

Track: Energy System Integration

Room: Milano I-III, Caesars Palace

Sponsor: 1.4 Control Theory and Application

Chair: Paul Ehrlich, P.E., Member, Building Intelligence Group, Portland, OR

1. Co-Design of HVAC Systems and Controls for Energy-Flexible Buildings

Veronica Adetola, Ph.D., Member, Pacific Northwest National Laboratory, Richland, WA

2. Optimal Renewable Resource Allocation and Load Scheduling of Resilient Communities

Wangda Zuo, Ph.D., Member, Colorado University at Boulder, Boulder, CO

8:00 AM – 9:00 AM
Seminar 4 (Intermediate)



Opportunities and Barriers for Self-Powered and Integrated HVAC

Track: Energy System Integration

Room: Augustus III/IV, Caesars Palace

Sponsor: 6.10 Fuels and Combustion

Chair: Aleksandr Fridlyand, Ph.D., Member, Gas Technology Institute, Des Plaines, IL

1. Gas-Electric Self-Powered, Hybrid and Grid-Interactive Energy Systems

Tim Kingston, Associate Member, Gas Technology Institute, Des Plaines, IL

2. Power Generation Cycle Options for Self-Powered Furnace

Ahmad Abu-Heiba, Associate Member, Oak Ridge National Laboratory, Oak Ridge, TN

3. Thermionic Converters for Self-Powered Residential Heating

Vikas Patnaik, Ph.D., Modern Electron, Bothell, WA

8:00 AM – 9:00 AM

Forum 1

Will High ACH Reduce the Spread of Airborne Contaminants?

Track: Environmental Health and IEQ in the International Arena

Room: Neopolitan III/IV, Caesars Palace

Sponsor: MTG.ACR, 1852

Chair: Roland Charneux, P.Eng., HFDP, Fellow ASHRAE, Pageau Morel et Associés Inc., Montreal, QC, Canada

9:45 AM – 10:45 AM



Paper Session 2



Indoor Environmental Quality Challenges in Public Places: Study Results from a College, School and Transit Buses

Track: Environmental Health and IEQ in the International Arena

Room: Neopolitan I/II, Caesars Palace

Chair: Suzanne LeViseur, Haddad Engineering, Inc., Jacksonville, FL

1. Indoor Conditions in Higher Education: A Survey of College Students on the California Central Coast (LV-22-C004)

Jennifer Mott, Ph.D., Associate Member, Khanhthy Le, Tarnvir Dhaliwal and Carly Tudor, California Polytechnic State University, San Luis Obispo, CA

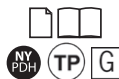
2. Indoor Air Quality Considerations for Transit Buses (LV-22-C005)

Christos Polyzois, Ph.D., Member¹, Chris Hsieh¹, Kathleen Owen, Fellow ASHRAE² and Scott Wenger, Member³, (1) Trane Technologies, Bloomington, MN, (2) Owen Air Filtration Consulting, Cary, NC, (3) Trane Technologies, Davidson, NC

3. Determining Airflows and VOC Source Strengths for an Occupied School (LV-22-C006)

Brett Stinson, Student Member, Aurélie Laguerre and Elliott Gall, Ph.D., Portland State University, Portland, OR

9:45 AM – 10:45 AM

Paper Session 3**Saving Energy and Water by Modelling***Track: Fundamentals and Applications**Room: Milano V-VII, Caesars Palace**Chair: Ahmed Abdelsalam, Amazon, Dublin, Ireland***1. Building Energy Modeling Case Study of Retrofit of a University Laboratory Building (LV-22-C007)***Kevin Anderson, Ph.D., P.E., Raymond Yip, P.E., Member, Gabriel Navarro, Khoa Tran, Nicholas Hills, Aaron Aguirre, Yun-Do Jang and Yew Wong, California State Polytechnic University at Pomona, Pomona, CA***2. Characterizing Data Center Cooling System Water Stress in the United States (LV-22-C008)***Li Chen and Aaron Wemhoff, Ph.D., Associate Member, Villanova University, Villanova, PA***3. A Numerical Investigation of the Gap Effect on the Condensation Heat Transfer in Vertical Mini-Channels with Various Wettability Conditions (LV-22-C009)***Hyo Je Son¹, Jae Sung Yang, M.D.¹, Man Yeong Ha, Ph.D.¹, Hanchoon Lee, Ph.D.², Seungmo Jung² and June Kee Min, Ph.D.¹, (1)Pusan National University, Busan, Korea, Republic of (South), (2)LG Electronics, Seoul, Korea, Republic of (South)*

9:45 AM – 10:45 AM

Seminar 5 (Intermediate)**Critical Ventilation in Critical Facilities: Demand Control Ventilation***Track: HVAC for Industrial and Commercial Purposes – Challenges and Opportunities**Room: Augustus III/IV, Caesars Palace***Sponsor: 9.10 Laboratory Systems***Chair: Christine Reinders-Caron, Member, Iowa State University, Omaha, IA***1. How the Demand for Ventilation Drives Safety and Energy Efficiency in Labs and Critical Workspaces***Tom Smith, Member, 3Flow, Cary, NC***2. Cost-Benefit Approach to Design and Operation of Laboratory Demand Control Ventilation Systems***Paul Fuson, Phoenix Controls, Acton, MA*

9:45 AM – 10:45 AM

Seminar 6 (Intermediate)**High Performance Design for Mega Airport Terminals***Track: Buildings at 360°**Room: Augustus V/VI, Caesars Palace***Sponsor: 9.8 Large Building Air-Conditioning Systems, 2.10 Resilience and Security***Chair: Anthony York, P.E., Member, Syska Hennessy Group, New York, NY***1. Challenges in Design of Modern Airport Terminals***Sergiu Pelau, P.E., Syska Hennessy Group, New York, NY***2. Sustainability and Resilient Design in Airport Environment***Kris Baker, P.E., Syska Hennessy Group, New York, NY*

9:45 AM – 10:45 AM

Seminar 7 (Basic)



Introduction of Building Decarbonization

Track: Building Decarbonization

Room: Milano I-III, Caesars Palace

Sponsor: Task Force on Building Decarbonization

Chair: Doug Cochrane, P.E., Member, Carrier, Toronto, ON, Canada

1. Building Decarbonization I

Don Brandt, Member, ASHRAE Design ESSENTIALS Instructor, Atlanta, GA

2. Building Decarbonization II

Ginger Scoggins, P.E., ASHRAE Fellow, Engineered Designs, Cary, NC

3. Building Decarbonization III

Kent Peterson, Presidential Fellow ASHRAE, P2S, Inc., Long Beach, CA

9:45 AM – 10:45 AM

Seminar 8 (Intermediate)



The Solar Panel: Enabling Renewable's Integration with Thermal Energy Storage Systems

Track: Energy System Integration

Room: Neopolitan III/IV, Caesars Palace

Sponsor: 6.9 Thermal Storage

Chair: Jason Woods, Ph.D., Associate Member, National Renewable Energy Laboratory, Golden, CO

1. Optimization of Photovoltaic Self-Consumption with Residential Electric Water Heaters

Celeste Fieberg, Student Member, National Renewable Energy Laboratory, Golden, CO

2. Enabling Grid Penetration of Renewables with Residential Cool Thermal Energy Storage

Amy Van Asselt, Ph.D., Associate Member, Lafayette College, Easton, PA

3. Synergies between Building-Sited Batteries and Thermal Energy Storage

Jason Woods, Ph.D., Associate Member, National Renewable Energy Laboratory, Golden, CO

11:00 AM – 12:30 PM

Paper Session 4



How to Achieve the Desired Comfort Level in Extreme Weather Conditions

Track: Buildings at 360°

Room: Augustus V/VI, Caesars Palace

Chair: Nohad Boudani, PEng, Member, Sodicom, Beirut, Lebanon

1. Preliminary Investigation of Active Demand Flexibility Control at AHUs Using Energy Feedback Control (LV-22-C010)

Rodney D. Hurt, Student Member¹, Zufen Wang, Gang Wang, P.E., Member³, Esber Andiroglu³ and Li Song, Ph.D., P.E., Member¹, (1) University of Oklahoma, Norman, OK, (2) University of Miami, Miami, FL, (3) University of Miami, Coral Gables, FL

2. Detailed Analysis of the Loads Impact of Passive Architectural Elements in Hot-Dry Climates (LV-22-C011)

Ahmed Mezaïen, *Student Member* and **Juan-Carlos Baltazar**, *Ph.D., P.E., BEMP, Member, Texas A&M University, College Station, TX*

3. Design and Implementation of a DC-Powered Local Weather Station Picogrid for Optimal Energy Management in a Residential Building (LV-22-C012)

Jonathan Ore, *Ph.D., Aaron Farha, Student Member, Davide Ziviani, Ph.D., Member, Eckhard Groll, Dr.Ing., Fellow ASHRAE and Daniel Hagedorn, Purdue University, West Lafayette, IN*

11:00 AM – 12:30 PM

Paper Session 5



Simulation, Integration and Optimization of Decentralized Energy into District Systems

Track: Energy System Integration

Room: Milano V-VII, Caesars Palace

Chair: Ahmed Abdelsalam, Amazon, Dublin, Ireland

1. Integrating Waste Heat Recovery from Railway Tunnels into Flexible Heat Networks (LV-22-C013)

Henrique Lagoeiro¹, **Akos Revesz**, *Ph.D.*¹, **Gareth Davies**, *Ph.D.*¹, **Daniel Curry**², **Gareth Faulks**¹, **Declan Murphy**², **Josh Vivian**² and **Graeme Maidment**, *Ph.D., P.E.*¹, (1) London South Bank University, London, United Kingdom, (2) Transport for London, London, United Kingdom

2. Strategic Integration of Renewable Energy, Energy Storage and Heat Pump with CHP Devices to Reduce Carbon Dioxide Emissions and Operation Cost: Case Study Using an Analysis and Design Software (LV-22-C014)

Yasin Naman¹, **Gregory J. Kowalski**, *Ph.D.*² and **Mansour Zenouzi**, *Ph.D., P.E., Member*³, (1) Universidad de America, Bogota, Colombia, (2) Emeritus, Boston, MA, (3) Wentworth Institute of Technology, Boston, MA

3. Demonstration and Analysis of Hybrid and Grid-Interactive Integrated Energy Systems Approaches (LV-22-C015)

Tim Kingston, *Associate Member*, **Alejandro Baez-Guada** and **Alex Fridlyand**, *Ph.D., Associate Member, Gas Technology Institute, Des Plaines, IL*

11:00 AM – 12:30 PM

Seminar 10 (Intermediate)



Building-Integrated Indoor Air Quality Sensors

Track: Environmental Health and IEQ in the International Arena

Room: Milano I-III, Caesars Palace

Sponsor: 7.5 Smart Building Systems, 6.10 Fuels and Combustion

Chair: Zachary Siefker, Student Member, Purdue University, West Lafayette, IN

1. Development and Evaluation of Low-Cost IAQ Sensors

Zachary Siefker, *Student Member, Purdue University, West Lafayette, IN*

2. Developing CO₂ Sensor System Reliability Evaluation Methods for Commercial Building Applications

Debruda Mitra, *Michigan State University, East Lansing, MI*

3. An Application of Kitchen Indoor Air Quality Sensors in Phius+ and Energy STAR Multifamily Units

Rich Swierczyna, Member, Gas Technology Institute, Des Plaines, IL

11:00 AM – 12:30 PM

Seminar 11 (Basic)



Introduction to Research Knowledge and Building Standards Working Groups

Track: Building Decarbonization

Room: Neopolitan III/IV, Caesars Palace

Sponsor: Task Force for Building Decarbonization

Chair: George Pantelidis, Member, ZEB SA, Athens, Greece

1. Research/Knowledge Hub for Building Decarbonization

Drury Crawley, Ph.D., BEMP, Fellow ASHRAE, Bentley Systems, Inc., Washington, DC

2. Building Performance Standard: The Pathway to Decarbonize the Existing Building Stock-Part 1

Bing Liu, P.E., Fellow ASHRAE, Pacific Northwest National Laboratory, Richland, WA

3. Building Performance Standard: The Pathway to Decarbonize the Existing Building Stock-Part 2

Harry Bergmann, Associate Member, U.S. Department of Energy, Washington, DC

11:00 AM – 12:30 PM

Seminar 12 (Advanced)



Renewables and the Smart Grid

Track: Energy System Integration

Room: Neopolitan I/II, Caesars Palace

Sponsor: 7.5 Smart Building Systems, 6.7 Solar Energy Utilization, 7.6 Building Energy Performance and 2.8 Building Environmental Impacts and Sustainability

Chair: Christie Kjellman, Member, Kliewer & Associates, Aliso Viejo, CA

1. Microgrid Applications

Mehdi Ganji, Ph.D., Willdan, San Francisco, CA

2. Field Demonstration of Optimal Control for Campus Cooling Plant for Renewable Energy Integration and Decarbonization

Donghun Kim, Ph.D., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

3. Integration of Renewables and the Smart Grid

Randall Higa, P.E., Member, Southern California Edison, Rosemead, CA

1:30 PM – 3:00 PM

Paper Session 6



Energy Codes, Standards, Emission Trading Scheme to Achieve NetZero in 2050

Track: Buildings at 360°

Room: Augustus V/VI, Caesars Palace

Chair: Gary Debes, Gary Debes Consulting Services, Coatesville, PA

1. Integrative Economic Analysis of Office Building HVAC Systems Incorporating the Emission Trading Scheme (LV-22-C016)

Hyeonsoo Kim, Ph.D., Student Member and Lars Junghans, Ph.D., Associate Member, University of Michigan, Ann Arbor, MI

2. Planning for Net Zero By 2050, What HVAC System Interventions Will Today's Code Minimum Commercial Buildings Require? (LV-22-C017)

Patrick Pease, P.E., Member, Libu Babu, Jayati Chhabra and Zahra Zolfaghari, cove.tool, Atlanta, GA

3. Expanding the Role of Energy Codes to Meet Generational Shifts (LV-22-C018)

Jim Edelson, Member, Alexi Miller, P.E., Member, Kim Cheslak and Mark Lyles, New Buildings Institute, Portland, OR

1:30 PM – 3:00 PM

Paper Session 7



Recent Advancement in Heat Pump and Heating Systems

Track: HVAC&R Systems and Equipment

Room: Milano V-VII, Caesars Palace

Chair: Ahmed Abdelsalam, Amazon, Dublin, Ireland

1. Combined Cold-Climate Air-Source Heat Pump and Heat Pump Water Heater System Performance in Multiple Climate Zones (LV-22-C019)

Alejandro Baez Guada, Associate Member¹ and Tim Kingston, Associate Member², (1) Gas Technology Institute, Chicago, IL, (2) Gas Technology Institute, Des Plaines, IL

2. Ejector Heat Pump for Water Heating (LV-22-C020)

Ahmad Abuheiba, Member¹, Kashif Nawaz, Ph.D., Member¹, Hongbin Ma, Ph.D.², Pengtao Wang² and Jeremy Spitzenberger³, (1) Oak Ridge National Laboratory, Oak Ridge, TN, (2) Missouri University, Columbia, MO, (3) University of Missouri, Columbia, MO

3. A Novel Approach to Determining As-Installed Space and Water Heating Equipment Performance and Quantifying Potential Energy and Cost Savings in Buildings (LV-22-C021)

Alejandro Baez Guada, Associate Member¹ and Tim Kingston, Associate Member², (1) Gas Technology Institute, Chicago, IL, (2) Gas Technology Institute, Des Plaines, IL

1:30 PM – 3:00 PM

Seminar 9 (Basic)



Accelerating Change in Building Design and Operation for a Resilient Future

Track: Buildings at 360°

Room: Milano I-III, Caesars Palace

Sponsor: 7.1 Integrated Building Design, CIBSE ASHRAE Liaison Committee

Chair: Tim Dwyer, CEng, Fellow ASHRAE, UCL Institute for Environmental Design and Engineering (IEDE), London, United Kingdom

1. Integrating Modern Methods for Sustainable Built Environments

Kevin Mitchell, CEng, Member, Mott MacDonald, London, United Kingdom

2. Sustainable Lighting for Health and Wellbeing in a Modern, and Swiftly Changing, World

Kevin Kelly, CEng, Technological University Dublin, Dublin, Ireland

3. Improving Building Performance with Intelligent Optimization

David Green, P.E., BCXP, Member, Integral Group, Edmonton, AB, Canada

4. Achieving Zero Energy

Tom Phoenix, P.E., BEMP and BEAP, Presidential Fellow Life Member, CPL (Clark Patterson Lee), Greensboro, NC

1:30 PM – 3:00 PM

Seminar 13 (Intermediate)



Expansion Devices 101: What Options Are There and Which One to Choose?

