



Your Guide to the ASHRAE **2017**
WINTER
CONFERENCE

Jan. 28 – Feb. 1
Las Vegas, NV



Technical program • Social events schedule • A/EI education courses • Maps of meeting areas

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ASHRAE EVENTS APP

Update your ASHRAE App to access the meeting agenda with venue floor plans, social events and tips for your time in Las Vegas. The app also features the ability to view Virtual Conference presentations, a customizable schedule, speaker evaluations, and live audience polling. The app is made possible through support from the following sponsors:



Premier Sponsor



Get the free mobile app at: www.ashrae.org/app

CAESARS PALACE – PROMENADE LEVEL

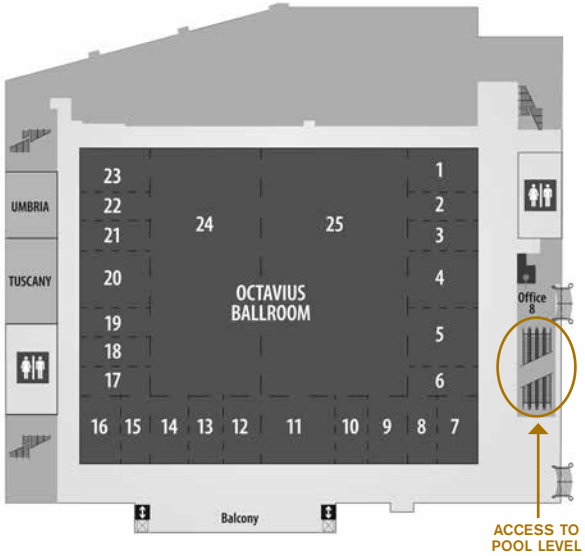
From the Hotel Lobby follow signage through the Palace Casino towards the “Conference Center” located past the Julius Tower and Mr. CHOW restaurant. The Conference Center escalators to Promenade Level are located across from Payard Patisserie. The Conference Center can be accessed by the elevator for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



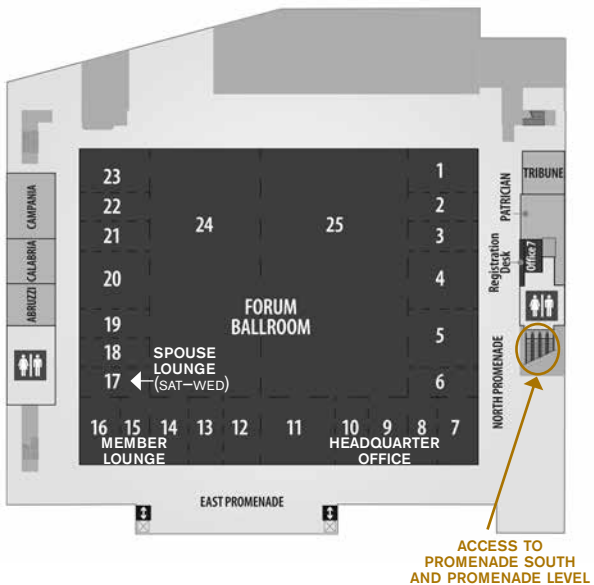
CAESARS PALACE – POOL LEVEL

From the Promenade level, take second set of stairs up to the Promenade South and then take escalators marked below to the Pool Level.

PROMENADE SOUTH LEVEL

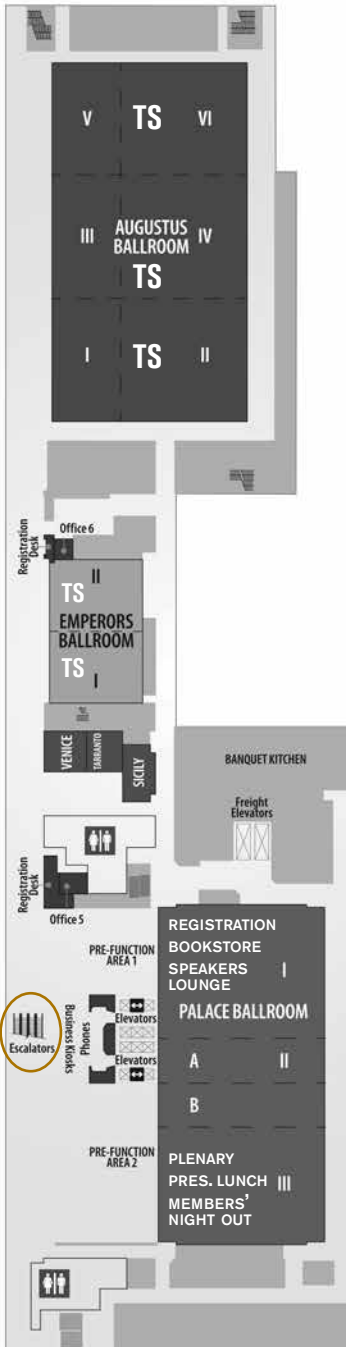


POOL LEVEL

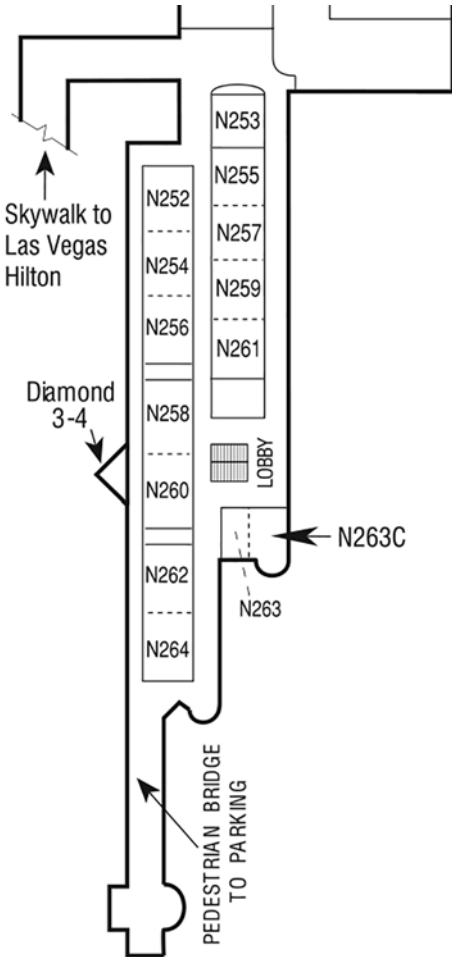


CAESARS PALACE – EMPERORS LEVEL

From the Promenade Level, take the escalator marked below to the Emperors Level.



LAS VEGAS CONVENTION CENTER NORTH BUILDING, LEVEL 2



CONFERENCE SPONSORS

ASHRAE thanks the following sponsors for their support of the 2017 ASHRAE Winter Conference:



Sponsor of the Keynote Speaker



we make life better®

Sponsor of the ASHRAE Bookstore



Sponsor of YEA



Sponsor of the Networking Coffee Break



Sponsor of the Women in ASHRAE Breakfast



Sponsor of Lanyards



Sponsor of Conference Note Pads

CHAPTER AND SOCIETY OFFICIALS

A special thanks to all the members in the Southern Nevada Chapter who helped make the 2017 ASHRAE Winter Conference a success!

SOUTHERN NEVADA CHAPTER OFFICERS

Manuel Galvez, PE, President
Joseph Clausing, President-Elect
Lance Douglas Banks, Secretary
Bryson Edwards, PE, Treasurer

LAS VEGAS HOST COMMITTEE

General Chair, Dave Fagotti
Vice Chair, Matt Lisiewski
Sessions, Bruce Lindsay
Entertainment, Keaton Frecker and Lance Banks
Hospitality, Manny Galvez
Information/Sustainability Project, Soren Peterson
Tours, Joe Clausing
Jason Williamson
Amber Aguilar
Brandon Holten

ASHRAE OFFICERS

Timothy G. Wentz, P.E., Fellow ASHRAE, HBDP, President
Bjarne W. Olesen, Ph.D., Fellow ASHRAE, Life Member,
President-Elect
Sheila J. Hayter, P.E., Fellow ASHRAE, Treasurer
Walid Chakroun, Ph.D., Fellow ASHRAE, professor,
Vice President
Patricia Graef, P.E., Fellow ASHRAE, Vice President
Ginger Scoggins, P.E., Vice President
Edward Tsui, Vice President
Jeff H. Littleton, Executive Vice President

CONFERENCES AND EXPOSITIONS COMMITTEE

Jon J. Cohen, Chair	Corey B. Metzger
David E. Claridge, Vice Chair	Cynthia L. Moreno
Abderrazak Alazazi	Robert (Alan) Neely
Dennis L. Alejandro	Leticia De Oliveira Neves
Vikrant C. Aute	Ann J. Peratt
Chris A. Balbach	Kimberly Pierson
Dimitris A. Charalambopoulos	Ashish Rakheja
Michael M. Collarin	Frank H. Schambach
Carrie Anne Crawford	Leon Shapiro
Charlie D. Curlin, Jr.	Las Vegas Conference Chair
Gary C. Debes	Sarah E. Maston
Jason W. DeGraw	Consultant
Melanie Derby	William K. Klock, BOD
Joseph T. Firrantello	Ex-Officio
Jennifer E. Leach	Bjarne W. Olesen
James F. Liston, Jr.	Coordinating Officer
Kevin L. Marple	

GENERAL INFORMATION

BADGES AND SCANNING

Badges must be worn for admission to the technical program. Room monitors will scan badges at the rooms. The scanning process will provide you with a summary of all sessions attended at the conclusion of the conference and will be emailed to you. Please keep track of the sessions that you attend at the conference. If you do not desire to have a summary of the sessions you do not need to be scanned. The room monitors will distribute evaluation forms for each session. Please complete the form and return it to the monitor when you leave the session. Session evaluations will also be available to complete in the App. Room monitors will also distribute and collect comment cards on which attendees are encouraged to submit written questions regarding papers presented at the Poster Session. Questions are given to the authors for reply and published in ASHRAE Transactions.