Track: HVAC&R Systems and Equipment

Room: Augustus III/IV, Caesars Palace

Sponsor: 8.8 Refrigerant System Controls and Accessories

Chair: Christian Bach, Ph.D., Associate Member, Oklahoma State University, Stillwater, OK

1. Thermostatic Expansion Valves: Basics and Application

Everardo Cano, Associate Member, Sporlan Division of Parker Hannifin, Washington, MO

2. Fixed Area Expansion Devices: Basics and Application

William V. (Vance) Payne, Member, National Institute of Standards and Technology, Gaithersburg, MD

3. Operation of Electronic Expansion Valves and Their Use for Efficient HVAC System Operation

Kirk Stifle, P.E., Member, Fujikoki America, Dallas, TX

4. Two-Phase Refrigerant Ejector: An Expansion Device Capable of Recovering Work

Stefan Elbel, Ph.D., Member, University of Illinois at Urbana-Champaign, Urbana, IL

1:30 PM – 3:00 PM

Workshop 1 (Basic)



Role Models: How to Inspire the Next Generation of Engineers

Track: HVAC&R Systems and Equipment

Room: Neopolitan III/IV, Caesars Palace

Chair: Catarina Marques, Ph.D., London South Bank University, London, United Kingdom

1. Benefits of Diversity, Equality and Inclusion in the Refrigeration Industry

Andres Sepúlveda, Member, Commtech and Fagerhult, Madrid, Spain

2. Role Models Influence of Young People Career Decisions: Case Studies

Ina Colombo, Ph.D., Associate Member, International Institute of Refrigeration, Paris, France

3. A Career in Refrigeration

Michael Kauffeld, Karlsruhe University, Karlsruhe, Germany

4. Women in ASHRAE: Opportunities from Networking, Mentoring and Learning

Sheila Hayter, Member, Energy & Environmental Applications, National Renewable Energy Laboratory, Golden, CO

5. Promoting RACHP in Schools

Graeme Maidment, Ph.D., P.E., London South Bank University, London, United Kingdom

1:30 PM – 3:30 PM

Seminar 14 (Basic)



Smart Thermostats, Energy Savings and Cooling Equipment Cycling

Track: HVAC&R Systems and Equipment

Room: Neopolitan I/II, Caesars Palace

Sponsor: 6.3 Central Forced Air Heating and Cooling Systems, 8.11 Unitary and Room Air Conditioners and Heat Pumps

Chair: Lawrence Brand, Member, Frontier Energy, Oakland, CA

1. How Smart Thermostats Determine Cycling and Save Energy

Michael Sinclair, Ecobee, Toronto, ON, Canada

2. Warm Climate Utility Incentives and Energy Savings for Smart Thermostats

John Lallier, CenterPoint Energy, Houston, TX

3. How ASHRAE Standard 240 Uses Thermostat Cycling

3:15 PM – 4:45 PM

Seminar 15 (Basic)



Update on the Progress of the Task Force on Building Decarbonization

Track: Building Decarbonization

Room: Augustus III/IV, Caesars Palace

Sponsor: Task Force on Building Decarbonization

Chair: Donald Brandt, Life Member, Trane Company – Retired, Phoenix, AZ

1. Update Session I

Don Colliver, Presidential Fellow Life Member, University of Kentucky, Lexington, KY

2. Update Session II

Tom Phoenix, P.E., BEMP and BEAP, Presidential Fellow Life Member, CPL (Clark Patterson Lee), Greensboro, NC

Monday, January 31

8:00 AM – 9:30 AM

Paper Session 8



Performance Evaluation of Latest HVAC Systems

Track: HVAC&R Systems and Equipment

Room: Milano V-VII, Caesars Palace

Chair: Suzanne LeViseur, Haddad Engineering, Inc., Jacksonville, FL

1. Hybrid Heating and Hot Water in Multifamily Buildings: Demonstration and Analysis of Integrated Boilers and Thermally-Driven Heat Pumps (LV-22-C022)

Paul Glanville, P.E., Member¹, Michael Mensinger Jr.¹, Matt Blaylock, Associate Member², Tao Li, Associate Member³ and Ryan Hardesty, Associate Member³, (1) Gas Technology Institute, Chicago, IL, (2) SMTI, Johnson City, TN, (3) Weil McLain, Burr Ridge, IL

2. Gas Engine Heat Pump VRF Modeling Comparison Study with Cold Climate Electric VRF and VAV System (LV-22-C023)

Ramanathan Dharmarajan, Associate Member, Aleksandr Fridlyand, Ph.D., Member and Patricia Rowley, Associate Member, Gas Technology Institute, Des Plaines, IL

3. A Review and an Evaluation of the Updated Method of Test for Rating Fuel-Fired Heat Pumps in HVAC (LV-22-C024)

Aleksandr Fridlyand, Ph.D., Member, Paul Glanville, P.E., Associate Member and Navin Kumar, Ph.D., Gas Technology Institute, Des Plaines, IL

4. Comparison of Residential Heat Pump Heating Seasonal Performance Based on Load-Based and Steady-State Testing Methodologies (LV-22-C025)

Parveen Dhillon, Student Member, Travis Horton, Ph.D., Member and James Braun, Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN

8:00 AM – 9:30 AM

Paper Session 9



Two Sides of a Coin: Addressing AC Energy Costs

Track: Energy System Integration

Room: Milano I-III, Caesars Palace

Chair: Brian M. Fronk, Ph.D., P.E., Associate Member, Oregon State University, Corvallis, OR

1. Comparing Combined Heat and Power with Conventional Forced Air/Grid in Residential Buildings (LV-22-C026)

Danielle Caron, Student Member and Ryan Milcarek, Ph.D., Member, Arizona State University, Tempe, AZ

2. Natural Gas Generators for Standby Power and Demand-Side Management for More Cost-Effective Energy Resilience (LV-22-C027)

Patricia Rowley, Alex Lovallo and Jason Stein, Gas Technology Institute, Des Plaines, IL

8:00 AM – 9:30 AM

Paper Session 13**Simulations and Control Algorithms for Reducing Energy Consumption***Track: Buildings at 360°**Room: Augustus VIVI, Caesars Palace**Chair: Raul Simonetti, Member, Carel Industries SpA, Brugine, Italy***1. Autonomous Buildings Enable Energy Efficiency (LV-22-C028)***Troy Harvey, Member, PassiveLogic, Salt Lake City, UT***2. The Impact of Existing Building Commissioning on Electric Peak Demand (LV-22-001)***Ahmed Morsy, Student Member, Texas A&M University, College Station, TX***3. Assessing the Impacts of Natural Ventilation on Building Energy Use: A Case Study of a Mid-rise Residential Building in Chicago, IL (LV-22-002)***Insung Kang, Student Member, Illinois Institute of Technology, Chicago, IL***4. New Configuration and Control for Dual VAV Systems to Achieve Better Building Energy Efficiency (LV-22-003)***Nabil Nassif, University of Cincinnati, Cincinnati, OH*

8:00 AM – 9:30 AM

Seminar 16 (Intermediate)**Electric Grid to Building Interface and Decarbonization through Sequestration***Track: Building Decarbonization**Room: Neopolitan III/IV, Caesars Palace***Sponsor: Task Force on Building Decarbonization***Chair: Martin Weiland, P.E., Member, US General Services Administration, Washington, DC***1. How Do Buildings Play a Role in Decarbonizing the Grid and How Does the Grid Talk Back?***Katherine Hammack, Fellow ASHRAE, US Green Building Council Washington DC***2. Decarbonization through Sequestration***Lance Davis, US General Services Administration, Washington, DC*

8:00 AM – 9:30 AM

Seminar 17 (Intermediate)**Energy System Integration a.k.a. Combined Heat and Power***Track: Energy System Integration**Room: Neopolitan I/II, Caesars Palace***Sponsor: 1.10 Cogeneration Systems***Chair: Blake Ellis, P.E., Fellow ASHRAE, Burns & McDonnell, Overland Park, KS***1. Energy System Integration with Loads and the Grid through CHP***Gearoid Foley, Member, Integrated CHP Systems Corp., Princeton, NJ***2. ESI Vs. ESI***Praveen Cheekatamarla, Member, Oak Ridge National Laboratory, Oak Ridge, TN***3. Energy Systems Integration with H2 CHP***Richard Sweetser, Life Member, Exergy Partners Corp., Herndon, VA*

8:00 AM – 9:30 AM

Seminar 18 (Intermediate)



Lubricants for New Low GWP Refrigerant Candidates

Track: Refrigerants and Refrigeration

Room: Augustus III/IV, Caesars Palace

Sponsor: 3.4 Lubrication

Chair: Greg Smith, Ph.D., Associate Member, Honeywell International, Buffalo, NY

1. Lubricants for Low GWP Refrigerants: From Concept to Compressor Operation

Joseph Karnaz, Member, Shrieve Chemical Products, Inc, The Woodlands, TX

2. Investigation of Lubricant Effects on Low GWP Refrigerant Performance

Ramesh Navaratnam, Patech Fine Chemicals Co. Ltd., Dublin, OH

3. Lubricants for New Low GWP Refrigerant Candidates

Joseph Karnaz, Member, Shrieve Chemical Products, Inc, The Woodlands, TX

9:45 AM – 10:45 AM

Paper Session 11



Research Advancements in Air Side Equipment and Components

Track: HVAC&R Systems and Equipment

Room: Milano V-VII, Caesars Palace

Chair: Davide Ziviani, Ph.D., Member, Center for High Performance Buildings, Purdue University, West Lafayette, IN

1. Studying the Effects of Suction Chamber Intrusions and Housing Proximity on Backward Centrifugal Fan Performance Utilizing Computational Fluid Dynamics (LV-22-C031)

Adam Michalson, Kevin L. Amende, P.E., Associate Member and Erick Johnson, Montana State University, Bozeman, MT

2. Analysis of Condensation on Ducts of Various Insulation Levels Using Coupled Heat-Mass Model with Building Simulation Data for California Climate Zones (LV-22-C032)

Antash Najib, Ph.D., Associate Member¹, Mark Modera, Ph.D., P.E., Fellow ASHRAE² and Frederick Meyers², (1) Pakistan Navy Engineering College (NUST), Karachi, Pakistan, (2) University of California, Davis, CA

3. Field and Simulation Testing and Improvement of ASHRAE Guideline 36 Duct Static Pressure Resetting Algorithm (LV-22-C033)

Nabil Nassif, Ph.D., P.E., Member, University of Cincinnati, Cincinnati, OH

4. Energy Modeling of Variable Air Volume Parallel Fan Powered Terminal Units Using Energyplus

Zahra Sardoueiniasab¹, Peng Yin, Ph.D., Associate Member² and Dennis O'Neal, Ph.D., Fellow ASHRAE³, (1) Nailor Industries, Houston, TX, (2) University of Louisiana at Lafayette, Lafayette, LA, (3) Baylor University, Waco, TX

9:45 AM – 10:45 AM

Seminar 19 (Basic)**ASHRAE Conference Crash Course***Track: Fundamentals and Applications**Room: Augustus VIVI, Caesars Palace***Sponsor: YEA Committee***Chair: Madison Schultz, P.E., Member, OK BeCo, Oklahoma City, OK***1. The Ins and Outs of ASHRAE***Elise Kiland, P.E., Member, Critchfield Mechanical, Inc, San Jose, CA***2. Make the Most of Your Conference Experience***Chris Krieps, P.E. Member, Salas O'Brien, Chicago, IL*

9:45 AM – 10:45 AM

Seminar 20 (Intermediate)**HVAC Design, Control and Operation of Hospitals After COVID-19 Fiasco***Track: Environmental Health and IEQ in the International Arena**Room: Augustus III/IV, Caesars Palace***Sponsor: 1.4 Control Theory and Application, 9.6 Healthcare Facilities, TC-1.5, TC-7.3, TC-7.5, TC-2.8***Chair: Frank Shadpour, P.E., Fellow ASHRAE, SC Engineers, Inc., San Diego, CA***1. The Hospital of the Future: Designing for Energy Efficiency and Infection Control***Timothy Jacoby, Scripps Health, San Diego, CA***2. Designing Flexible and Adaptable HVAC Systems***Renshaw Edward, P.E., Kaiser Permanente, La Mesa, CA*

9:45 AM – 10:45 AM

Forum 2**Diversity, Equity, Inclusion and ASHRAE: Does It Really Matter?***Track: Fundamentals and Applications**Room: Neopolitan III/IV, Caesars Palace***Sponsor: Board of Directors DEI Advisory Subcommittee***Chair: Adrienne Thomle, ASHRAE Fellow, Retired, Reno, NV*

9:45 AM – 10:45 AM

Workshop 2 (Intermediate)**Benefits and Cost Justification of Cloud-Based Building Energy Analytics***Track: HVAC for Industrial and Commercial Purposes – Challenges and Opportunities**Room: Milano I-III, Caesars Palace**Chair: Bert Phillips, UNIES Ltd., Winnipeg, MB, Canada***1. Benefits and Cost Justification of Cloud-Based Building Energy Analytics***Pavan Kumar Ryali, NYSERDA, New York, NY*

11:00 AM – 12:00 PM

Seminar 3 (Intermediate)

Would Your Building Perform Satisfactorily During a Heatwave or Power-Blackout?

Track: Buildings at 360°

Room: Neopolitan I/II, Caesars Palace

Sponsor: 4.2 Climatic Information, 2.8 Building Environmental Impacts and Sustainability

Chair: Joe Huang, White Box Technologies, Inc. Moraga, CA

1.Strategies for Urban Cooling: How Buildings Can Improve Indoor and Outdoor Urban Climates

David Sailor, Ph.D., P.E., Arizona State University, Tempe, AZ

2.Could a Passive Design Satisfy the Needs of Building Occupants?

Eric Peterson, Ph.D., P.E., Member, University of Leeds, Leeds, United Kingdom

11:00 AM – 12:00 PM

Paper Session 12



Modelling Materials and Devices to Use Them at Best

Track: HVAC&R Systems and Equipment

Room: Augustus V/VI, Caesars Palace

Chair: Suzanne LeViseur, Haddad Engineering, Inc., Jacksonville, FL

1. Development of a U-factor Calculation Procedure for Cold-Formed Steel C-shape Clear Wall Assemblies (LV-22-004)

Merle McBride, Ph.D., P.E., Life Member, Consulting Engineer, Granville, OH

2. The Use of CFD to Understand Mixing, Controls, and Dampers in Air Handling Units (LV-22-005)

Donald Willoughby

3. A Novel Process for Selecting a PCM for a Building Energy Retrofit (LV-22-006)

Neda Askari Tari, Arizona State University, Tempe, AZ

11:00 AM – 12:00 PM

Seminar 21 (Intermediate)



Does it Matter Where your Weather Data Comes From?

Track: Buildings at 360°

Room: Milano V-VII, Caesars Palace

Sponsor: 4.2 Climatic Information, 2.5 Global Climate Change

Chair: Parag Rastogi, Ph.D., Member, arbnco ltd, Glasgow, United Kingdom

1. How the Sausage Is Made: Past, Present and Future Adventures in Determining Climate Zones

Drury Crawley, Ph.D., BEMP, Fellow ASHRAE, Bentley Systems, Inc., Washington, DC

2. Adventures in Wrangling Weather Data for Building Design and Analysis

Drury Crawley, Ph.D., BEMP, Fellow ASHRAE, Bentley Systems, Inc., Washington, DC

11:00 AM – 12:00 PM

Seminar 22 (Intermediate)**Infection Control in Commercial Spaces***Track: Environmental Health and IEQ in the International Arena**Room: Milano I-III, Caesars Palace***Sponsor: 4.10 Indoor Environmental Modeling***Chair: Wangda Zuo, University of Colorado, Boulder, CO***1. Evaluation of Mitigation Strategy for Aerosol Disease****Transmission in a Conference Room***Wangda Zuo, Ph.D., Member, University of Colorado, Boulder, CO***2. The Micro (Individual) and Macro (Population) Aspects of****Assessing Infection Control in Commercial Spaces***Duncan Phillips, Ph.D., P.E., Member, Rowan Williams Davies & Irwin, Guelph, ON, Canada*

11:00 AM – 12:00 PM

Seminar 23 (Advanced)**Integrated Smart Heating and Cooling Systems***Track: Energy System Integration**Room: Neopolitan III/IV, Caesars Palace***Sponsor: 6.8 Geothermal Heat Pump and Energy Recovery Applications***Chair: Graeme Maidment, Ph.D., P.E., London South Bank University, London, United Kingdom***1. Feeding R&D Back into Government Policy***Joel Hamilton, UK Government, London, United Kingdom***2. The Need for Smart Local Energy Systems***Graeme Maidment, Ph.D., P.E., London South Bank University, London, United Kingdom***3. Green Smart Community Integrated Energy Systems***Akos Revesz, Ph.D., Affiliate, London South Bank University, London, United Kingdom***4. Low Temperature Heat Networks in Sweden***Helen Carlström, E.ON, Malmö, Sweden*

11:00 AM – 12:00 PM

Seminar 24 (Intermediate)**The Future of Controls: Transition from Algorithmic to Predictive Control***Track: HVAC&R Systems and Equipment**Room: Augustus III/IV, Caesars Palace***Sponsor: 1.4 Control Theory and Application***Chair: Paul Ehrlich, P.E., Member, Building Intelligence Group, Portland, OR***1. Moving to MPC: What, Why and How***Draguna Vrabie, Ph.D., Member, Pacific Northwest National Laboratory, Richland, WA***2. Practical Applications Using MPC***Troy Harvey, Member, HunPassive Logic, Salt Lake City, UT*

2:15 PM – 3:45 PM
Seminar 25 (Intermediate)



Seismic Certification of Equipment

Track: Fundamentals and Applications

Room: Augustus III/IV, Caesars Palace

Sponsor: 2.7 Seismic and Wind Resistant Design

Chair: Matthew Hooti, P.E., Member, ISOTECH Industries inc, Woodbridge, ON, Canada

1. Code Requirements: When/Where

Robert Simmons, P.E., Member, Petra Seismic Design, Houston, TX

2. Equipment Manufacturing Experience

Harold Dubensky, P.E., Member, Johnson Controls, Inc., York, PA

3. How: Certification Requirements

John Giuliano, P.E., Member, The VMC Group, Bloomingdale, NJ

Tuesday, February 1

8:00 AM – 9:30 AM
Panel 1 (Intermediate)