HOTEL ADDRESS, TELEPHONE

Caesars Palace
3570 S Las Vegas Blvd, Las Vegas, NV 89109
(866) 227-5938

ONLINE REGISTRATION

Need to register or buy a ticket for social events, tours, or Learning Institute courses? You can register online throughout the conference. You can also register during registration hours in Palace I, Emperors Level of the Caesars Palace. Come to registration to pick up your tickets or badge.

INTERNET ACCESS

Internet access for e-mail is available in the Cyber Café located in the registration area during operating hours. Please be considerate to others and limit your usage to five minutes.

Wireless internet will be available in all meeting rooms. 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: ashrae2017

Passcode: lasvegas

**network and passcode are case sensitive*

ASHRAE APP

Download or update the ASHRAE App for access to content such as the meeting agenda, floor plans, social events, and tips for your time in Las Vegas. App features also include the capability to view Virtual Conference presentations from your mobile device, a customizable schedule, an attendee list, and speaker evaluations.

To download the app, visit www.ashrae.org/app.

NOTICE

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, videotaping and recording of this program are 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, ASHRAE's headquarters hotel.

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 ASHRAE-related publications or Web site.



WHAT TO WEAR

Normal business attire is appropriate for meetings and social events; however, the Welcome Party and Members' Night Out will be business casual.

LOST AND FOUND

Items found during the conference should be turned into the staff in the ASHRAE headquarters room, Forum 8-10 or ASHRAE registration. Caesars also has a lost and found, available 24/7 at the security booth (across from the Barge Bar/Gossy Room).

TECHNICAL PROGRAM 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 are approved for the State of New York PDHs and AIA Learning Units. Those programs are indicated with a  symbol. Others are approved 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. In order to report your attendance at the session, PDH and AIA sign-in sheets are in the session room. Sessions are approved for 1, 1.5 or 2 PDHs depending on the length of the session.

MEETING PAPERS

During the conference, papers presented in the poster and conference paper sessions can be purchased in the ASHRAE Bookstore. After the conference, papers will be posted in the online ASHRAE Bookstore. Papers are not available for seminars or forums. For this Conference, all Technical Papers will be presented in the Poster Session and will be published with discussion in ASHRAE Transactions. Other meeting papers can be purchased in the online Bookstore at www.ASHRAE.org or searched online in the Abstract Center. The Abstract Center is a searchable database of abstracts on everything ASHRAE has published since 1980. This service is free to ASHRAE members, but a subscription fee will be charged to nonmembers. For ordering information, contact ASHRAE Customer Service at 1-800-527-4723.

VIRTUAL CONFERENCE

Don't miss the state-of-the-art concepts and latest design techniques presented in the Society's technical program available through the virtual conference. The Las Vegas Virtual Conference allows you to view presentations and to interact with an online audience through a discussion board. All registered conference attendees will receive an email notification when sessions are available for viewing. The email will include a link to the Las Vegas Virtual Conference. If you do not have your password, go to www.ashrae.org/lasvegasvirtual and click on the link to access the Virtual Conference and put in your email address to request your password.

Virtual Conference registration includes:

- Synced audio and PowerPoint presentations from all, conference paper sessions, seminars and workshops.
- Ability to post comments and rate presentations.
- Print presentation slides in notes format.
- Ability to post questions or answers for selected sessions through Wednesday, February 15. Presentations available online for 18 months.

A full slate of technical programs will be posted beginning Monday, January 29, of the sessions that were presented the previous day, with additional content posted through Thursday, February 2.

Access to the Las Vegas Virtual Conference is free with your conference registration. To register only for the Virtual Conference, go to ASHRAE Registration in Palace I or register online.

\$249 ASHRAE member; \$445 non-member

AHR Expo®

See new products from 2,000+ Exhibitors

Las Vegas Convention Center

3150 Paradise Rd. Las Vegas, NV 89109

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

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 29. Starting Monday, you can register one hour before the doors open.

Show Hours:

Monday, January 30 10:00 a.m.–6:00 p.m.

Tuesday, January 31 10:00 a.m.–6:00 p.m.

Wednesday, February 1 10:00 a.m.–4:00 p.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.

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 between the Colosseum Gift Store and Fizz Lounge. This area is adjacent to the Caesars Palace Food Court.

Shuttle Bus Hours of Operation:

Monday, January 30 7:00 a.m. – 7:00 p.m.

Tuesday, January 31 8:00 a.m. – 7:00 p.m.

Wednesday, February 1 8:00 a.m. – 6:00 p.m.

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 of the locking devices provided. Don’t reveal your room number or discuss plans for leaving the hotel within earshot of strangers.

EMERGENCY SITUATIONS

In case of an emergency, dial from a “House Phone” x5911 or 702-650-5911 from an outside line. For non-emergency issues, dial from a “House Phone” x7909 or 702-731-7909. Caesars has EMTs on staff 24/7 to handle basic life support. If an issue arises where further care is warranted, Clark County Fire and Medic West will be dispatched by Caesars to assist.

The closest hospital is Desert Springs Hospital located at 2075 E. Flamingo Road, 702-733-8800.

Fire Emergency... Preparedness in Hotels

In case of a fire, strobes with a loud “whoop” will activate. An audible investigation message will play over the hotel’s PA system. It is important not to panic. If a fire emergency does in fact happen, take all cues from security and hotel staff.

Plan ahead—when you check into your room, check the location of exits. Walk to the nearest exit; learn the route, obstacles, etc. Keep your room key on the night stand when you are in your room. Examine your room. Check the windows to see if they open and how. Examine the area outside your window.

CHARGING STATION

A kiosk to charge your cell phone and other devices has been provided by the Chapter Technology Transfer Committee’s Annual Webcast. The charging station is located in the Palace Foyer.

notes

SPOUSE/GUEST GUIDE

ASHRAE MEMBER LOUNGE

Forum 14-16, Pool Level, Caesars Palace

The ASHRAE Member Lounge is open daily for all individuals who are registered for the meeting. Light refreshments are available in the morning each day and beverages are available all afternoon. Members of the Las Vegas Host Committee will be present to answer questions about local activities in the morning. Detailed information on the city including brochures and maps can be found at the Host Committee Desk located in the ASHRAE Registration area in Palace I, Emperors Level, Caesars Palace.

SPOUSE LOUNGE

Forum 17, Pool Level, Caesars Palace

The Spouse Lounge has returned to ASHRAE Conferences! The Spouse Lounge is open daily with light refreshments available in the morning and beverages available all day. The lounge is open to all registered spouses and is a great place to meet other spouses and guests of conference attendees.

ASHRAE Member and Spouse Lounge Hours:

Saturday, Jan. 28	7:30 a.m.–3:00 p.m.
Sunday, Jan. 29	7:30 a.m.–4:00 p.m.
Monday, Jan. 30	7:30 a.m.–4:00 p.m.
Tuesday, Jan. 31	7:30 a.m.–4:00 p.m.
Wednesday, Feb. 1	7:30 a.m.–1:00 p.m.

MEET AND GREET

Caesars Palace, Florentine III/IV, Promenade Level

Monday, Jan. 30

9:30–11 a.m.



The Meet and Greet, open to all registered spouses and guests, gives spouses an opportunity to meet with old friends and greet new ones. Museum Administrator and the frequent guest star of The History Channel's "Pawn Stars," expert Mark Hall-Patton will speak on the history of Clark County and the Vegas valley, as well as saying a bit about the impact on life of being on and internationally-televvised show. If you wonder why over 2 million people live in

the middle of the desert, come hear Mark's talk. After the presentation, Mark will be available for photos with attendees.

Light refreshments will be served.

SOCIAL EVENTS

PLENARY SESSION KEYNOTE SPEAKER – ADAM STELTZNER

Palace III, Emperors Level, Caesars Palace

Saturday, Jan. 28

3:15–5:30 p.m.



Adam Steltzner is an award-winning rocket scientist and the Team Leader & Chief Engineer EDL at NASA's Jet Propulsion Laboratories. He worked on the revolutionary “sky crane” landing system that successfully placed the Mars rover, Curiosity, on the Martian surface in 2012.

To inspire attendees, Steltzner will discuss the power of human curiosity, the importance of fostering a culture of collaborative innovation and proves that with the “right kind of crazy,” we can significantly expand boundaries and achieve the impossible. His insight and journey are captured in his book, *The Right Kind of Crazy: A True Story of Teamwork, Leadership and High Stakes Innovation*, released in 2016.

WELCOME PARTY

Forum Ballroom, Pool Level, Caesars Palace

Saturday, Jan. 28

6:30–8:30 p.m.

Cost: \$80

Saturday, January 28 marks the first day of the Chinese New Year. Enjoy an evening filled with food, drinks and friends as we kick off the conference and celebrate the Year of the Rooster. To mark the occasion, we'll have an Asian inspired menu, and two photo booths complete with red carpet, back drops, props, and instantly printed pictures. A ticket is required to attend and includes two drink tickets. Menu details are available on the conference website.

WOMEN IN ASHRAE BREAKFAST

Florentine III/IV, Promenade Level, Caesars Palace

Monday, Jan. 30

7:00–8:30 a.m.

Join women from around the world to share ideas and learn how to be active at the chapter, region, and/or Society level. Current ASHRAE members will share insight and experiences. A light breakfast and coffee will be served. This event requires pre-registration.

PRESIDENT'S LUNCHEON

Palace III, Emperors Level, Caesars Palace

Monday, Jan. 30

12:15–2:00 p.m.

Cost: \$70

2016–17 ASHRAE President Tim Wentz provides an update on his presidential theme, "Adapt Today to Shape Tomorrow." Major contributors to the ASHRAE RP Campaign also are recognized. A ticket is required.

LIFE MEMBERS' LUNCHEON

Pompeian I, Promenade Level, Caesars Palace

Tuesday, Jan. 31

12 p.m.–1:30 p.m.

Cost: \$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. A ticket is required.

MEMBER'S NIGHT OUT

Palace III, Emperors Level, Caesars Palace

Tuesday, Jan. 31

Cost: \$80

Reception and Cash Bar

6:30 p.m.

Palace Ballroom Foyer

Dinner and Entertainment

7:30 p.m.–10:30 p.m.

Enjoy a cocktail reception and dinner, and then dance the night away with Love Shack, a 1980s cover band that is the premiere nostalgia band of Las Vegas.