In Real Time: Charting the Pathway for Existing Buildings to Get to Carbon Neutrality

Track: Buildings at 360°

Room: Milano I-III, Caesars Palace

Sponsor: 2.8 Building Environmental Impacts and Sustainability

Chair: Paul Torcellini, Ph.D., P.E., Fellow ASHRAE, National Renewable Energy Laboratory, Golden, CO

1. Creating an Effective Action Plan #1

Stet Sanborn, AIA, Member, Smith Group, San Francisco, CA

2. Creating an Effective Action Plan #2

Kent Peterson, P.E., Presidential Fellow ASHRAE, P2S, Inc., Long Beach, CA

3. Creating an Effective Action Plan #3

John Hickey, P.E., Jacobs, Seattle, WA

4. Creating an Effective Action Plan #4

Kiersten Washle, Associate Member, CMTA, Boston, MA

TECH PROGRAM

8:00 AM – 9:30 AM
Paper Session 14



Characterizing Device Performances by Field Tests and Measurements

Track: HVAC&R Systems and Equipment

Room: Milano V-VII, Caesars Palace

Chair: Davide Ziviani, Ph.D., Member, Purdue University, West Lafayette, IN

1. Demonstration of Hybrid Boiler Arrays to Improve Heating Season Efficiency, Provide Redundancy, and Minimize Capital Investment (LV-22-C035)

Abinesh Ravi, Associate Member¹, Kris Jorgensen, Ph.D., Associate Member², Douglas Kosar, Member², Alex Lavollo² and Patricia Rowley, Associate Member², Gas Technology Institute, Des Plaines, IL

2. Experimental Characterization of Adsorption Isotherm of Solid Desiccant Materials for Use in Air Dehumidification Devices (LV-22-C036)

Tomas Venegas, BEMP, Associate Member¹, Ming Qu, Ph.D., Associate Member¹, Kashif Nawaz, Ph.D., Member² and Lingshi Wang², (1) Purdue University, West Lafayette, IN, (2) Oak Ridge National Laboratory, Oak Ridge, TN

3. Repeatability Assessment of Load-Based Testing Methodology for Residential Air Conditioning Equipment (LV-22-C037)

Parveen Dhillon, Student Member, Dohyeon Kim, Travis Horton, Ph.D., Member and James Braun, Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN

8:00 AM – 9:30 AM

Paper Session 15



Light and Shade

Track: Buildings at 360°

Room: Augustus VIVI, Caesars Palace

Chair: Nohad Boudani, PEng, Member, Sodicom, Beirut, Lebanon

1. More Light, Less Energy: Validating Fully-Integrated LED Controls for DoD Interior Lighting Applications (LV-22-C038)

Bryan Urban, Fraunhofer USA, Boston, MA

2. Co-Simulation and Validation of Automated Shading Devices Using Energyplus and Radiance to Optimize Building Energy Use (LV-22-C039)

Soham Vanage, Student Member¹, Niraj Kunwar, Associate Member², Diba Malekpour¹ and Kristen Cetin, Ph.D., P.E., Member¹, (1) Michigan State University, East Lansing, MI, (2) Oakridge National Laboratory, Oakridge, TN

8:00 AM – 9:30 AM

Seminar 26 (Intermediate)



Advanced Heat Exchanger Simulation and Optimization Tools for HVAC Applications

Track: HVAC&R Systems and Equipment

Room: Neopolitan I/II, Caesars Palace

Sponsor: 1.13 Optimization

Chair: Khaled Saleh, Ph.D., P.E., Member, Goodman Manufacturing, Daikin Group, Houston, TX

1. Optimization of Heat Exchangers Using Steady State Simulation Tools Coupled with CFD and Multiobjective Genetic Algorithms

Vikrant Aute, Ph.D., Member, University of Maryland, College Park, MD

2. Evap-Cond Simulation Tool with Optimization Refrigerant Circuitry

Piotr Domanski, Ph.D., Fellow ASHRAE, National Institute of Standards and Technology, Gaithersburg, MD

3. Optimization and LCCP Evaluation of a Residential Heat Pump Using 5-Mm Tubes and Refrigerants with GWP <150

Zhenning Li, Ph.D., Associate Member, Oak Ridge National Laboratory, Oak Ridge, TN

8:00 AM – 9:30 AM

Seminar 27 (Advanced)



Impact of Workplace Furnishing System and Air Distribution on Infectious Diseases

Track: Environmental Health and IEQ in the International Arena

Room: Neopolitan III/IV, Caesars Palace

Chair: Julia Murphy, SOM, New York City, NY

1. Framework of Infectious Disease Spread in the Workplace

L. Bourouiba, Ph.D., MIT, Cambridge, MA

2. The Effect of Workplace Furnishing Layouts on Air Flow and Disease Transmission

Sharon Tracy, Ph.D., Steelcase, Grand Rapids, MI

3. ASHRAE ETF Office Guide: Consideration of Air Flow and Furnishing Systems

Luke Leung, P.E., BEMP, Member, Skidmore, Owings, & Merrill LLP, Chicago, IL

4. Utilizing CFD to Study Different Post Pandemic Workplace Layouts

Stephen Ray, Ph.D., P.E., Associate Member, North Park University, Chicago, IL

8:00 AM – 9:30 AM

Seminar 28 (Intermediate)



Understanding and Applying Gas-Fired Low Intensity Infrared Radiant Heat Systems in Industrial Facilities

Track: HVAC for Industrial and Commercial Purposes – Challenges and Opportunities

Room: Augustus III/IV, Caesars Palace

Sponsor: 6.5 Radiant Heating and Cooling

Chair: Ongun Berk Kazanci, Ph.D., Associate Member, International Centre for Indoor Environment and Energy, Technical University of Denmark, Kgs. Lyngby, Denmark

1. Intermediate Understanding of Infrared Radiant Heating

Kevin Mahoney, Specified Air, Comstock Park, MI

2. Gas-Fired Infrared Heat for Distribution and Fulfillment Centers

Donald E. Larsson, Member, Specified Air Solutions, Buffalo, NY

3. Gas Fired Infrared Heating from a Consulting Engineer's Perspective

Gregory Topp, P.E., Member, Roger D Fields Associates, Columbus, OH

4. Gas Fired Infrared Heating from an Owner's Perspective

Firyal Kassim, Federal Express Ground, Moon Township, PA

9:45 AM – 10:45 AM

Paper Session 16



How the Use of Smart "Self-Learning" Controls Can Enhance the Building Efficiency

Track: Buildings at 360°

Room: Neopolitan I/II, Caesars Palace

Chair: Nohad Boudani, PEng, Member, Sodicom, Beirut, Lebanon

1. A Data-Driven Method to Test and Fine-Tune Occupant-Centric Building Controls Prior to Implementation (LV-22-C040)

Hamidreza Karimian¹, Mohamed Ouf, Associate Member², Nunzio Cotrufo, Student Member³ and Jean-Simon Venne⁴, Concordia University, Montreal, QC, Canada, (4) BrainBox AI, Montreal, QC, Canada

2. Experimental Design and Analysis of Reliability Evaluation of Off-the-Shelf Occupancy Sensor System in Residential Buildings (LV-22-C042)

Yiyi Chu, Student Member, Debrudra Mitra, Kristen Cetin, Ph.D., P.E., Member and Sam Evans, Michigan State University, East Lansing, MI

9:45 AM – 10:45 AM

Paper Session 17



Water-Energy Nexus Both in Central and District Systems

Track: HVAC&R Systems and Equipment

Room: Milano V-VII, Caesars Palace

Chair: Brian M. Fronk, Ph.D., P.E., Associate Member, Oregon State University, Corvallis, OR

1. Waterside Economizer Control in ASHRAE RP-1711 (LV-22-007)

Steven Taylor, Taylor Engineering LLC, Alameda, CA

2. Installation Energy and Water Resilience Planning (LV-22-008)

William James Wolfe and Jill Schuekler, US Army Corps of Engineers, Champaign, IL

3. Reducing Cost of Chilled Water Thermal Storage Systems to Encourage Adoption of Energy Efficient Thermal Plants

Jacob Miller, Member, M2 Thermal Solutions LLC, Somerville, MA

9:45 AM – 10:45 AM

Seminar 29 (Intermediate)



Cutting-Edge Japanese Technologies: 2021 SHASE Annual Award Winners for Buildings in Special Environments

Track: HVAC&R Systems and Equipment

Room: Augustus III/IV

Chair: Ryoza Ooka, Ph.D., Member, University of Tokyo Institute of Industrial Science, Tokyo, Japan

1. Indirect Outdoor Air-Cooling System for Data Centers in Cold Regions

Katsuhiro Miura, Ph.D., Member, Kajima Technical Research Institute, Tokyo, Japan

2. Methods for Using Air-Conditioning and Renewable Energy in Training Facilities in Coastal Areas

Jun Yoshida, Takenaka Corporation, Osaka, Japan

9:45 AM – 10:45 AM

Seminar 30 (Intermediate)



High Performance Lab Design for Mixed Use Research Building

Track: Buildings at 360°

Room: Augustus VIVI, Caesars Palace

Sponsor: 9.10 Laboratory Systems

Chair: Eric Fontaine, Member, vanZelm Engineers, Farmington, CT

1. High Performance Lab Design for Mixed Use Research Building

Eric Fontaine, Member¹ and Samir Srouji, AIA², (1) vanZelm Engineers, Farmington, CT, (2) HGA Architects, Boston, MA

9:45 AM – 10:45 AM

Forum 3

Should Have Seen That Coming! Climate Impacts on Cleanrooms, Labs, Hospitals and other Critical Environment Operations

Track: HVAC for Industrial and Commercial Purposes – Challenges and Opportunities

Room: Neopolitan III/IV, Caesars Palace

Sponsor: 9.11 Clean Spaces, 1823, TC 1.7; TC 9.02; TC 9.09; TC 9.10

Chair: Mitchell Swann, P.E., Resolution Management Consultants, Marlton, NJ

11:00 AM – 12:30 PM

Workshop 3 (Basic)



Best Practices of the Mentor-Mentee Relationship

Track: Fundamentals and Applications

Room: Milano I-III, Caesars Palace

Sponsor: YEA Committee, College of Fellows

Chair: Shona O'Dea, Member, DLR Group, Chicago, IL

1. Best Practices of the Mentor-Mentee Relationship

Ralph Kison, Member, Growth Through Learning Inc., Vancouver, BC, Canada

11:00 AM – 12:30 PM

Paper Session 18



Addressing IEQ Challenges Through CFD Simulations, Air Cleaning Technologies and Advanced Particle Removal Technology

Track: Environmental Health and IEQ in the International Arena

Room: Augustus VIVI, Caesars Palace

Chair: Som Shrestha, Ph.D., Member, Oak Ridge National Laboratory, Oak Ridge, TN

1. Computational Fluid Dynamics (CFD) Analysis of Ultraviolet Germicidal (UV-C) to Control the Probability of Infection Due to Transmission of Airborne Pathogens (LV-22-C043)

Kishor Khankari, Ph.D., Fellow ASHRAE¹ and William Bahnfleth, Ph.D., P.E., Presidential Fellow ASHRAE², (1) AnSight LLC, Ann Arbor, MI, (2) Penn State, University Park, PA

2. Comparative Testing and Evaluation of Air-Cleaning Technologies (LV-22-C044)

Christos Polyzois, Ph.D., Member¹, Chris Hsieh¹ and Kathleen Owen, Fellow ASHRAE², (1) Trane Technologies, Bloomington, MN, (2) Owen Air Filtration Consulting, Cary, NC

3. Advanced Particle Removal Technology as an Efficient Tool for Addressing Emerging Global Air Quality and Safety Challenges (LV-22-C045)

Igor Krichtafovitch, Ph.D.¹, **Larry Rothenberg, J.D.²**, Alan Viosca¹ and Norm Long, Member¹, AgentiAir, Rockville, MD

11:00 AM – 12:30 PM

Paper Session 19



Dehumidification: Materials, Devices, Energy Issues and Water Recovery

Track: Fundamentals and Applications

Room: Milano V-VII, Caesars Palace

Chair: Gary Debes, Gary Debes Consulting Services, Coatesville, PA

1. Investigation of Influence of Superhydrophilic and Superhydrophobic Coated Aluminum Surfaces on Frost Formation (LV-22-C046)

Emma Nyholm Humire¹, Mikael Järn, Ph.D.² and Erik Björk, Ph.D.¹, (1) Royal Institute of Technology (KTH), Stockholm, Sweden, (2) RISE Research Institutes of Sweden, Stockholm, Sweden

2. Novel Use of Fertilizer as a Liquid Desiccant for Greenhouse Dehumidification and Water Recovery (LV-22-C047)

Jonathan Maisonneuve, Ph.D. and Sanchayan Pushparajah, Oakland University, Rochester, MI

3. Comparative Energy Analysis of Dehumidification Technologies for Indoor Cannabis Operations (LV-22-C048)

Josh Spalding, Associate Member, Quest, Los Angeles, CA

11:00 AM – 12:30 PM

Seminar 31 (Intermediate)



High Efficiency Variable Speed Pumping Systems and Integration Challenges with Chiller Plant Design

Track: Buildings at 360°

Room: Augustus III/IV, Caesars Palace

Sponsor: 8.2 Centrifugal Machines, 6.1 Hydronic and Steam Equipment and Systems, TC 8.1, TC 2.8

Chair: Trent Hunt, Member, Mechanical Products NSW, Salt Lake City, UT

1. Key Chiller Selection Criteria in a Variable Flow Pumping System

Rick Heiden, Member, Trane – Ingersoll Rand, La Crosse

2. Pumps That Know the Flow in Chilled Water Pumping Systems

David Lee, P.Eng., Member, Armstrong Fluid Technology, Toronto, ON, Canada

3. Lessons Learned in Control and Operation of Primary-Secondary and Distributed Pumping Chilled Water Systems.

Chris Miller, P.E., Member, P2S, Inc., Long Beach, CA

4. Key Design Considerations for the Implementation of Variable Primary Chilled Water Pumping Systems

Brandon Gill, P.E., Member, Taylor Engineering, Alameda, CA

11:00 AM – 12:30 PM

Seminar 32 (Intermediate)



Novel Heat Exchangers Enabled by Shape Optimization and Additive Manufacturing

Track: HVAC&R Systems and Equipment

Room: Neopolitan III/IV, Caesars Palace

Sponsor: 8.5 Liquid-to-Refrigerant Heat Exchangers, 1.3 Heat Transfer and Fluid Flow, TC 1.13

Chair: Kashif Nawaz, Ph.D., ORNL, Oak Ridge, TN

1. Shape and Topology Optimized Heat Exchangers: Challenges and Opportunities

Vikrant Aute, Ph.D., Member, University of Maryland, College Park, MD

2. Heat Transfer Enhancement of Single-Phase Internal Flows Enabled by Shape Optimization and Additive Manufacturing

William King, Ph.D., University of Illinois at Urbana-Champaign, Champaign, IL

3. Topology Optimization of Fluid-Fluid Heat Exchange Systems

Kentaro Yaji, Ph.D., Osaka University, Osaka, Japan

11:00 AM – 12:30 PM

AHR Expo Session 1 (Intermediate)



The Industry Transition to A2L Refrigerants: Where Are We and Where Are We Headed?