HOW TO GET THE MOST OUT OF THE ASHRAE CONFERENCE

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.

Whether you are attending your first conference or your tenth, chances are that you will have questions about what is available, which events you want to attend, how to hear one speaker without missing another or where to go to give input regarding a standard or research project. The following summary should answer some of your questions and aid you in getting the most out of an ASHRAE conference and meeting.

SHARING TECHNOLOGY:

The ASHRAE Conference Technical Program

The technical program for the ASHRAE Conference includes conference paper sessions, seminars, workshops, a poster session, and forums. Refer to page 42 for descriptions of these different types of sessions. Check the program book or conference app to see what you want to attend. You can jump between sessions if you want to hear one specific presentation in each session. Host committee volunteers will be at the door checking and scanning badges.

ADVANCING THE INDUSTRY: Society Meetings

The technical expertise of ASHRAE is concentrated in its technical committees, task groups and technical resource 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) are appointed specifically by the Standards Committee to develop and revise standards to reflect technical advances in the areas that they cover. To qualify for membership in a committee, you must be knowledgeable in the discipline of the proposed standard.

A schedule of all meetings is included in the conference program and app. Attendance at TC and SPC meetings is open. Please consult your schedule and plan to attend the committee meetings that interest you.

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 conference papers, are available for sale in the ASHRAE Bookstore. Located in the registration area of the headquarters hotel and in the Expo, the bookstore features a display of books devoted entirely to the HVAC&R industry. Publications from ASHRAE's publications catalog, as well as a variety of new publications and books from allied organizations are on display. ASHRAE publications may be purchased individually on site, or you may wish to order several books and have them shipped to you at a later date or use the online bookstore at www.ashrae.org/bookstore.

The membership booth is located in the registration area of the headquarters hotel. Membership applications are available, as well as brochures about the HVAC&R industry, information on student membership and information about the ASHRAE group insurance plan. Registrants paying the non member registration fee receive their first year of membership free. To obtain membership an application form must be submitted with the meeting registration form or within 60 days following the meeting. A staff member will be present during registration hours to assist you.

NETWORKING: Getting Involved

ASHRAE conferences and meetings provide an international setting for attendees to gather and exchange ideas, to explore possibilities in the industry and to examine its problems. Opportunities to get involved range from presenting a conference 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.

UPCOMING CONFERENCES

Second International Conference on Energy and Indoor Environment for Hot Climates

February 26–27, 2017 • Doha, Qatar

CIBSE Delivering Resilient High-Performance Buildings

April 5–6, 2017 • Loughborough, United Kingdom

Sustainable Management of Refrigeration Technologies in Marine and Off-Shore Fisheries Sectors

April 6–8, 2017 • Bangkok, Thailand

ASHRAE 2017 Building Performance Analysis Conference

September 27–29, 2017 • Atlanta, GA

Second ASHRAE Developing Economies Conference

November • India

notes

AWARDS PRESENTATION

Saturday, January, 28, 2017, 3:15–5:30 p.m.

Plenary Session, Caesars Palace

Palace Ballroom III, Emperors Level

ASHRAE PIONEERS OF INDUSTRY AWARD

“Given to recognize deceased individuals who have made milestone contributions to the growth of air conditioning, heating, refrigeration and ventilation”

Carl Georg Munters

Frederick Wittenmeier

ASHRAE HONORARY MEMBER

“Given to recognize notable persons of preeminent professional distinction”

Stephen T. Ayers, FAIA, Washington, DC

STUDENT DESIGN PROJECT COMPETITION

“Given in recognition of outstanding student research and design projects”

HVAC System Selection

First Place: Christian Garcia, Sevan Hovsepien, Asped Khachatourian, Tade Mirzakhanyan, Miro Zaroukian
California State Polytechnic University, Pomona (Faculty Advisors: Henry Xue, Ph.D., and Richard L. Gilbert, P.E.)

HVAC Design Calculations

First Place: Alexander Brosky, Samarth Joshi, Aubrey McNeill, Silvia Odaya, Cheng Yang, Ziran Yu
University of British Columbia (Faculty Advisors: Nima Atabaki, Ph.D., P.Eng., and Steven Rogak, Ph.D., P.E.)

Integrated Sustainable Building Design

First Place: Austin B. Christianson, Logan G. Harrell, Gerald Hornik, Travis Kalikapersaud, Jeremy Palavecino
University of Central Florida (Faculty Advisor: Muthusamy V. Swami, Ph.D.)

Applied Engineering Challenge

First Place: Bradley E.R. Lulik, Eva Rennie, Brent Yeske
University of Regina, Saskatchewan (Faculty Advisor: Adisorn Aroonwilas, Ph.D.)

TECHNOLOGY AWARDS

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

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 – New

Kitaro Mizuide, Ph.D., P.E., for YKK80 Building
Owner Representative, Takashi Matano, YKK Real Estate Co., Ltd.