Track: Refrigerants and Refrigeration

Room: N235/N237, Las Vegas Convention Center

Sponsor: 7.3 Operation and Maintenance Management

Chair: Matthew Mullen, P.E., BEAP, Member, EMCOR Services New England Mechanical, South Windsor, CT

1. U.S. and Worldwide Regulatory Drivers for Transitioning to Low GWP Refrigerants

Helen Walter-Terrinoni, Air Conditioning, Heating and Refrigeration Institute, Arlington, VA

2. Understanding the Risks: Research Results on A2L Refrigerant Safety

Dick Lord, Fellow ASHRAE, Carrier, Monteagle, TN

3. The Standard and Code Impacts of A2L Refrigerants

Mary Koban, Member, Air Conditioning, Heating and Refrigeration Institute, Arlington, VA

4. Servicing Equipment with A2L Refrigerants: What Technicians Will Need Know

Jason Obrzut, ESCO Group, Mt. Prospect, IL

1:00 PM – 1:30 PM

Panel 2 (Basic)

Building Automation, Cybersecurity, Artificial Intelligence, BACnet/SC and Optimizing Controls Sequences: A Panel Discussion for YEA

Track: Fundamentals and Applications

Room: Milano IV, Caesars Palace

Sponsor: 1.4 Control Theory and Application

Chair: Michelle Shadpour, Member, SC Engineers, Inc., San Diego, CA

1:00 PM – 2:30 PM

AHR Expo Session 4 (Basic)**System Stability and Contaminant Control with Lower GWP Refrigerants***Track: Refrigerants and Refrigeration**Room: N235/N23, Las Vegas Convention Center***Sponsor: 3.2 Refrigerant System Chemistry***Chair: Rashid Zakeri, Member, Circle Proscos, Inc.,
Bloomington, IN***1. An Update on Low GWP Refrigerant Material Compatibility and Lubricant Research***Xudong Wang, Ph.D., Member, Air-Conditioning, Heating and Refrigeration Technology Institute, Arlington, VA***2. Filter-Drier for Contaminant Control in Air Conditioning Application of R466A***Debasis Banerjee, Associate Member, Parker Hannifin Corporation, Washington, MO***3. AHRT19016: Insights with R-32, R-1234yf and Their Blends***Elyse Sorenson, Member, Trane Technologies, La Crosse, WI***4. Compatibility of Odorants with Refrigerant/Lubricant Systems***Ngoc Dung (Rosine) Rohatgi, Ph.D., Member¹, Eric Forsell¹,**Scott Ayers¹ and Marc Scancarello, P.E., Member²,**(1) Spauschus Associates Inc., Bethlehem, GA,**(2) Emerson Climate Technologies, Inc., Sidney, OH*

2:45 PM – 3:45 PM

AHR Expo Session 3 (Basic)**Decarbonization as it Applies to Appliance and Equipment Standards***Track: Buildings at 360°**Room: N235/N237, Las Vegas Convention Center**Chair: William McQuade, P.E., Member, Air Conditioning, Heating and Refrigeration Institute, Arlington, VA***1. Appliance and Equipment Standards for Building Decarbonization***William McQuade, P.E., Member, Air Conditioning, Heating and Refrigeration Institute, Arlington, VA*

3:15 PM – 4:45 PM

Seminar 33 (Intermediate)**Level Up Your Flower Game: Hydronic Design for Cannabis Grow Facilities***Track: HVAC for Industrial and Commercial Purposes – Challenges and Opportunities**Room: Augustus III/IV, Caesars Palace***Sponsor: 6.1 Hydronic and Steam Equipment and Systems***Chair: David Lee, P.Eng., Member, Armstrong Fluid Technology, Toronto, ON, Canada***1. Indoor Climate Forecasting***Adam Zebrowski, PID Controls, Toronto, ON, Canada***2. Hydronic Pumping for Cannabis Grow Facilities***Tony Furst, Member, Armstrong Fluid Technology, North Tonawanda, NY*

3. Psychrometric Analysis for Cannabis Cultivation

Devin Lake, P.Eng., Associate Member, Greer Galloway Consulting Engineers, Kingston, ON, Canada

4:00 PM – 5:30 PM

AHR Expo Session 2 (Advanced)



Thermal and Hydraulic Performance of Low GWP Refrigerants under Flow Condensation and Evaporation

Track: Refrigerants and Refrigeration

Room: N235/N237, Las Vegas Convention Center

Sponsor: 1.3 Heat Transfer and Fluid Flow, 8.5 Liquid-to-Refrigerant Heat Exchangers, Co-Sponsor: MTG.LowGWP

Chair: Pratik Deokar, Ph.D., Member, Rheem Manufacturing Company, Lewisville, TX

1. Condensation of R32 inside Microfin and Smooth ID 4 Mm Tubes: A Direct Experimental Comparison

Simone Mancin, Ph.D., University of Padova, Padua, TN, Italy

2. Condensation of Low Global Warming Potential

Non-Azeotropic Mixture R454C in Horizontal Microfin Tubes

Brian Fronk, Ph.D., Member, Oregon State University, Corvallis, OR

3. Condensation Heat Transfer Performance of R513A and R450A in Minichannel Square Tubes

Melanie Derby, Ph.D., Member, Kansas State University, Manhattan, KS

4. Spray Evaporation on an Enhanced Surface Tube Bundle with Low GWP Refrigerant HFO-1234ze(E)

Joshua Rothe, Student Member, Auburn University, Auburn, AL

Wednesday, February 2

8:00 AM – 9:30 AM

Paper Session 20



Innovation in Closed Cavity Façade, Double Skin Façade and Drying Air Cavity

Track: Buildings at 360°

Room: Augustus VIVI, Caesars Palace

Chair: Som Shrestha, Ph.D., Member, Oak Ridge National Laboratory, Oak Ridge, TN

1. Challenges and Opportunities of Using Closed Cavity Façade for Improving Energy Efficiency and Indoor Environmental Quality in Office Buildings in US Climates (LV-22-C049)

Michalis Michael, Associate Member¹ and Mauro Overend²,
(1) University of Cambridge UK, Cambridge, United Kingdom,
(2) Delft University of Technology, Delft, Netherlands

2. Double Skin Façade Integrating Semi-Transparent

Photovoltaics: A Case Study for Different Climates (LV-22-C050)

Zisis Ioannidis, Student Member, Andreas Athienitis, Ph.D., P.E.,
Fellow ASHRAE, Ted Stathopoulos, Ph.D., P.E., Member and
Stratos Rounis, Concordia University, Montreal, QC, Canada

3. Potential Drying of Air Cavity Behind Vinyl Siding for Building Envelopes (LV-22-009)

Yanmei Xie, North Dakota State University, Fargo, ND

8:00 AM – 9:30 AM

Paper Session 21**Refining ASHRAE COVID Guidelines and Standard 100***Track: HVAC&R Systems and Equipment**Room: Milano I-III, Caesars Palace**Chair: Suzanne LeViseur, Haddad Engineering, Inc., Jacksonville, FL***1. From Guidance to Implementation: Applying ASHRAE Epidemic Task Force Building Readiness Strategies in 100+ Commercial Office Buildings (LV-22-C051)***Meghan McNulty, P.E., Member, Jamie Kono, P.E., Associate Member and Barry Abramson, P.E., BEAP, Member, Servidyne, LLC, Atlanta, GA***2. Ashrae Standard 100 Energy Targets Using Local Benchmarking Data (LV-22-C052)***Jamie Kono, P.E., Associate Member¹ and Noriaki Kono², (1) Servidyne, LLC, Atlanta, GA, (2) Independent Researcher, Atlanta, GA*

8:00 AM – 9:30 AM

Seminar 34 (Intermediate)**Advanced Pumping Designs for Hydronic Systems***Track: HVAC&R Systems and Equipment**Room: Milano V-VII, Caesars Palace***Sponsor: 6.1 Hydronic and Steam Equipment and Systems***Chair: David Lee, P.Eng., Member, Armstrong Fluid Technology, Toronto, ON, Canada***1. Theory and Concepts Behind***Agisilaos Tsouvalas, Associate Member, Grundfos Holding A/S, Midtjylland, ON, Denmark***2. A Case Story from Singapore: Ngee Ann Polytechnic***Sam Lam, CEng, Member, Ngee Ann Polytechnic, Singapore, Singapore***3. A Digital Twin Approach: What Energy Modelling Can Provide Us***Ben L. Davis, P.E., Member, Van Boerum & Frank Associates, Salt Lake City, UT*

8:00 AM – 9:30 AM

Seminar 35 (Intermediate)**Energy Modeling and Performance Assessment of Fuel Switching Retrofit Strategies with Air-to-Water Heat Pump Central Plant Systems***Track: Buildings at 360°**Room: Neopolitan I/II, Caesars Palace***Sponsor: 1.5 Computer Applications, 7.1 Integrated Building Design***Chair: Krishnan Gowri, Ph.D., BEMP, Fellow ASHRAE, Intertek, Tacoma, WA***1. An Energy Modeling Case Study of Air-to-Water Heat Pump Fuel-Switch Retrofit Central Plant Systems***Krishnan Gowri, Ph.D., Fellow ASHRAE, Intertek, Tacoma, WA*

2. Air-to-Water Heat Pump Application Techniques for Fuel-Switching Retrofit

Chris DesRoches, P.Eng., Associate Member, Mitsubishi Electric Sales Canada Inc., Toronto, ON, Canada

8:00 AM – 9:30 AM

Seminar 36 (Basic)



How to Select and Size HVAC Fans for Optimum Acoustical Performance

Track: Fundamentals and Applications

Room: Neopolitan III/IV, Caesars Palace

Sponsor: 2.6 Sound and Vibration, 5.1 Fans

Chair: Jerry Lilly, P.E., Life Member, Issaquah, WA

1. Basics of Fan Noise and Application Considerations

Rad Ganesh, Ph.D., Member, Twin City Fan & Blower, Minneapolis, MN

2. Fan Noise in Air Handling Systems

Paul Bauch, Member, Johnson Controls, York, PA

3. 20-20 Foresight: Choosing the Right Fan for the Job

Jerry Lilly, P.E., Life Member, Issaquah, WA

8:00 AM – 9:30 AM

Seminar 37 (Intermediate)



Reduced Order Modeling for HVAC&R Systems and their Components

Track: HVAC&R Systems and Equipment

Room: Augustus III/IV, Caesars Palace

Sponsor: 8.1 Positive Displacement Compressors, 8.2 Centrifugal Machines

Chair: Alex Schmig, Member, Trane, La Crosse, WI

1. Application of Data-Driven Models for Positive Displacement Compressor Mapping

Davide Ziviani, Ph.D., Member, Purdue University, West Lafayette, IN

2. Semi-Empirical Compressor Model Evaluation Considering Modulation and Extrapolation Performance

Kalen Gabel, Student Member, Center for Integrated Building Systems, Oklahoma State University, Stillwater, OK

3. Reduced-Order Modeling and Fast Simulation of Transient Vapor Compression Cycles

Jiacheng Ma, Student Member, Purdue University, West Lafayette, IN

9:45 AM – 10:45 AM

Panel 3 (Basic)

AIM Act Impact on Commercial Refrigeration and Technology Opportunities

Track: HVAC for Industrial and Commercial Purposes – Challenges and Opportunities

Room: Milano I-III, Caesars Palace

Chair: David Reitz, Matelex/Climallife, Paris, France

1. AIM Act Impact on Commercial Refrigeration and Technology Opportunities 1

Ted Atwood, TrakRef, Nashville, TN

2. AIM Act Impact on Commercial Refrigeration and Technology Opportunities 2

Elodie Delonca, Matelex/Climalife, Paris, France

3. AIM Act Impact on Commercial Refrigeration and Technology Opportunities 3

Michael May, Effecterra, San Francisco, CA

9:45 AM – 10:45 AM

Paper Session 22



Implementing and Optimizing Smart Local Energy Systems

Track: Energy System Integration

Room: Neopolitan I/II, Caesars Palace

Chair: Raul Simonetti, Member, Carel Industries SpA, Brugine, Italy

1. A Systematic Optimization Approach of Smart Local Energy Systems in Cities (LV-22-C053)

Akos Revesz, Ph.D., Affiliate¹, Phil Jones, CEng¹, Chris Dunham², Catarina Marques, Ph.D.¹ and Graeme Maidment, Ph.D., P.E.¹, (1) London South Bank University, London, United Kingdom, (2) Carbon Descent Projects, London, United Kingdom

2. Opportunities and Challenges for Implementing Smart Local Energy Systems in Cities and Towns, Demonstrated through Case Studies (LV-22-C054)

Ana Catarina Marques, Ph.D.¹, Helen Turnell, Ph.D.¹, Phil Jones², Chris Dunham³, Akos Revesz, Ph.D., Affiliate¹ and Graeme Maidment, Ph.D., P.E.¹, (1) London South Bank University, London, United Kingdom, (2) Building Low Carbon Solutions, London, United Kingdom, (3) Carbon Descent Projects, London, United Kingdom

9:45 AM – 10:45 AM

Seminar 39 (Intermediate)



Transmission of Aerosols in Dental Treatment Rooms

Track: Environmental Health and IEQ in the International Arena

Room: Augustus III/IV, Caesars Palace

Sponsor: MTG.ACR, 9.10 Laboratory Systems,

Co-sponsor: TC 9.6 Healthcare Facilities

Chair: Pratik Deokar, Ph.D., Associate Member, Rheem Manufacturing Company, Lewisville, TX

1. Airborne Contaminants at Dental Care Facilities

Michael Wetzel, P.E., Air Innovations, North Syracuse, NY

2. Aerosols in the Dental Treatment Environment

David J Ahearn, Design Ergonomics, Inc., Little Compton, RI

3. CFD Analysis of Aerosol Transmission and Probability of Infection in a Dental Treatment Room

Kishor Khankari, Ph.D., Fellow ASHRAE, AnSight LLC, Ann Arbor, MI

9:45 AM – 10:45 AM

Forum 4

The Future of Thermally Driven Heat Pumping and Cooling in the Age of Decarbonization

Track: Energy System Integration

Room: Neopolitan III/IV, Caesars Palace

Sponsor: 8.3 Absorption and Heat Operated Machines

Chair: Kyle R. Gluesenkamp, Kyle R., Ph.D., Member, Oak Ridge National Laboratory, Oak Ridge, TN

11:00 AM – 12:30 PM

Paper Session 23



Effectiveness of Various Cleaning Methods and Kitchen Hoods

Track: Environmental Health and IEQ in the International Arena

Room: Augustus V/VI, Caesars Palace

Chair: Suzanne LeViseur, Haddad Engineering, Inc., Jacksonville, FL

1. Optimization and Control of Layered Air and Surface Cleaning Methods Based on Air Quality Sensor Data (LV-22-C055)

Scott Wenger, Member¹ and **Christos Polyzois, Ph.D., Member²**,
(1) Trane Technologies, Davidson, NC, (2) Trane Technologies, Bloomington, MN

2. Evaluating Residential Kitchen IAQ and Hood Performance (LV-22-C056)

Rich Swierczyna, Member¹, **M. Frank G. Johnson, Ph.D., Member¹**,
Rob Lafleur¹ and **Jason Stein²**, Gas Technology Institute, Des Plaines, IL

11:00 AM – 12:30 PM

Seminar 40 (Intermediate)



Climate Change Considerations in Energy Audits

Track: Buildings at 360°

Room: Milano V-VII, Caesars Palace

Sponsor: 2.5 Global Climate Change, 7.9 Building Commissioning, TC4.2

Chair: Elizabeth Tomlinson, P.E., BCXP, Member, Stantec, Minneapolis, MN

1. Incorporating Project Climate Change Information into Building Design and Analysis

Parag Rastogi, Ph.D., Member, *arbnco ltd, Glasgow, United Kingdom*

2. Predictive Energy Modeling for a Changing Climate

Pierre Khalil, P.E., *Metrus, Minneapolis, MN*

3. Corporate Considerations of Future Climate Change: ESG Scope I-III Calculations

Daniel Katzenberger, P.E., Member, *Best Buy, Minneapolis, MN*

11:00 AM – 12:30 PM

Seminar 41 (Advanced)
**Design Challenges to the Electrification of Heating
in Mid to Large Buildings**
Track: Energy System Integration
Room: Milano I-III, Caesars Palace
**Sponsor: 8.2 Centrifugal Machines, 2.8 Building
Environmental Impacts and Sustainability**
*Chair: Raymond Good Jr., P.E., Member, Danfoss Turbocor
Compressors, Inc., Tallahassee, FL*
1. Fundamentals and Technologies of Heating Electrification
Drew Turner, Member, Danfoss, Baltimore, MD
**2. Time Independent Energy Recovery: The Solution to Large
Building Electrification**
Brandon Gill, P.E., Member, Taylor Engineering, Alameda, CA
3. The Ins and Outs of Heat Recovery Chiller Sizing and Control
Chris Miller, P.E., Member, P2S, Inc., Long Beach, CA

11:00 AM – 12:30 PM

Seminar 42 (Intermediate)
**Humidifiers for Health and Comfort:
Installation and Use Considerations**
Track: HVAC&R Systems and Equipment
Room: Neopolitan III/IV, Caesars Palace
**Sponsor: 5.11 Humidifying Equipment, 5.7 Evaporative
Cooling**
*Chair: Steven Slayzak, Associate Member, Seeley International,
Denver, CO*
1. Steam Humidification Systems: How to Get the Best Results
*David Baird, Associate Member, Dristeem Corporation,
Eden Prairie, MN*
2. Adiabatic Humidification Systems: How to Get the Best Results
Duncan Curd, Member, DriSteem, Eden Prairie, MN
3. Indirect-Direct Cooling: An Optimum Humidity Opportunity
*Edgar Necoechea, P.E., Associate Member, Seeley International
Pty Ltd, Sacramento, CA*
4. Clean and Under Control: Getting Humidifier Maintenance Right
Nicholas Lea, P.Eng., Member, Condair Ltd., Ottawa, ON, Canada

11:00 AM – 12:30 PM

Seminar 43 (Advanced)
**Latest Developments in Low-GWP Refrigerants, Systems
for Refrigeration and Related Regulations**
Track: Refrigerants and Refrigeration
Room: Neopolitan I/II, Caesars Palace
**Sponsor: 10.7 Commercial Food and Beverage Refrigeration
Equipment, 3.1 Refrigerants and Secondary Coolants,
8.1; 10.6, REF Committee**
*Chair: Vishaldeep Sharma, Member, Oak Ridge National
Laboratory, Oak Ridge, TN*

1. Global View on the Implementation of Flammable Refrigerants in Refrigeration and Air Conditioning

Rajan Rajendran, Ph.D., Associate Member, Emerson Climate Technologies, Inc., Dayton, OH

2. Transition to Low Global Warming Potential Refrigerants in Light Commercial and Residential Air Conditioning

Helen Walter-Terrinoni, Air-Conditioning, Heating, and Refrigeration Institute, Arlington, VA

3. Updates on ASHRAE Standard 15

Tim Anderson, Ph.D., Hussmann, Bridgeton, MO

4. Update on UL Standards

Brian Rodgers, Underwriters Laboratories, Northbrook, IL

11:00 AM – 12:30 PM

Seminar 44 (Intermediate)



Upgrading Existing Building Control Systems for High Performance Operation

Track: Buildings at 360°

Room: Augustus III/IV, Caesars Palace

Sponsor: 1.4 Control Theory and Application, 7.6 Building Energy Performance, 2.8 Building Environmental Impacts and Sustainability

Chair: Gregory Cmar, Associate Member, Interval Data Systems, Boston, MA

1. Upgrading Building Control Systems for High Performance Operation across a Portfolio

Dick Mink, Commonwealth of Kentucky, Frankfort, KY

2. Designing, Specifying and Managing High Performance Controls Upgrades into a Centralized System

Casey Wilson, Member, CMTA, Inc., Louisville, KY

3. Verifying Control System Performance Using Data, a Digital Twin, and Easy-to-Understand Analytics

Bill Gnerre, Member, Interval Data Systems, Waltham, MA

COMMITTEE MEETINGS SCHEDULE

The “Schedule” section in the ASHRAE 365 app lets you create your own schedule as well as filter committee meetings by date, time, room, and committee type (Standing, Technical, Project).

In the listing below, floor levels and venue names are indicated in parenthesis, and subcommittees are indented. Rooms will be set as best as possible as indicated in the parentheses beside the committee, i.e., (20/20) will accommodate at least 20 in-person attendees at the conference table and at least 20 chairs for the audience.

NEW! Meetings marked with an “(H)” will have hybrid capabilities for remote committee members to join to achieve quorum. If a committee requested a WebEx meeting from ASHRAE, the requester or chair should have received detailed information including:

- Host log-in information (email address and password)
- Hosting instructions
- Dedicated, secure WiFi network for hybrid meeting hosts.

If the requester or chair did not receive this information in advance, please email meetings@ashrae.org or visit the registration desk at Augustus I/II.

You must register to attend committee meetings. Committee meeting only registration is free.

Register at ashrae.org/2022winter.

Meeting Space Floor and Venue Key

All committee meetings will take place at Caesars Palace. Any events located at the Las Vegas Convention Center will be marked with “LVCC-North” after the Floor number.

Symbol	Description
(P)	Promenade Level, Caesars Palace
(E)	Emperors Level, Caesars Palace
(PS)	Promenade South Level, Caesars Palace

Society Standing Committees

AEDG Steering Committee (7/3) (H)

Mon (1/31) 2:30 PM – 4:30 PM Livorno (P)

ASHRAE AIA Liaison Committee (10/10)

Sat (1/29) 1:00 PM – 3:00 PM Modena (P)

ASHRAE Associate Society Alliance (AASA) (40/20) (H)

Mon (1/31) 2:30 PM – 6:30 PM Roman I (P)

ASHRAE Associate Society Alliance Subcommittee (25/15)

Sun (1/30) 1:30 PM – 4:30 PM Florentine IV (P)

Communications Committee (8/4) (H)

Sat (1/29) 8:00 AM – 12:00 PM Anzio (P)

ASHRAE/AHRI Joint Exposition Policy Committee (25/0)

Sun (1/30) 9:00 AM – 11:00 AM Florentine III (P)

Board of Directors (34/50) (H)

Sun (1/30)	1:30 PM – 5:30 PM	Palace I (E)
Wed (2/2)	2:00 PM – 6:00 PM	Roman I/III (P)

BOD Operational Streamlining Subcommittee (12/5)

Sat (1/29)	12:00 PM – 2:00 PM	Palermo (P)
------------	--------------------	-------------

BOD Composition and Leadership Subcommittee (15/10)

Tue (2/1)	3:30 PM – 5:30 PM	Florentine IV (P)
-----------	-------------------	-------------------

Building EQ Committee (10/10) (H)

Sun (1/30)	8:00 AM – 10:00 AM	Modena (P)
------------	--------------------	------------

Buildings XV 2022 Steering Committee Meeting (15/15) (H)

Sun (1/30)	9:00 AM – 12:00 PM	Anzio (P)
------------	--------------------	-----------

Certification Committee (12/8) (H)

Sat (1/29)	8:00 AM – 12:00 PM	Livorno (P)
------------	--------------------	-------------

Chapter Technology Transfer Committee (CTTC) (14/5) (H)

Fri (1/28)	8:00 AM – 12:00 PM	Genoa (P)
------------	--------------------	-----------

Sat (1/29)	8:00 AM – 12:00 PM	Genoa (P)
------------	--------------------	-----------

CIBSE/ASHRAE Liaison Committee (25/4) (H)

Wed (2/2)	10:00 AM – 12:00 PM	Pisa (P)
-----------	---------------------	----------

CLIMA 2022 (12/0)

Sat (1/29)	1:00 PM – 2:15 PM	Genoa (P)
------------	-------------------	-----------

College of Fellows (4/25) (H)

Sun (1/30)	1:00 PM – 3:00 PM	Genoa (P)
------------	-------------------	-----------

Conferences and Expositions Committee (30/10)

Sat (1/29)	8:00 AM – 3:00 PM	Florentine I (P)
------------	-------------------	------------------

Conferences and Expositions Executive Committee (30/5)

Fri (1/28)	1:00 PM – 3:30 PM	Florentine I (P)
------------	-------------------	------------------

Conferences and Expositions Annual and Winter Meetings (30/5)

Fri (1/28)	3:45 PM – 6:00 PM	Florentine I (P)
------------	-------------------	------------------

Development Committee (10/5) (H)

Mon (1/31)	9:45 AM – 11:45 AM	Genoa (P)
------------	--------------------	-----------

DRC Forum (25/15)

Fri (1/28)	4:00 PM – 6:00 PM	Florentine II (P)
------------	-------------------	-------------------

Environmental Health Committee (EHC) (12/10) (H)

Mon (1/31)	2:30 PM – 6:30 PM	Senate Boardroom (P)
------------	-------------------	----------------------

Epidemic Task Force (ETF) Executive Session (20/0) (H)

Sun (1/30)	9:00 AM – 11:00 AM	Verona (P)
------------	--------------------	------------

Executive Committee (10/15) (H)

Sat (1/29)	8:30 AM – 1:00 PM	Senate Boardroom (P)
------------	-------------------	----------------------

Wed (2/2)	7:30 AM – 9:00 AM	Pisa (P)
-----------	-------------------	----------

Thu (2/3)	7:30 AM – 11:00 AM	Consul Boardroom (P)
-----------	--------------------	----------------------

Finance Committee (11/12)

Fri (1/28)	8:00 AM – 12:00 PM	Consul Boardroom (P)
------------	--------------------	----------------------

Finance Investment Subcommittee (4/0)

Thu (1/27)	4:00 PM – 6:00 PM	Consul Boardroom (P)
------------	-------------------	----------------------

Finance Planning Subcommittee (5/0)

Thu (1/27)	4:00 PM – 6:00 PM	Senate Boardroom (P)
------------	-------------------	----------------------

Foundation Board Trustees (25/10) (H)

Mon (1/31)	7:30 AM – 9:30 AM	Florentine I (P)
------------	-------------------	------------------

Foundation Executive Committee (5/9) (H)

Sat (1/29)	1:30 PM – 2:45 PM	Livorno (P)
------------	-------------------	-------------

Government Affairs Committee (GAC) (29/35) (H)

Sat (1/29)	8:00 AM – 12:00 PM	Florentine III (P)
------------	--------------------	--------------------

Handbook Committee (25/10) (H)

Sun (1/30)	9:00 AM – 1:30 PM	Florentine II (P)
------------	-------------------	-------------------

Historical Committee (10/2)

Sun (1/30)	8:00 AM – 12:00 PM	Siena (P)
------------	--------------------	-----------

Honors and Awards Committee (8/2) (H)

Sun (1/30)	1:00 PM – 5:00 PM	Livorno (P)
------------	-------------------	-------------

Mon (1/31)	2:30 PM – 6:30 PM	Genoa (P)
------------	-------------------	-----------

IAQ2020 Steering Committee (16/10)

Tue (2/1)	1:00 PM – 3:00 PM	Consul Boardroom (P)
-----------	-------------------	----------------------

Indoor Environmental Quality Global Alliance (IEQ-GA) (10/5) (H)

Tue (2/1)	3:00 PM – 5:00 PM	Consul Boardroom (P)
-----------	-------------------	----------------------

LeadershipU Meet and Greet

Fri (1/28)	6:00 PM – 6:45 PM	Capri (P)
------------	-------------------	-----------

Life Members Club Luncheon (6/25) (H)

Tue (2/1)	12:00 PM – 1:30 PM	Florentine IV (P)
-----------	--------------------	-------------------

Members Council (40/20)

Tue (2/1)	8:15 AM – 12:00 PM	Roman III (P)
-----------	--------------------	---------------

Membership Promotion (21/15) (H)

Sat (1/29)	8:00 AM – 4:00 PM	Verona (P)
------------	-------------------	------------

Membership Promotion Subcommittee (20/5)

Fri (1/28)	1:00 PM – 5:30 PM	Capri (P)
------------	-------------------	-----------

Nominating Committee (40/0) (H)

Sun (1/30)	7:30 AM – 12:00 PM	Emperors I (E)
------------	--------------------	----------------

Planning Committee (12/8) (H)

Fri (1/28)	1:00 PM – 4:00 PM	Senate Boardroom (P)
------------	-------------------	----------------------

President Elect Advisory Committee (8/15) (H)

Tue (2/1)	12:00 PM – 2:00 PM	Pisa (P)
-----------	--------------------	----------

Publications Committee (14/4) (H)

Sat (1/29)	8:00 AM – 12:00 PM	Consul Boardroom (P)
------------	--------------------	----------------------

Publishing and Education Council (23/15) (H)

Tue (2/1)	8:00 AM – 12:00 PM	Florentine II (P)
-----------	--------------------	-------------------

Publishing and Education Council Products & Professional Development (19/5) (H)

Mon (1/31)	7:30 AM – 9:30 AM	Florentine II (P)
------------	-------------------	-------------------

Publishing and Education Council Fiscal & Planning (34/5) (H)

Mon (1/31)	10:00 AM – 12:00 PM	Florentine II (P)
------------	---------------------	-------------------

Refrigeration Technology for Comfort Process & Cold-Chain (9/5) (H)

Sun (1/30)	8:00 AM – 12:00 PM	Livorno (P)
------------	--------------------	-------------

Region-at-Large (30/0) (H)

Mon (1/31)	2:30 PM – 4:30 PM	Florentine I (P)
------------	-------------------	------------------

Research Administration Committee (RAC) (8/5) (H)

Sat (1/29)	8:00 AM – 12:00 PM	Modena (P)
------------	--------------------	------------

Wed (2/2)	7:00 AM – 11:00 AM	Senate Boardroom (P)
-----------	--------------------	----------------------

Research Promotion (18/5) (H)

Sat (1/29)	8:00 AM – 12:00 PM	Capri (P)
------------	--------------------	-----------

Research Promotion Executive Committee (6/4)

Fri (1/28)	1:00 PM – 5:00 PM	Consul Boardroom (P)
------------	-------------------	----------------------

Scholarship Trustees (8/4)

Tue (2/1)	8:00 AM – 12:00 PM	Palermo (P)
-----------	--------------------	-------------

Society Rules Committee (7/3) (H)

Tue (2/1)	2:30 PM – 5:30 PM	Palermo (P)
-----------	-------------------	-------------

Standards Committee (20/20) (H)

Wed (2/2)	7:30 AM – 10:00 AM	Roman I/III (P)
-----------	--------------------	-----------------

PPIS (15/2) (H)

Tue (2/1)	11:00 AM – 2:00 PM	Verona (P)
-----------	--------------------	------------

SPLS (12/15) (H)

Tue (2/1)	2:00 PM – 6:00 PM	Verona (P)
-----------	-------------------	------------

Student Activities Committee (15/20) (H)

Fri (1/28)	1:00 PM – 5:00 PM	Verona (P)
------------	-------------------	------------

Student Activities Grants Subcommittee Meeting (5/10)

Fri (1/28)	8:00 AM – 10:00 AM	Modena (P)
------------	--------------------	------------

Student Activities Post-High Subcommittee Meeting (5/10)

Fri (1/28)	8:00 AM – 10:00 AM	Siena (P)
------------	--------------------	-----------

Student Activities Design Competition Subcommittee Meeting (5/10)

Fri (1/28)	10:00 AM – 12:00 PM	Modena (P)
------------	---------------------	------------

Student Activities K-12/STEM Subcommittee Meeting (5/10)

Fri (1/28)	10:00 AM – 12:00 PM	Siena (P)
------------	---------------------	-----------

Student Welcome (15/250)

Sat (1/29)	1:00 PM – 3:00 PM	Palace III (E)
------------	-------------------	----------------

Student/YEA Mixer (15/250)

Sat (1/29) 5:00 PM – 6:30 PM Palace III (E)

Student Program (15/250)

Sun (1/30) 10:00 AM – 2:00 PM Palace III (E)

Task Force for Building Decarbonization (15/25) (H)

Tue (2/1) 1:00 PM – 3:00 PM Capri (P)

Technical Activities Committee (TAC) (12/5) (H)

Sat (1/29) 8:00 AM – 11:00 AM Messina (P)

Wed (2/2) 7:00 AM – 9:00 AM Consul Boardroom (P)

Technology Council (20/5) (H)

Wed (2/2) 8:00 AM – 12:00 PM Roman II (P)

Technology Council Special Projects Subcommittee (6/5)

Tue (2/1) 8:00 AM – 9:00 AM Consul Boardroom (P)

Technology Council Operations Subcommittee (15/5) (H)

Tue (2/1) 9:00 AM – 11:00 AM Consul Boardroom (P)

Technology Council Document Review Subcommittee (5/8) (H)

Tue (2/1) 11:00 AM – 12:00 PM Consul Boardroom (P)

Training and Education Committee (12/11)

Sun (1/30) 1:00 PM – 5:00 PM Verona (P)

Treasurer Elect Advisory Committee (13/7) (H)

Mon (1/31) 10:00 AM – 12:00 PM Consul Boardroom (P)

UNEP ASHRAE Senior Leadership Meeting (8/0)

Fri (1/28) 10:00 AM – 12:00 PM Senate Boardroom (P)

UNEP ASHRAE Coordinating Committee (12/6)

Sat (1/29) 5:30 PM – 6:00 PM Venice (E)

Young Engineers in ASHRAE (YEA) Committee (20/10) (H)

Sat (1/29) 8:00 AM – 12:00 PM Pisa (P)

YEA Hospitality Reception (50/50)

Sun (1/30) 4:00 PM – 6:00 PM Emperors II (E)

Technical Committees

Attendance at these meetings is open to all society members, to all registered guests at scheduled Society Conferences, and to those invited by the chairman at the request of a member. You are encouraged to attend any of these meetings in which you have a technical interest.

Abbreviations

TC	Technical Committee
TRG	Technical Research Group
MTG	Multidisciplinary Task Group
RP	Research Project

TECHINCAL COMMITTEES (TCs)

TC/TG/TRG/MTG Chair's Breakfast and Training Workshop (H)

Sun (1/30) 7:00 AM – 9:00 AM Palace I/II (E)

Research Subcommittee Chair's Breakfast (120/0)

Mon (1/31) 6:30 AM – 9:15 AM Palace I/II (E)

TC Program Subcommittee Training (30/0)

Tue (2/1) 11:15 AM – 12:00 PM Milano VIII (P)

TC 1.2 Instruments & Measurements (65/15) (H)

Tue (2/1) 1:00 PM – 3:00 PM Roman II (P)

TC 1.4 Control Theory and Application (40/35) (H)

Tue (2/1)	1:00 PM – 3:30 PM	Milano IV (P)
	TC 1.4 YEA/Education (20/10) (H)	
Sun (1/30)	2:00 PM – 3:00 PM	Octavius 20 (PS)
	TC 1.4 Control Components and Applications (20/10) (H)	
Sun (1/30)	3:00 PM – 4:00 PM	Octavius 20 (PS)
	TC 1.4 Programs (20/10) (H)	
Sun (1/30)	4:00 PM – 5:30 PM	Octavius 20 (PS)
	TC 1.4 Research (30/10) (H)	
Mon (1/31)	2:30 PM – 4:30 PM	Octavius 20 (PS)
	TC 1.4 Handbook (20/5) (H)	
Mon (1/31)	4:30 PM – 6:30 PM	Octavius 20 (PS)
	TC 1.4 Executive (15/0)	
Tue (2/1)	8:30 AM – 9:30 AM	Octavius 10 (PS)

TC 1.5 Computer Applications (4/15) (H)

Mon (1/31)	7:30 PM – 10:00 PM	Consul Boardroom (P)
	TC 1.5 Emerging Applications (4/12)	
Sun (1/30)	6:00 PM – 7:00 PM	Imperial Boardroom (P)
	TC 1.5 Program (4/7)	
Sun (1/30)	7:00 PM – 8:00 PM	Imperial Boardroom (P)
	TC 1.5 Research (4/7)	
Sun (1/30)	8:00 PM – 9:00 PM	Imperial Boardroom (P)

TC 1.6 Terminology (8/0) (H)

Sun (1/30)	3:30 PM – 5:30 PM	Modena (P)
------------	-------------------	------------

TC 1.7 Business, Management & General Legal Education (16/4) (H)

Mon (1/31)	2:30 PM – 4:30 PM	Consul Boardroom (P)
------------	-------------------	----------------------

TC 1.9 Electrical Systems (8/1) (H)

Tue (2/1)	3:30 PM – 5:30 PM	Octavius 7 (PS)
-----------	-------------------	-----------------

TC 1.10 Combined Heat and Power Systems (20/20) (H)

Tue (2/1)	1:00 PM – 3:00 PM	Pompeian I (P)
-----------	-------------------	----------------

TC 1.11 Electric Motors and Motor Control (5/15) (H)