Category I – Commercial Buildings – New

Brian Rose, P.E., Tracy Steward for Cincinnati District 3

Police HQ – NZE Building

Owner, City of Cincinnati

Category I – Commercial Buildings – Existing

Shannon M. Allison for 435 Indio Way

Owner, Huettig & Schromm Inc. – WTA Indio LLC

Category II – Educational Facilities – New

Bradford Crowley, P.E., for Johns Hopkins University,
Undergraduate Teaching Laboratories

Owner, Johns Hopkins University

Category II – Other Institutional Buildings – EBCx

Adam C. S. Wheeler, P.E., for UCSF PSSRB MBCx

Owner Representative, James Hand, University of California,
San Francisco

Category III – Health Care Facilities – New

Kurt Monteiro, P.Eng., HFDP, HBDP, for Humber River
Hospital

Owner Representative, Jennifer Tredinnick, Humber River
Hospital

Category IV – Industrial Facilities or Processes – New

Julien Allard for STM – Construction du Centre de transport
de Stinson

Owner Representative, Chantal Dubuc, P.Eng., Société de
transport de Montreal

E.K. CAMPBELL AWARD OF MERIT

presented by the Life Members' Club

*“Given in recognition of outstanding service and achievement
in teaching”*

Thomas H. Kuehn Ph.D., P.E.

Minneapolis, MN

JOHN F. JAMES INTERNATIONAL AWARD

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

Gerald C. Groff, Cazenovia, NY

ASHRAE FELLOWS

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

Charles S. Barnaby, BEMP, Moultonborough, NH
Charlene Warres Bayer, Ph.D., Atlanta, GA
Michel Bernier, Ph.D., P.E., Montreal, QC, Canada
James J. Bushnell, Solana Beach, CA
Thomas D. Colvin, P.E., Salt Lake City, UT
John F. Dunlap, P.E., BEAP, BEMP, CPMP, HBDP, HFDP,
Richmond, VA
Steven J. Emmerich, Gaithersburg, MD
Krishnan Gowri, Ph.D., San Francisco, CA
John L. Harrod, P.E., Edmond, OK
Eliseo Huergo, Ing., Buenos Aires, Argentina
Julia Keen, Ph.D., P.E., HBDP, BEAP, Manhattan, KS
Thomas M. Lawrence, Ph.D., P.E., Athens, GA
Zoltan Magyar, Ph.D., Budapest, Hungary
David R. Olson, P.E., Longmont, CO
Richard L. Pavlak, P.E., Dayton, OH
Michael Rosenberg, Richland, WA
Timothy A. Shedd, Ph.D., Madison, WI
Carey J. Simonson, Ph.D., P.E., Saskatoon, SK, Canada
Robert L. Towell, P.E., Edwardsville, IL
Phillip M. Trafton, Tarzana, CA
R. Vijayakumar, Ph.D., Liverpool, NY
Fu-Jen Wang, Ph.D., P.E., Taiping City, Taichung, Taiwan

MILTON W. GARLAND COMMEMORATIVE REFRIGERATION AWARD FOR PROJECT EXCELLENCE

"Given in recognition of a non-comfort cooling refrigeration application which highlights innovation or new technologies"

Claude Dumas, P.Eng., Montreal, QC, Canada

COMFORT COOLING AWARD FOR PROJECT EXCELLENCE

"Given to recognize the designer and the owner of a comfort cooling application which highlights innovation or new technologies"

Andy Pearson, Ph.D., C.Eng., Glasgow, United Kingdom

ROOMS/HOURS

FINDING YOUR ASSIGNED MEETING ROOM

Please refer to the Caesars Palace Conference Center floor plans located in this program.

Caesar's meeting space is located in the Conference Center. 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 Payard Patisserie. The Conference Center can be accessed by the elevator for guests staying in the Palace Tower.

CONFERENCE REGISTRATION, Palace I, Emperors Level

Registration is required for all conference participants. Official badges must be worn at all functions and for admission into the technical sessions. ASHRAE conference registration will be open during the following hours:

Friday, January 27	10:00 a.m.–5:00 p.m.
Saturday, January 28	7:15 a.m.–6:00 p.m.
Sunday, January 29	7:00 a.m.–5:00 p.m.
Monday, January 30	7:00 a.m.–5:00 p.m.
Tuesday, January 31	7:30 a.m.–4:30 p.m.
Wednesday, February 1	7:30 a.m.–11:00 a.m.

ASHRAE BOOKSTORE, Palace I, Emperors Level

More than 300 books, conference papers 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. The ASHRAE Bookstore will be open during the following hours:

Friday, January 27	10:00 a.m.–5:00 p.m.
Saturday, January 28	7:15 a.m.–6:00 p.m.
Sunday, January 29	7:00 a.m.–5:00 p.m.
Monday, January 30	7:00 a.m.–5:00 p.m.
Tuesday, January 31	7:30 a.m.–4:30 p.m.
Wednesday, February 1	7:30 a.m.–1:00 p.m.

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.

SPEAKER'S LOUNGE, Palace I, Emperors Level

The Speaker's Lounge will be open during the following hours:

Saturday, January 28	1:00 p.m.–3:00 p.m.
Sunday, January 29	7:00 a.m. 5:00 p.m.
Monday, January 30	7:00 a.m.–12:15 p.m. and 1:30–4:30 p.m.
Tuesday, January 31	7:00 a.m.–5:00 p.m.
Wednesday, February 1	7:00 a.m.–1:00 p.m.