Tue (2/1)	1:00 PM – 3:30 PM	Milano V-VII (P)
-----------	-------------------	------------------

TC 1.12 Moisture Management in Buildings (25/10) (H)

Sat (1/29)	1:00 PM – 3:00 PM	Pisa (P)
	TC 1.12 Research, Program, Handbook, Standard (25/10)	
Sat (1/29)	8:00 AM – 12:00 PM	Octavius 1-2 (PS)

TC 2.2 Plant and Animal Environment (5/20) (H)

Mon (1/31)	2:30 – 4:30 PM	Pompeian IV (P)
------------	----------------	-----------------

TC 2.3 Gaseous Air Contaminants and Gas Contaminant Removal Equipment (50/50) (H)

Tue (2/1)	1:00 PM – 3:30 PM	Roman I (P)
-----------	-------------------	-------------

TC 2.4 Particulate Air Contaminants and Particulate Contaminant Removal Equipment (VIRTUAL)

Tue (2/1)	3:30 PM – 5:30 PM	
WebEx – see schedule in ASHRAE 365 for link		

TC 2.5 Global Climate Change (20/10)

Tue (2/1)	1:00 PM – 3:00 PM	Pompeian IV (P)
-----------	-------------------	-----------------

TC 2.6 Sound and Vibration (40/15) (H)

Mon (1/31)	2:30 PM – 4:30 PM	Milano VIII (P)
	TC 2.6 Vibration Isolation, Publication, Research and Programs (30/10)	
Sun (1/30)	8:00 AM – 12:00 PM	Octavius 1-2 (PS)

TC 2.8 Building Environmental Impacts and Sustainability (8/20) (H)

Sun (1/30) 6:00 PM – 8:00 PM Livorno (P)

TC 2.9 Ultraviolet Air and Surface Treatment (40/20) (H)

Mon (1/31) 2:30 PM – 4:30 PM Roman III (P)

TC 2.10 Resilience and Security (20/5) (H)

Wed (2/2) 1:00 PM – 2:30 PM Capri (P)

TC 3.1 Refrigerants and Secondary Coolants (15/30) (H)

Mon (1/31) 5:00 PM – 7:00 PM Imperial Boardroom (P)

TC 3.2 Refrigerant System Chemistry and Contaminant Control (25/15) (H)

Tue (2/1) 3:30 PM – 5:30 PM Pompeian I (P)

TC 3.4 Lubrication (40/10) (H)

Tue (2/1) 1:00 PM – 3:00 PM Florentine I (P)

TC 3.6 Water Treatment (30/10) (H)

Tue (2/1) 1:00 PM – 3:00 PM Roman IV (P)

TC 3.6 Programs, Handbook and Research (25/5)

Sun (1/30) 3:30 PM – 5:30 PM Pompeian III (P)

TC 3.8 Refrigerant Containment (15/2) (H)

Mon (1/31) 5:00 – 7:00 PM Anzio (P)

TC 4.1 Load Calculation Data and Procedures (10/15) (H)

Mon (1/31) 2:30 PM – 4:30 PM Tarranto (E)

TC 4.2 Climatic Information (4/10) (H)

Tue (2/1) 1:00 PM – 3:30 PM Livorno (P)

TC 4.3 Ventilation Requirements and Infiltration (3/15) (H)

Mon (1/31) 5:00 PM – 7:00 PM Tarranto (E)

TC 4.4 Building Materials and Building Envelope Performance (40/5) (H)

Mon (1/31) 2:30 PM – 4:30 PM Milano IV (P)

TC 4.5 Fenestration (VIRTUAL)

Mon (1/31) 2:30 PM – 4:30 PM

WebEx – see schedule in ASHRAE 365 for link

TC 4.7 Energy Calculations (30/10) (H)

Tue (2/1) 3:30 PM – 5:30 PM Florentine I (P)

TC 4.7 Multiscale Building Energy Modeling (20/10)

Mon (1/31) 6:00 PM – 7:00 PM Pompeian II (P)

TC 4.7 Simulation and Component Models (20/10)

Mon (1/31) 7:00 PM – 8:00 PM Pompeian II (P)

TC 4.7 Data Driven Modeling (20/10)

Mon (1/31) 8:00 PM – 9:00 PM Pompeian II (P)

TC 4.10 Indoor Environmental Modeling (30/10)

Mon (1/31) 2:30 PM – 4:30 PM Florentine II (P)

TC 4.10 RP-1675 (15/5)

Sun (1/30) 1:00 PM – 2:00 PM Anzio (P)

TC 4.10 Handbook (15/5)

Sun (1/30) 2:00 PM – 3:00 PM Anzio (P)

TC 4.10 Program (15/5)

Sun (1/30) 3:00 PM – 4:00 PM Anzio (P)

TC 4.10 Research (15/5)

Sun (1/30) 4:00 PM – 5:00 PM Anzio (P)

TC 5.1 Fans (20/5) (H)

Mon (1/31) 2:30 PM – 4:30 PM Pisa (P)

TC 5.2 Duct Design (4/15) (H)

Wed (2/2)	11:00 AM – 1:30 PM	Consul Boardroom (P)
-----------	--------------------	----------------------

TC 5.3 Room Air Distribution (15/5) (H)

Tue (2/1)	1:00 PM – 3:00 PM	Imperial Boardroom (P)
-----------	-------------------	------------------------

TC 5.4 Industrial Process Air Cleaning (20/15) (H)

Mon (1/31)	2:30 PM – 4:15 PM	Pompeian I (P)
------------	-------------------	----------------

TC 5.5 Air-to-Air Energy Recovery Equipment (30/10)

Tue (2/1)	3:30 PM – 6:00 PM	Florentine III (P)
-----------	-------------------	--------------------

TC 5.7 Evaporative Cooling (14/5) (H)

Sun (1/30)	3:30 PM – 5:30 PM	Capri (P)
------------	-------------------	-----------

TC 5.9 Enclosed Vehicular Facilities (8/12) (H)

Tue (2/1)	3:30 PM – 5:30 PM	Neopolitan I/II (P)
-----------	-------------------	---------------------

TC 5.10 Kitchen Ventilation (20/5) (H)

Mon (1/31)	2:30 PM – 4:30 PM	Verona (P)
------------	-------------------	------------

TC 5.11 Humidifying Equipment (15/5) (H)

Tue (2/1)	1:00 PM – 3:00 PM	Florentine II (P)
-----------	-------------------	-------------------

TC 6.1 Hydronic and Steam Equipment and Systems (6/35) (H)

Tue (2/1)	1:00 PM – 3:00 PM	Venice (E)
-----------	-------------------	------------

TC 6.2 District Energy (30/10) (H)

Sun (1/30)	3:30 PM – 5:30 PM	Florentine II (P)
------------	-------------------	-------------------

TC 6.3 Central Forced Air Heating and Cooling Systems (15/5) (H)

Tue (2/1)	1:00 PM – 3:30 PM	Sorrento (P)
-----------	-------------------	--------------

TC 6.5 Radiant Heating and Cooling (20/10) (H)

Mon (1/31)	2:30 PM – 4:30 PM	Messina (P)
------------	-------------------	-------------

TC 6.6 Service Water Heating Systems (10/20) (H)

Mon (1/31)	5:00 PM – 7:00 PM	Sorrento (P)
------------	-------------------	--------------

TC 6.6 Research, Handbook, and Program (10/20)

Mon (1/31)	2:30 PM – 4:30 PM	Palermo (P)
------------	-------------------	-------------

TC 6.7 Solar and Other Renewable Energies (VIRTUAL)

Tue (2/1)	1:00 PM – 3:00 PM	
-----------	-------------------	--

Webex – see schedule in ASHRAE 365 for link

TC 6.8 Geothermal Heat Pump and Energy Recovery Applications (25/10) (H)

Tue (2/1)	3:30 PM – 6:00 PM	Pompeian III (P)
-----------	-------------------	------------------

TC 6.8 Handbook (15/10)

Sun (1/30)	4:00 PM – 5:00 PM	Senate Boardroom (P)
------------	-------------------	----------------------

TC 6.8 Program and Education (15/10)

Sun (1/30)	5:00 PM – 6:30 PM	Senate Boardroom (P)
------------	-------------------	----------------------

TC 6.8 Research (10/10)

Mon (1/31)	5:00 PM – 7:00 PM	Livorno (P)
------------	-------------------	-------------

TC 6.8 Energy Recovery Applications (10/5)

Tue (2/1)	8:00 AM – 9:30 AM	Senate Boardroom (P)
-----------	-------------------	----------------------

TC 6.9 Thermal Energy Storage (20/5) (H)

Mon (1/31)	5:00 PM – 6:30 PM	Capri (P)
------------	-------------------	-----------

TC 6.10 Fuels and Combustion (40/35)

Tue (2/1)	2:00 PM – 5:00 PM	Roman III (P)
-----------	-------------------	---------------

TC 7.2 HVAC&R Construction & Design Build Technologies (20/15) (H)

Sat (1/29)	1:00 PM – 3:00 PM	Capri (P)
------------	-------------------	-----------

TC 7.3 Operation, Maintenance and Cost Management (15/10) (H)

Tue (2/1) 1:00 PM – 3:00 PM Genoa (P)

TC 7.5 Smart Building Systems (45/15) (H)

Tue (2/1) 3:30 PM – 6:00 PM Emperors II (E)

TC 7.5 Enabling Technologies Subcommittee (20/5)

Sun (1/30) 1:30 PM – 2:15 PM Octavius 17-18 (PS)

TC 7.5 Fault Detection and Diagnostics (30/10)

Sun (1/30) 2:30 PM – 3:15 PM Octavius 17-18 (PS)

TC 7.5 Building Operations and Dynamics (10/20)

Sun (1/30) 3:30 PM – 4:15 PM Octavius 17-18 (PS)

TC 7.5 Smart Grid (30/25)

Sun (1/30) 4:30 PM – 5:15 PM Octavius 17-18 (PS)

TC 7.5 Program (25/10)

Sun (1/30) 5:30 PM – 6:00 PM Octavius 17-18 (PS)

TC 7.5 Research (25/10) (H)

Mon (1/31) 5:15 PM – 6:00 PM Octavius 17-18 (PS)

TC 7.6 Building Energy Performance (15/15) (H)

Tue (2/1) 1:00 PM – 3:30 PM Pompeian II (P)

TC 7.6 Federal Buildings (5/15)

Sat (1/29) 9:00 AM – 3:00 PM Venice (E)

TC 7.6 Federal Buildings (5/15)

Sun (1/30) 9:00 AM – 12:00 PM Venice (E)

TC 7.6 Research (6/6)

Sun (1/30) 1:00 PM – 2:00 PM Venice (E)

TC 7.6 Commercial Building Energy Audit (15/15)

Sun (1/30) 2:00 PM – 3:00 PM Venice (E)

TC 7.6 Handbook (VIRTUAL)

Sun (1/30) 3:00 PM – 4:00 PM

WebEx – see schedule in ASHRAE 365 for link

TC 7.6 Monitoring and Energy Performance (10/20)

Mon (1/31) 2:30 PM – 4:30 PM Venice (E)

TC 7.6 Energy Management (10/20)

Mon (1/31) 4:30 PM – 5:30 PM Venice (E)

TC 7.6 Standards and Programs (10/20)

Mon (1/31) 5:30 PM – 6:30 PM Venice (E)

TC 7.6 Executive (5/0) (H)

Mon (1/31) 6:30 PM – 7:15 PM Venice (E)

TC 7.6 Building Data Exchange (10/15)

Tue (2/1) 9:00 AM – 12:00 PM Pompeian II (P)

TC 7.7 Testing and Balancing (10/10)

Tue (2/1) 1:00 PM – 3:00 PM Senate Boardroom (P)

TC 7.9 Building Commissioning (40/10) (H)

Sun (1/30) 3:30 PM – 5:30 PM Milano IV (P)

TC 8.1 Positive Displacement Compressors (40 /20) (H)

Tue (2/1) 3:30 PM – 6:00 PM Florentine II (P)

TC 8.2 Centrifugal Machines (12/15) (H)

Tue (2/1) 1:00 PM – 3:00 PM Octavius 10 (PS)

TC 8.3 Absorption and Heat Operated Machines (20/10) (H)

Mon (1/31) 2:30 PM – 4:30 PM Capri (P)

TC 8.5 Liquid to Refrigerant Heat Exchangers (30/10) (H)

Mon (1/31) 2:30 PM – 4:30 PM Florentine IV (P)

TC 8.5/1.3 Research Review Meeting (25/20)

Sun (1/30) 3:30 PM – 5:30 PM Octavius 1-2 (PS)

TC 8.6 Cooling Towers and Evaporative Condensers (14/25)

Mon (1/31) 2:30 PM – 4:30 PM Octavius 3 (PS)

TC 8.8 Refrigerant System Controls & Accessories (10/5) (H)

Tue (2/1) 1:00 PM – 3:00 PM Pompeian III (P)

TC 8.10 Mechanical and Desiccant Humidification Equipment, Heat Pipes and Components (8/15) (H)

Tue (2/1) 3:30 PM – 5:30 PM Genoa (P)

TC 8.11 Unitary and Room Air Conditioners and Heat Pumps (20/8) (H)

Mon (1/31) 5:00 PM – 7:00 PM Messina (P)

TC 9.1 Large Building Systems (10/10)

Tue (2/1) 1:00 PM – 3:30 PM Octavius 3 (PS)

TC 9.1 Subcommittees (10/10)

Tue (2/1) 12:00 PM – 1:00 PM Octavius 3 (PS)

TC 9.2 Industrial Air Conditioning & Ventilation (40/30)

Tue (2/1) 1:00 PM – 3:30 PM Milano VIII (P)

TC 9.3 Transportation Air Conditioning (VIRTUAL)

Mon (1/31) 5:00 PM – 7:00 PM

WebEx – see schedule in ASHRAE 365 for link

TC 9.6 Healthcare Facilities (35/75)

Sun (1/30) 3:30 PM – 5:30 PM Florentine III (P)

TC 9.7 Educational Facilities (20/10) (H)

Sun (1/30) 3:30 PM – 5:30 PM Messina (P)

TC 9.8 Large Building Air-Conditioning Applications (30/10) (H)

Mon (1/31) 2:30 PM – 4:30 PM Emperors II (E)

TC 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment (109/10)

Mon (1/31) 2:30 PM – 7:15 PM Emperor I (E)

TC 9.9 Subcommittees (20/10)

Sun (1/30) 2:00 PM – 5:30 PM Pisa (P)

TC 9.9 Programs, Handbook and Research (54/0)

Sun (1/30) 5:00 PM – 7:00 PM Emperor I (E)

TC 9.9 Subcommittees (20/10)

Mon (1/31) 7:30 PM – 9:00 PM Pisa (P)

TC 9.10 Laboratory Systems (14/30) (H)

Tue (2/1) 3:30 PM – 5:30 PM Imperial Boardroom (P)

TC 9.12 Tall Buildings (8/2)

Sun (1/30) 3:30 PM – 5:30 PM Palermo (P)

TC Section 10 Program/Research Joint Subcommittee Meetings (10/2)

Mon (1/31) 5:00 PM – 7:00 PM Octavius 3 (PS)

TC 10.1 Custom Engineered Refrigeration Systems, Piping, Controls & Accessories (20/10) (H)

Tue (2/1) 1:00 PM – 3:00 PM Milano I-III (P)

TC 10.2 Refrigeration Applications (12/10) (H)

Tue (2/1) 3:30 PM – 5:30 PM Milano I-III (P)

TC 10.6 Transport Refrigeration (8/12) (H)

Mon (1/31) 5:00 PM – 7:00 PM Consul Boardroom (P)

TC 10.7 Commercial Food and Beverage Refrigeration Equipment (70/20) (H)

Mon (1/31) 5:00 PM – 7:00 PM Roman II/IV (P)

TECHNICAL RESOURCE GROUPS (TRGs)

TRG4.IAQP Indoor Air Quality Procedure Development (20/15) (H)

Sun (1/30) 6:00 PM – 8:00 PM Capri (P)

MULTIDISCIPLINARY TASK GROUPS (MTGs)

MTG.BIM Building Information Modeling (15/5) (H)

Mon (1/31) 2:30 PM – 4:30 PM Anzio (P)

MTG.CEA Controlled Environment Agriculture (10/30) (H)

Sun (1/30) 3:30 PM – 5:30 PM Sicily (E)

MTG.HCDG Hot Climate Design Guide (10/10)

Wed (2/2) 8:00 AM – 10:00 AM Octavius 3 (PS)

MTG.HWBE Health and Wellness in the Built Environment (10/3)

Tue (2/1) 1:00 PM – 3:00 PM Florentine III (P)

MTG.LowGWP Lower Global Warming Potential Alternative Refrigerants (24/15)

Sun (1/30) 6:00 PM – 7:00 PM Pompeian I (P) (H)

Wed (2/2) 10:00 AM – 12:00 PM Capri (P)

MTG.LowGWP Codes and Standards (28/5)

Tue (2/1) 1:00 PM – 3:00 PM Octavius 1-2 (PS)

MTG.OBB Occupant Behavior in Buildings (VIRTUAL)

Tue (2/1) 10:00 AM – 12:00 PM

Zoom – see schedule in ASHRAE 365 for link

MTG.RAC Refrigeration and Air Conditioning (RAC) Plant Assessment Guide (17/10)

Tue (2/1) 3:30 PM – 5:30 PM Capri (P)

MTG.VIC Ventilation for Infection Control (10/5) (H)

Tue (2/1) 7:00 AM – 8:00 AM Imperial Boardroom (P)

WHAT IS A TECHNICAL COMMITTEE?