MEMBERSHIP DESK, Palace I, Emperors Level

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.

HEADQUARTER OFFICE, Forum 8-10, Pool Level

The ASHRAE Headquarter office offers members complimentary copying, services of a typist and access to printers for laptop computers.

Friday, January 27	12:00 p.m.–5:00 p.m.
Saturday, January 28	8:00 a.m.–5:00 p.m.
Sunday, January 29	8:00 a.m.–5:00 p.m.
Monday, January 30	8:00 a.m.–5:00 p.m.
Tuesday, January 31	8:00 a.m.–5:00 p.m.
Wednesday, February 1	8:00 a.m.–1:00 p.m.

YEA ACTIVITY

Young Engineers in ASHRAE (YEA) Hospitality Reception, Florentine III/IV, Promenade Level

Attention young professional members age 35 and younger! You are invited to visit the YEA Hospitality Suite on Sunday, January 29, from 4:00 p.m.–6:00 p.m. The reception offers social and networking opportunities, and light refreshments will be served.

LEADERSHIP U

At each ASHRAE conference, the Leadership U program gives four future ASHRAE leaders the opportunity to shadow an ASHRAE Board member, providing a high level conference experience and unique networking opportunity. This program is operated by the Young Engineers in ASHRAE (YEA) Committee and more information can be found at www.ashrae.org/yea. The Leadership U participants for the 2017 ASHRAE Winter Conference are:

- Enrica Galasso, Central New York Chapter, Region I
- Robert Hoadley, NB/PEI Chapter, Region II
- Annie Smith, St. Louis Chapter, Region VI
- Kris Tan, Singapore Chapter, Region XIII

ASHRAE MEMBER LOUNGE, Forum 14-16, Pool Level

The lounge will be open to all registered attendees during the following hours:

Saturday, January 28	7:30 a.m.–3:00 p.m.
Sunday, January 29	7:30 a.m.–4:00 p.m.
Monday, January 30	7:30 a.m.–4:00 p.m.
Tuesday, January 31	7:30 a.m.–4:00 p.m.
Wednesday, February 1	7:30 a.m.–1:00 p.m.

More information about the ASHRAE Member Lounge can be found on page 13.

ASHRAE SPOUSE LOUNGE, Forum 17, Pool Level

The lounge will be open to all registered spouses/guests during the following hours:

- Saturday, January 287:30 a.m.–3:00 p.m.
- Sunday, January 29.....7:30 a.m.–4:00 p.m.
- Monday, January 307:30 a.m.–4:00 p.m.
- Tuesday, January 317:30 a.m.–4:00 p.m.
- Wednesday, February 17:30 a.m.–1:00 p.m.

More information about the ASHRAE Spouse Lounge can be found on page 13.

LAS VEGAS DESK, Palace I, Emperors Level

Information about the city of Las Vegas will be available.

LONG BEACH ANNUAL CONFERENCE INFORMATION

Palace I, Emperors Level

Information on the upcoming Annual Conference scheduled for June 24–28, 2017 at Hyatt Regency Long Beach and Long Beach Convention Center will be available in the registration area.

notes

Empty rectangular area for notes.

LOCATION OF MEETINGS

Please refer to the Caesars Palace Conference Center floor plans located in this program. The Conference Center at Caesars Palace has three levels with ASHRAE functions: Promenade, Pool and Emperors Levels.

MEETING SCHEDULE

FRIDAY, JANUARY 27

- 8:00 am–5:00 pm **Committee Meetings**
See listing on pages 81–112
- 10:00 am–5:00 pm **Registration and ASHRAE Bookstore,**
Palace I, Emperors Level

SATURDAY, JANUARY 28

- 7:30 am–3:00 pm **ASHRAE Member Lounge,** Forum
14-16 and **Spouse Lounge,** Forum 17,
Pool Level. *See description on page 13.*
- 7:15 am–6:00 pm **Registration and ASHRAE Bookstore,**
Palace I, Emperors Level
- 8:00 am–5:00 pm **Committee Meetings**
See listing on pages 81–112
- 1:00 pm–3:00 pm **Speakers' Lounge,** Palace I,
Emperors Level
- 1:30 pm–3:00 pm **Student Orientation,** Augustus III/IV,
Emperors Level

Special Event

- 3:15 pm–5:00 pm **Meeting of the Members,**
Plenary Session, Palace III,
Emperors Level
- Opening and Welcoming Remarks** by
ASHRAE President Timothy G. Wentz
- Welcome** by Director and Chair,
Region X, Karine Leblanc
- Secretary's Report** by Executive Vice
President Jeff H. Littleton
- Awards Presentation**
See description on page 19–21.
- Keynote Address:** Adam Steltzner
See description on page 14.
Plenary Session is open, no badge nor
registration is required to attend.
- 5:00 pm–6:30 pm **YEA/Student Mixer,** Augustus III/IV,
Emperors Level

Special Event

- 6:30 pm–8:30 pm **Welcome Party,** Forum Ballroom,
Pool Level. *Ticket required.*
See description on page 14.