The technical expertise of ASHRAE is concentrated in its Technical Committees (TCs), Task Groups (TGs), Technical Resource Groups (TRGs) and Multidisciplinary Task Groups (MTGs). These groups are responsible in various degrees for:

- Preparing the text of ASHRAE Handbook chapters
- Originating, coordinating and supervising Society-sponsored research projects
- Presenting programs at ASHRAE conferences
- Reviewing papers for conferences
- Developing ASHRAE publications
- Evaluating the need for standards, and
- Advising the Society on all aspects of the technology it embraces

ASHRAE TCs and these other groups are comprised of volunteers who have a recognized proficiency in a specific field of interest. There are some active 100 TCs addressing all aspects of the HVAC&R and buildings industries.

APPLYING FOR MEMBERSHIP ON A TECHNICAL COMMITTEE

ASHRAE welcomes new members to its technical committees. You can join a technical committee by accessing our website at ashrae.org/joinatc. You will immediately be assigned as a Provisional Corresponding Member for a two-year term. And able to participate in committee activities. At the end of the term, you may be considered for a position that has voting membership.

Please note:

If you do not have an ashrae.org login please go to ashrae.org and click on the Log In tab at the top of the page. Next, click on “Create an Account”.

ATTENDING TECHNICAL COMMITTEE MEETINGS

TC meetings take place at the Society’s Winter and Annual Conferences, and they are open Attend any meetings in which you have a technical interest. TC chairs welcome new attendees—a TC can never have too many willing and able volunteers.

See the listing of Technical Committee meetings in the Final Program, online or in the app.

Project Committees

Attendance at these meetings is open to all Society members, to all registered guests at scheduled Society Conferences, and to those invited by the chairman at the request of a member. You are encouraged to attend any of these meetings in which you have a technical interest

Abbreviations

SPC	Standard Project Committee
SSPC	Standing Standard Project Committee
GPC	Guideline Project Committee
SGPC	Standing Guideline Project Committee

STANDARD PROJECT COMMITTEES (SPCs) and STANDING STANDARD PROJECT COMMITTEES (SSPCs)

PC Chair’s Breakfast (84/0)

Sun (1/30)	7:30 AM – 9:00 AM	Emperors II (E)
------------	-------------------	-----------------

SSPC 15, Safety Standard for Refrigeration Systems (25/50) (H)

Sun (1/30)	1:00 PM – 5:00 PM	Florentine I (P)
SSPC 15, Safety Standard for Refrigeration Systems Ad Hoc and Rewrite (25/50) (H)		
Sat (1/29)	1:00 PM – 3:00 PM	Emperors II (E)

SPC/SSPC/GPC/
SGPC MTGS

SSPC 15, Safety Standard for Refrigeration Systems Rewrite (25/50) (H)

Sun (1/30) 9:00 AM – 12:00 PM Florentine I (P)

SSPC 15, Standard 15.2P Subcommittee, Safety Standard for Refrigeration Systems in Residential Applications (20/20) (H)

Tue (2/1) 8:00 AM – 12:00 PM Emperors II (E)

SPC 16 MOT for Room Air Conditioners, Packaged Terminal Air Conditioners and Packaged Terminal Heat Pumps for Cooling and Heating Capacity (12/10) (H)

Mon (1/31) 10:00 AM – 12:00 PM Livorno (P)

SSPC 30 Method of Testing Liquid Chillers (7/4)

Tue (2/1) 3:30 PM – 5:30 PM Senate Boardroom (P)

SSPC 34 Designation and Safety Classification of Refrigerants (20/30) (H)

Mon (1/31) 6:30 PM – 10:00 PM Pompeian I (P)

SSPC 34 Designation and Nomenclature Subcommittee (20/30) (H)

Sat (1/29) 7:30 AM – 10:00 AM Florentine II (P)

SSPC 34 Flammability Subcommittee (20/30) (H)

Sat (1/29) 10:00 AM – 3:00 PM Florentine II (P)

SSPC 34 Toxicity Subcommittee/ISO 817 MA Toxicity Task Force (Joint Meeting) (20/25) (H)

Mon (1/31) 8:00 AM – 10:30 AM Pompeian I (P)

SPC 37 Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment (10/10) (H)

Wed (2/2) 8:00 AM – 12:00 PM Palermo (P)

SSPC 41 Standard Methods for Measurements (20/5)

Tue (2/1) 9:30 AM – 12:00 PM Pompeian III (P)

SSPC 52.2 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (12/35)

Sat (1/29) 8:00 AM – 12:00 PM Imperial Boardroom (P)

SSPC 55 Thermal Environmental Conditions for Human Occupancy (8/10) (H)

Sat (1/29) 8:30 AM – 3:00 PM Siena (P)

Sun (1/30) 9:00 AM – 12:00 PM Sicily (E)

SSPC 62.1 (Standard 62.1 and Guideline 42) Ventilation and Acceptable Indoor Air Quality (30/30) (H)

Sat (1/29) 8:00 AM – 12:00 PM Neopolitan I (P)

Sun (1/30) 1:00 PM – 5:00 PM Milano VIII (P)

SSPC 62.1 Administration Subcommittee (13/15)

Sat (1/29) 1:00 PM – 3:00 PM Neopolitan II (P)

SSPC 62.1 Research and Education Subcommittee (20/15)

Sat (1/29) 1:00 PM – 3:00 PM Neopolitan I (P)

SSPC 62.1 Ventilation Subcommittee (25/15)

Sat (1/29) 3:00 PM – 5:00 PM Neopolitan I (P)

SSPC 62.2 (Standard 62.2) Ventilation and Acceptable IAQ in Residential Buildings (40/30) (H)

Fri (1/28) 8:00 AM – 12:00 PM Milano VIII (P)

Fri (1/28) 1:00 PM – 5:00 PM Milano VIII (P)

Sat (1/29) 8:00 AM – 12:00 PM Milano VIII (P)

Sat (1/29) 1:00 PM – 3:00 PM Milano VIII (P)

SPC 70 Method of Testing for Rating the Performance of Air Outlets and Air Inlets (VIRTUAL)

Mon (1/31) 9:00 AM – 10:00 AM

WebEx – see schedule in ASHRAE 365 for link

SPC 72 Method of Testing Open and Closed Commercial Refrigerators and Freezers (30/10) (H)

Sun (1/30)	1:00 PM – 4:00 PM	Pompeian I (P)
------------	-------------------	----------------

SSPC 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings (60/10) (H)

Sat (1/29)	8:00 AM – 12:00 PM	Roman II/IV (P)
------------	--------------------	-----------------

Sun (1/30)	9:00 AM – 12:00 PM	Roman II/IV (P)
------------	--------------------	-----------------

Mon (1/31)	8:00 AM – 12:00 PM	Roman II/IV (P)
------------	--------------------	-----------------

SSPC 90.1 Lighting Subcommittee (25/10) (H)

Fri (1/28)	9:00 AM – 5:00 PM	Florentine III (P)
------------	-------------------	--------------------

Sat (1/29)	1:00 PM – 6:00 PM	Florentine III (P)
------------	-------------------	--------------------

Sun (1/30)	1:00 PM – 3:00 PM	Florentine III (P)
------------	-------------------	--------------------

SSPC 90.1 Envelope Subcommittee (25/10) (H)

Fri (1/28)	9:00 AM – 8:00 PM	Roman III (P)
------------	-------------------	---------------

Sat (1/29)	1:00 PM – 8:00 PM	Roman III (P)
------------	-------------------	---------------

Sun (1/30)	1:00 PM – 8:00 PM	Roman III (P)
------------	-------------------	---------------

SSPC 90.1 Mechanical Subcommittee (25/10) (H)

Fri (1/28)	9:00 AM – 8:00 PM	Roman II/IV (P)
------------	-------------------	-----------------

Sat (1/29)	1:00 PM – 8:00 PM	Roman II/IV (P)
------------	-------------------	-----------------

Sun (1/30)	1:00 PM – 8:00 PM	Roman II/IV (P)
------------	-------------------	-----------------

SSPC 90.1 Energy Cost Budget Subcommittee (10/10) (H)

Sun (1/30)	3:30 PM – 5:30 PM	Genoa (P)
------------	-------------------	-----------

SSPC 90.2 Energy-Efficient Design of Low-Rise Residential Buildings (20/5)

Mon (1/31)	2:15 PM – 6:15 PM	Florentine III (P)
------------	-------------------	--------------------

SSPC 90.4 Energy Standard for Data Centers (20/5) (H)

Sat (1/29)	8:00 AM – 12:00 PM	Salerno (P)
------------	--------------------	-------------

Mon (1/31)	8:00 AM – 12:00 PM	Florentine III (P)
------------	--------------------	--------------------

SSPC 100 Energy Efficiency in Existing Buildings (15/5) (H)

Tue (2/1)	8:00 AM – 12:00 PM	Capri (P)
-----------	--------------------	-----------

SPC 124 MOT for Rating Combinations Space-Heating and Water Heating Appliances (15/10) (H)

Tue (2/1)	9:00 AM – 12:00 PM	Imperial Boardroom (P)
-----------	--------------------	------------------------

SSPC 127 Method of Testing for Rating Air-Conditioning Units Serving Data Center (DC) and Other Information Technology Equipment (ITE) Spaces (15/5) (H)

Wed (2/2)	9:00 AM – 1:00 PM	Verona (P)
-----------	-------------------	------------

SSPC 135 BACnet Plenary (20/30) (H)

Sat (1/29)	8:00 AM – 5:00 PM	Milano IV (P)
------------	-------------------	---------------

Mon (1/31)	8:00 AM – 12:00 PM	Milano IV (P)
------------	--------------------	---------------

SSPC 135 BACnet Working Group (15/5)

Thu (1/27)	8:00 AM – 5:00 PM	Messina (P)
------------	-------------------	-------------

Fri (1/28)	8:00 AM – 5:00 PM	Salerno (P)
------------	-------------------	-------------

Fri (1/28)	8:00 AM – 5:00 PM	Sorrento (P)
------------	-------------------	--------------

Sun (1/30)	8:00 AM – 5:00 PM	Salerno (P)
------------	-------------------	-------------

Sun (1/30)	8:00 AM – 5:00 PM	Sorrento (P)
------------	-------------------	--------------

SSPC 140 Method of Test for Evaluating Building Performance Simulation Software (20/10) (H)

Mon (1/31)	2:15 PM – 6:00 PM	Pompeian II (P)
------------	-------------------	-----------------

SSPC 145 Test Method for Assessing the Performance of Gas-Phase Air Cleaning Equipment (25/10) (H)

Sun (1/30)	3:30 PM – 5:30 PM	Pompeian II (P)
------------	-------------------	-----------------

SSPC 147 Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems (6/4)

Tue (2/1) 8:00 AM – 12:00 PM Livorno (P)

SPC 150 Method of Testing the Performance of Cool Storage Systems (12/4)

Sat (1/29) 1:00 PM – 3:00 PM Tarranto (E)

SPC 152 Method of Test for Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution Systems (8/4) (H)

Tue (2/1) 3:30 PM – 4:30 PM Venice (E)

SSPC 154 Ventilation For Commercial Cooking Operations (14/8) (H)

Sun (1/30) 3:30 PM – 5:30 PM Consul Boardroom (P)

SPC 155P MOT for Rating Commercial Space Heating Boiler Systems (9/6) (H)

Sun (1/30) 1:00 PM – 5:00 PM Imperial Boardroom (P)

SSPC 161 Air Quality Within Commercial Aircraft (15/3) (H)

Sat (1/29) 9:00 AM – 12:00 PM Sorrento (P)

SSPC 170 Ventilation of Healthcare Facilities (30/20) (H)

Tue (2/1) 8:00 AM – 12:00 PM Florentine I (P)

Mon (1/31) 4:00 PM – 6:00 PM

WebEx (VIRTUAL) – see schedule in ASHRAE 365 for link

[SSPC 170 Natural Ventilation Subcommittee \(VIRTUAL\)](#)

Mon (1/31) 3:00 PM – 4:00 PM

WebEx – see schedule in ASHRAE 365 for link

SPC 173 Method of Test to Determine the Performance of Halocarbon Refrigerant Leak Detectors (5/5) (H)

Tue (2/1) 1:00 PM – 2:00 PM Octavius 15 (PS)

SSPC 185 Methods of Test to Inactivate Microorganisms in HVAC Systems with UV-C lights (15/5) (H)

Sat (1/29) 10:30 AM – 12:30 PM Sicily (E)

SSPC 188, Legionellosis: Risk Management for Building Water Systems (Session 1) (30/50) (H)

Tue (2/1) 3:45 PM – 5:30 PM Roman IV (P)

Wed (2/2) 8:00 AM – 12:00 PM Roman IV (P)

SSPC 189.1 Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings (35/5) (H)

Tue (2/1) 8:00 AM – 12:00 PM Roman I (P)

SSPC 189.3 Design, Construction and Operation of Sustainable High-Performance Health Care Facilities (17/7) (H)

Mon (1/31) 8:00 AM – 12:00 PM Capri (P)

SPC 196 Method of Test for Measuring Refrigerant Leak Rates (10/0)

Sun (1/30) 6:00 PM – 10:00 PM Consul Boardroom (P)

SPC 198 Method of Test for Rating DX-Dedicated Outdoor Air Systems for Moisture Removal Capacity and Moisture Removal Efficiency (6/20) (H)

Sun (1/30) 3:30 PM – 5:30 PM Siena (P)

SPC 205 Representation of Performance Data for HVAC&R and Other Facility Equipment (12/15)

Sun (1/30)	9:00 AM – 12:00 PM	Messina (P)
Tue (2/1)	8:00 AM – 12:00 PM	Genoa (P)

SPC 209 Energy Simulation Aided Design for Buildings Except Low-Rise Residential Buildings (30/10) (H)

Fri (1/28)	1:00 PM – 5:00 PM	Milano IV (P)
------------	-------------------	---------------

SPC 213P Method for Calculating Moist Air Thermodynamic Properties (3/5) (H)

Mon (1/31)	7:30 PM – 9:00 PM	Genoa (P)
------------	-------------------	-----------

SPC 217 Non-Emergency Ventilation in Enclosed Road, Rail and Mass Transit Facilities (10/5) (H)

Tue (2/1)	1:00 PM – 3:00 PM	Neopolitan I/II (P)
-----------	-------------------	---------------------

SPC 220P Method of Testing for Rating Small Commercial Blast Chillers, Chiller-Freezers, and Freezers (15/5) (H)

Mon (1/31)	10:00 AM – 12:00 PM	Anzio (P)
------------	---------------------	-----------

SSPC 221 Test Method to Field-Measure and Score the Cooling and Heating Performance of an Installed Unitary HVAC System (10/15) (H)

Wed (2/2)	10:00 AM – 12:00 PM	Genoa (P)
-----------	---------------------	-----------

SPC 222 Standard Method of Test for Electrical Power Drive Systems (6/3) (H)

Tue (2/1)	7:30 AM – 12:30 PM	Pompeian I (P)
-----------	--------------------	----------------

SPC 224P Standard for the Application of Building Information Modeling (15/5) (H)

Mon (1/31)	2:30 PM – 4:30 PM	Modena (P)
------------	-------------------	------------

SPC 228P Standard Method of Evaluating Zero Net Energy and Zero Net Carbon Building Performance (17/7) (H)

Mon (1/31)	5:00 PM – 7:00 PM	Pisa (P)
------------	-------------------	----------

SPC 231P CDL- A Control Description Language for Building Environmental Control Sequences (15/15)

Mon (1/31)	2:30 PM – 4:30 PM	Sorrento (P)
------------	-------------------	--------------

SSPC 300, Commissioning (24/30) (H)

Mon (1/31)	8:00 AM – 12:00 PM	Florentine IV (P)
------------	--------------------	-------------------

SSPC 300 Guideline 0.2 Subcommittee, Commissioning Process for Existing Systems and Assemblies (10/10) (H)

Fri (1/28)	10:30 AM – 12:00 PM	Florentine IV (P)
------------	---------------------	-------------------

SSPC 300 Standard 230P Subcommittee, Commissioning Process for Existing Buildings and Systems (18/15) (H)

Fri (1/28)	1:00 PM – 3:00 PM	Florentine IV (P)
------------	-------------------	-------------------

SSPC 300 Guideline 1.2 Subcommittee, Technical Requirements for the Commissioning Process for Existing HVAC&R Systems and Assemblies (10/12) (H)

Fri (1/28)	4:00 PM – 5:30 PM	Florentine IV (P)
------------	-------------------	-------------------

SSPC 300 Guideline 1.6P Subcommittee, Commissioning of Data Centers (20/24) (H)

Sat (1/29)	8:00 AM – 10:00 AM	Florentine IV (P)
------------	--------------------	-------------------

SSPC 300 Guideline 0 Subcommittee, The Commissioning Process for New Buildings and New Systems (24/12) (H)

Sat (1/29)	10:00 AM – 11:30 AM	Florentine IV (P)
------------	---------------------	-------------------

SSPC 300 Guideline 1.1 Subcommittee, Application of the Commissioning Process for New HVAC&R Systems (18/12) (H)

Sat (1/29)	12:00 PM – 1:30 PM	Florentine IV (P)
------------	--------------------	-------------------

SSPC 300 Standard 202 Subcommittee, Commissioning Process for New Buildings and New Systems (20/16) (H)

Sat (1/29) 1:30 PM – 3:00 PM Florentine IV (P)

SSPC 300 Guideline 1.3 Subcommittee, Building Operation and Maintenance Training for the HVAC&R Commissioning Process (20/12) (H)

Sun (1/30) 8:30 AM – 10:00 AM Florentine IV (P)

SSPC 300 Guideline 1.5 Subcommittee, The Commissioning Process for Smoke Control Systems (8/12) (H)

Sun (1/30) 10:00 AM – 11:30 AM Florentine IV (P)

SSPC 300 Guideline 1.4 Subcommittee, Preparing Systems Manuals for Facilities (10/10) (H)

Sun (1/30) 10:00 AM – 12:00 PM Genoa (P)

SSPC 300 Guideline 1.7P Subcommittee, Ongoing Commissioning Process for Buildings, Systems and Assemblies (8/8) (H)

Sun (1/30) 12:00 PM – 1:30 PM Florentine IV (P)

GUIDELINE PROJECT COMMITTEES (GPCs)

GPC 6 Refrigerant Information Recommended for Product Development and Standards (15/10)

Mon (1/31) 8:00 AM – 10:00 AM Messina (P)

GPC 14 Measurement of Energy, Demand and Water Savings (8/4) (H)

Sun (1/30) 8:00 AM – 12:00 PM Senate Boardroom (P)

GPC 23 Guideline for the Design and Application of Heating, Ventilation and Air Conditioning Equipment for Rail Passenger Vehicles (Business Meeting) (20/10) (H)

Tue (2/1) 3:30 PM – 5:30 PM Pisa (P)

GPC 23 Guideline for the Design and Application of Heating, Ventilation and Air Conditioning Equipment for Rail Passenger Vehicles (Working Session) (20/10) (H)

Mon (1/31) 2:30 PM – 6:30 PM Pompeian III (P)

GPC 35P Method for Determining the Energy Consumption Caused By Air-Cleaning and Filtration Devices (10/15) (H)

Mon (1/31) 2:30 PM – 6:30 PM Siena (P)

STANDING GUIDELINE PROJECT COMMITTEES (SGPCs)

SGPC 13 Specifying Building Automation Systems (25/0)

Sat (1/29) 8:00 AM – 12:00 PM Emperors II (E)

SGPC 36 High Performance Sequences of Operation for HVAC Systems (30/5)

Mon (1/31) 8:00 AM – 12:00 PM Emperors II (E)

SGPC 41, Design, Installation and Commissioning of Variable Refrigerant Flow (VRF) Systems (12/5)

Mon (1/31) 8:00 AM – 12:00 PM Imperial Boardroom (P)

WHAT IS A PROJECT COMMITTEE?

ASHRAE Project Committees (PCs) develop ASHRAE standards and guidelines. ASHRAE PCs consist of people who have a recognized expertise in a specific field of interest. Standards produced by ASHRAE are used as authoritative documents throughout our industry.

APPLYING FOR MEMBERSHIP OF A PROJECT COMMITTEE

ASHRAE welcomes new members to its project committees. With the exception of PC Chairs and Vice Chairs, it is not necessary to be a member of ASHRAE to participate on any of ASHRAE's Standards Project Committee (SPC), Guideline Project Committee (GPC), or Standing Standard/Guideline Project Committees (SSPC, SGPC).

To be considered for project committee membership, you must:

- Create an ASHRAE account if you do not already have an ASHRAE Account.
- Create or update your existing bio as necessary based on your current line of work.
- Complete the online application through the membership portal.
- After you correctly submit all necessary paperwork:
- You will receive an automated email letting you know that your application was successfully submitted.
- ASHRAE staff processes the application and provides the membership package to the PC chair
- The PC Chair reviews the membership package and accepts or declines each applicant
- ASHRAE's Standards Project Liaison Subcommittee approves new members

More details on applying for PC membership are available at <https://www.ashrae.org/technical-resources/standards-and-guidelines/apply-to-a-project-committee>.

ATTENDING PROJECT COMMITTEE MEETINGS

A PC member is expected to attend meetings and pay attention to correspondence. The PC Chair may recommend removal of a PC member for lack of participation such as failing to attend at least half of the scheduled PC meetings in a year.

ASHRAE Project Committees meet at each Society Winter and Annual Conference. Attendance at these meetings is open to everyone. You are encouraged to attend any of these meetings in which you have a technical interest. PC Chairs

welcome visitors to PC meetings – a PC can never have too many willing and able volunteers.

See the listing of Standards and Guidelines Committees meetings in the Final Program, online or in the app.

International Standards and Misc. Committees

Green Building XML Semi-Annual Meeting (5/0) (H)

Mon (1/31) 1:00 PM – 2:00 PM Imperial Boardroom (P)

International Standards Interaction Task Force (12/15) (H)

Fri (1/28) 1:00 PM – 4:00 PM Genoa (P)

Student Paper Competition Presentations (25/10)

Sat (1/29) 12:00 PM – 1:00 PM Octavius 17-18 (PS)

US TAG to ISO/TC 205, ‘Building environment design’ and US TAG to ISO/TC 163, ‘Thermal Performance and Energy in a Building Environment’ (Joint Meeting) (30/20) (H)

Tue (2/1) 1:00 PM – 3:30 PM Emperor II (E)

USNC/IIR (12/5) (H)

Tue (2/1) 2:00 PM – 4:00 PM Octavius 9 (PS)

USNT/IEA (12/10) (H)

Tue (2/1) 4:00 PM – 6:00 PM Octavius 9 (PS)

Listing of Virtual Committee Meetings Prior to Las Vegas

Due to the COVID–19 pandemic, subcommittees were strongly encouraged to meet virtually in advance of the Winter Conference in Las Vegas as ASHRAE eases back into in-person meetings. Some committees also chose to meet virtually in advance of the Winter Conference in Las Vegas. Below is a listing of virtual meetings that took place in advance of attendees arriving in Las Vegas.

VIRTUAL STANDING COMMITTEE MEETINGS

All times listed below are in PST.

Appointments Roadmap Committee

Tue (1/18) 8:00 AM – 9:30 AM

Building EQ Committee

Thu (1/20) 8:00 AM – 9:30 AM

Building EQ Business Development Subcommittee

Tue (1/11) 8:30 AM – 10:00 AM

Building EQ Technical Development Subcommittee

Thu (1/13) 8:00 AM – 9:30 AM

College of Fellows Executive Committee

Thu (1/20) 1:00 PM – 2:00 PM

Environmental Health Committee: Education Subcommittee

Fri (1/14) 7:00 AM – 8:00 AM

GAC: Nominating Subcommittee

Mon (1/10) 7:30 AM – 8:30 AM

GAC: Global Affairs Subcommittee Meeting

Thu (1/13) 5:00 AM – 6:00 AM

GAC: Rules Subcommittee Meeting

Thu (1/13) 12:00 PM – 1:00 PM

GAC: Policy and Programs Subcommittee Meeting

Thu (1/20) 7:00 AM – 8:00 AM

GAC: Member Mobilization Subcommittee Meeting

Fri (1/21) 10:00 AM – 11:00 AM

GAC: Executive Subcommittee Meeting

Mon (1/24) 7:00 AM – 8:30 AM

Handbook ExCom/Strategic Planning

Tue (1/18) 10:00 AM – 12:00 PM

Handbook 2024S Q&A with TCs

Wed (1/19) 7:00 AM – 8:00 AM

Handbook 2022R Q&A for TCs

Thu (1/20) 7:00 AM – 8:00 AM

Handbook 2023A Q&A for Subcommittees

Fri (1/21) 11:00 AM – 12:00 PM

Handbook Functional Subcommittee

Mon (1/24) 8:00 AM – 9:00 AM

Handbook Electronic Media Subcommittee

Mon (1/24) 10:00 AM – 11:00 AM

Handbook Review Committee

Mon (1/24) 11:30 AM – 12:30 PM

Handbook 2024S Subcommittee

Tue (1/25) 11:00 AM – 12:00 PM

Handbook Training for TCs and Liaisons

Wed (1/26) 10:00 AM – 11:00 AM

Handbook 2022R Subcommittee

Wed (1/26) 11:30 AM – 12:30 PM

Handbook 2023A Subcommittee

Thu (1/27) 11:00 AM – 12:00 PM

Life Members Executive Committee

Wed (1/12) 6:00 AM – 7:30 AM

Members Council Planning Subcommittee

Thu (1/6) 6:00 AM – 9:00 AM

Members Council Regional Operations Subcommittee

Fri (1/14) 6:00 AM – 9:00 AM

Members Council PAOE Subcommittee

Thu (1/20) 6:00 AM – 9:00 AM

Publications Committee Planning Subcommittee

Thu (1/20) 7:00 AM – 9:00 AM

Residential Buildings Committee

Fri (1/21) 7:00 AM – 9:00 AM

Residential Buildings Communication Subcommittee

Tue (1/18) 7:00 AM – 8:30 AM

Residential Buildings Process Subcommittee

Wed (1/19) 7:00 AM – 8:30 AM

Standards Committee

Mon (1/24) 8:00 AM – 12:00 PM

Standards: Planning, Policy and Interpretations Subcommittee (PPIS)

Thu (1/6) 6:00 AM – 8:00 AM

Standards: ILS/ISAS

Thu (1/13) 6:00 AM – 9:00 AM

StdC ExCom

Tue (1/18) 10:00 AM – 1:00 PM

VIRTUAL TECHNICAL COMMITTEE MEETINGS

TC 1.8 Mechanical Insulation Systems

Tue (1/11) 10:00 AM – 1:00 PM

TC 2.1 Physiology and Human Environment Main Meeting and Subcommittees

Fri (1/21) 6:00 AM – 9:00 AM

TC 2.3 RP 1720, RP 1838 and Research Subcommittee

Wed (1/19) 9:00 AM – 1:00 PM

TC 2.3 Program and Handbook Subcommittees

Thu (1/20) 10:00 AM – 12:00 PM

TC 2.3 Planning and Standards Subcommittees

Fri (1/21) 10:00 AM – 12:00 PM

TC 2.4 Handbook

Mon (1/24) 7:00 AM – 8:00 AM

TC 2.4 RP 1734

Mon (1/24) 8:00 AM – 9:00 AM

TC 2.4 RP 1784

Mon (1/24) 10:00 AM – 11:00 AM

TC 2.4 Standards

Tue (1/25) 10:00 AM – 11:00 AM

TC 2.4 Program

Tue (1/25) 11:00 AM – 12:00 PM

TC 2.4 Research

Thu (1/27) 10:00 AM – 12:00 PM

TC 2.8 Research

Fri (1/21) 9:00 AM – 9:45 AM

TC 2.8 Water Energy Nexus

Thu (1/27) 7:00 AM – 8:00 AM

TC 2.8 Programs

Thu (1/27) 8:00 AM – 9:00 AM

TC 2.10 Standards, Research, Programs, Handbook and Honors and Awards

Tue (1/11) 12:30 PM – 4:00 PM

TC Section 3 Combined Research Subcommittees Meeting

Tue (1/18) 10:00 AM – 11:00 AM

TC Section 3 Combined Program Subcommittees Meeting

Tue (1/18) 11:00 AM – 12:00 PM

TC 4.1 Subcommittees

Wed (1/26) 9:00 AM – 11:00 AM

TC 4.2 Program

Sat (1/15) 8:30 AM – 9:00 AM

TC 4.2 Research

Sat (1/15) 9:00 AM – 11:00 AM

TC 4.2 Handbook

Sat (1/15) 11:00 AM – 12:00 PM

TC 4.5 Subcommittee meetings

Mon (1/10) 10:00 AM – 2:00 PM

TC 5.1 Handbook, Research, Standards, Program

Tue (1/25) 11:00 AM – 2:00 PM

TC 5.3 Room Air Distribution Handbook Subcommittee

Mon (17) 6:00 AM – 3:00 PM

TC 5.3 Room Air Distribution Research and Programs

Mon (1/24) 10:00 AM – 1:00 PM

TC 5.6 Control of Fire and Smoke Main Meeting and Subcommittees

Fri (1/21) 10:00 AM – 1:00 PM

TC 5.10 Research Subcommittee

Thu (1/13) 8:30 AM – 9:00 AM

TC 5.10 Handbook

Thu (1/20) 11:00 AM – 1:00 PM

TC 5.11 Humidifying Equipment Handbook, Programs and Research

Mon (1/24) 12:00 PM – 3:00 PM

TC 6.1 Programs

Thu (1/20) 10:00 AM – 11:00 AM

TC 6.1 Handbook and Research

Thu (1/20) 12:00 PM – 1:30 PM

TC 6.2 District Energy Subcommittees

Wed (1/19) 9:00 AM – 11:00 AM

TC 7.5 Handbook

Tue (1/25) 1:00 PM – 2:00 PM

TC 7.5 Honors and Awards

Thu (1/27) 6:00 PM – 6:30 PM

TC 7.9 Building Commissioning Subcommittees

Tue (1/18) 11:00 AM – 1:30 PM

TC 8.1/8.2 – Joint Research, Program, Handbook

Thu (1/20) 12:00 PM – 2:00 PM

TC 8.3 Absorption and Heat Operated Machines Subcommittees

Tue (1/25) 10:00 AM – 12:00 PM

TC 8.8 Program, Research, Handbook

Wed (1/12) 8:00 AM – 10:00 AM

TC 8.10 Mechanical and Desiccant Humidification Equipment, Heat Pipes and Components

Tue (1/18) 10:00 AM – 12:00 PM

TC 8.11 Subcommittee Meeting

Wed (1/26) 11:00 AM – 2:00 PM

TC 9.3 Automotive HVAC and Handbook Subcommittees

Tue (1/25) 10:00 AM – 12:30 PM

TC 9.3 Programs

Wed (1/26) 9:00 AM – 10:00 AM

TC 9.8 Subcommittees

Thu (1/6) 9:00 AM – 12:00 PM

TC 9.10 RP-1780 Progress VM, Research , Program, and Lab Classification

Wed (1/26) 8:30 AM – 12:45 PM

TC 9.10 Design Guide, Handbook and Standard

Thu (1/27) 10:30 AM – 12:15 PM

MTG.CEA Subcommittee

Fri (1/14) 10:30 AM – 12:30 PM

MTG.EBO Effective Building Operations

Wed (1/19) 1:00 PM – 3:00 PM

VIRTUAL PROJECT COMMITTEE MEETINGS

SPC 16 MOT for Room Air Conditioners, Packaged Terminal Air Conditioners and Packaged Terminal Heat Pumps for Cooling and Heating Capacity

Wed (1/12) 10:00 AM – 12:00 PM

SSPC 41.8 – 2019R Standard Methods for Liquid Flow Measurement

Wed (1/12) 7:30 AM – 9:00 AM

SSPC 41.13P Standard Methods for Fuel Heat Value Measurement

Wed (1/19) 7:00 AM – 8:30 AM

SSPC 62.1 Ventilation Subcommittee

Thu (1/13) 8:00 AM – 10:00 AM

SSPC 62.1 (Guideline 42) IAQ Guideline Subcommittee

Fri (1/14) 8:00 AM – 10:00 AM

SSPC 62.1 Administration Subcommittee

Tue (1/18) 10:00 AM – 12:00 PM

SSPC 62.1 Research and Education Subcommittee

Tue (1/18) 10:00 AM – 1:00 PM

SSPC 62.2 Envelope Subcommittee

Thu (1/6) 7:00 AM – 11:00 AM

SSPC 100 WG9 – EUI-Based Energy Targets

Tue (1/11) 12:00 PM – 2:30 PM

SPC 110 Method of Testing Performance of Laboratory Fume Hoods

Fri (1/21) 9:00 AM – 11:00 AM

SPC 130 Laboratory Methods of Test For Air Terminal Units

Tue (1/11) 8:00 AM – 10:00 AM

SPC 164 Methods of Test for Humidifiers

Tue (1/25) 7:00 AM – 9:00 AM

SSPC 169 Climatic Data for Building Design Standards

Wed (1/19) 7:00 AM – 9:00 AM

SSPC 185.3 Method of Testing In-Room Devices and Systems for Microorganism Removal or Inactivation in a Chamber

Wed (1/5) 7:30 AM – 9:30 AM

SSPC 185.3 Method of Testing In-Room Devices and Systems for Microorganism Removal or Inactivation in a Chamber

Wed (1/26) 7:30 AM – 9:30 AM

SPC 191P Standard for the Efficient Use of Water in Building Mechanical Systems

Tue (1/18) 9:00 AM – 12:00 PM

SPC 227 Passive Building Design Standard (VIRTUAL)

Thu (2/3) 10:00 AM – 12:00 PM

SPC 229P Protocols for Evaluating Ruleset Implementation in Building Performance Modeling Software

Mon (1/10) 10:00 AM – 2:00 PM

GPC 44P Protecting Building Occupants from Smoke During Wildfire and Prescribed Burn Events

Wed (1/26) 12:00 PM – 2:00 PM

GPC 45P Measurement of Whole Building Performance for Occupied Buildings Except Low-Rise Residential Buildings

Wed (1/12) 8:00 AM – 10:00 AM

MISCELLANEOUS

U.S. TAG to ISO/TC 142, Cleaning Equipment for Air and Other Gases

Wed (1/19) 7:00 AM – 10:00 AM

Conference registrants receive a 10% publications discount!

Use discount code LASVEGAS2022 in the online ASHRAE bookstore.
This discount code is good for 10% off any online bookstore
purchases made during the dates of the winter conference.