SUNDAY, JANUARY 29

- 7:00 am–5:00 pm **Speakers' Lounge**, Palace I, Emperors Level
- 7:00 am–5:00 pm **Registration** and **ASHRAE Bookstore**, Palace I, Emperors Level
- 7:30 am–4:00 pm **ASHRAE Member Lounge**, Forum 14-16, and **Spouse Lounge**, Forum 17, Pool Level
- 8:00 am–4:45 pm **Technical Sessions**
See Technical Program on pages 43–80
- 8:00 am–5:00 pm **Committee Meetings**
See listing on pages 81–112
- 9:00 am–1:30 pm General Tour: Hoover Dam
See description on page 29
- 9:00 am–9:30 am **Networking Coffee Break**
Outside of Augustus and Emperors Ballrooms, Emperors Level
- 9:00 am–2:00 pm **Student Program**, Milano I-IV, Promenade.
- 4:00 pm–6:00 pm **Young Engineers in ASHRAE (YEA)**
Hospitality Reception, Florentine III/IV, Promenade Level

Attention members age 35 and younger! You are invited to visit the YEA Hospitality Reception, offering social and networking opportunities. Light refreshments will be available.
See description on page 23

MONDAY, JANUARY 30

- 7:00 am–8:30 am **Women in ASHRAE Continental Breakfast**, Florentine III/IV, Promenade Level
See description on page 15
- 7:00 am–12:15 pm **Speakers' Lounge**, Palace I, Emperors Level
- 7:00 am–5:00 pm **Registration** and **ASHRAE Bookstore**, Palace I, Emperors Level
- 7:30 am–4:00 pm **ASHRAE Member Lounge**, Forum 14-16, and **Spouse Lounge**, Forum 17, Pool Level
- 8:00 am–12:00 pm **Technical Sessions**
See Technical Program on pages 43–80
- 9:30 am–11:00 am **ASHRAE Meet and Greet**, Florentine III/IV, Promenade Level.
See description on page 13
- 8:00 am–5:00 pm **Committee Meetings**
See listing on pages 81–112

10:00 am–6:00 pm **AHR Expo®**, Las Vegas Convention Center, 3150 Paradise Rd.

Free shuttle buses between the LVCC and Caesars are available and will run on 20 minute intervals from 7:00 a.m.–7:00 p.m. on Monday. See description on page 11

10:00 am–11:45 am **Student Congress**, Florentine II, Promenade Level

Special Event

12:15 pm–2:00 pm **President's Luncheon**, Palace III, Emperors Level
Doors open at 12:00 p.m.
Ticket required.

See description on page 15

1:30 pm–4:30 pm **Speakers' Lounge**, Palace I, Emperors Level

2:15 pm–5:00 pm **Technical Sessions**

See Technical Program on pages 43–80

2:30 pm–5:00 pm **General Tour:** Spring Preserves Archaeological History Tour.
Ticket required.

Technical Tour: High Roller Central Plant and Observation Wheel.
Ticket required.

See descriptions on page 29–31

After 5:00 pm **Regional Dinners**
Sign up in ASHRAE registration area.

TUESDAY, JANUARY 31

7:00 am–5:00 pm **Speakers' Lounge**, Palace I, Emperors Level

7:30 am–4:00 pm **ASHRAE Member Lounge**, Forum 14-16, and **Spouse Lounge**, Forum 17, Pool Level

7:30 am–4:30 pm **Registration** and **ASHRAE Bookstore**, Palace I, Emperors Level

8:00 am–4:45 pm **Technical Sessions**
See Technical Program on pages 43–80

8:00 am–5:00 pm **Committee Meetings**
See listing on pages 81–112

8:45 am–12:15 pm **General Tour:** El Segundo Sol Cooking Demonstration. *Ticket required.*

9:00 am–2:30 pm **General Tour:** Quirky Las Vegas City Tour. *Ticket required.*
See descriptions on page 30

10:00 am–6:00 pm **AHR Expo®**, Orange County Convention Center, 9800 International Blvd.

Free shuttle buses between the LVCC and Caesars are available and will run on 20 minute intervals from 8:00 a.m. – 7:00 p.m. on Tuesday. See description on page 11

- 12:00 pm–1:30 pm **Life Members' Lunch**, Pompeian I, Promenade Level. *Ticket required. See description on page 15*
- 1:00 pm–5:30 pm **General Tour**: Wayne Newton's Casa De Shenandoah. *Ticket Required.*
- 1:30 pm–2:30 pm **Technical Tour**: MGM CityCenter and Central Plant. *Ticket Required.*
- 1:45 pm–2:45 pm **Technical Tour**: Caesars Palace Central Plant. *Ticket Required.*
- 2:45 pm–3:45 pm **Technical Tour**: MGM CityCenter and Central Plant. *Ticket Required.*
- 4:00 pm–5:00pm **Technical Tour**: MGM CityCenter and Central Plant. *Ticket Required. See descriptions on page 30–31*

Special Event

- 6:15 pm–7:15 pm **Reception**, Palace III Foyer, Emperors Level
- 7:30 pm–10:30 pm **Members' Night Out**, Palace III, Emperors Level. *Ticket Required. See description on page 15*

WEDNESDAY, FEBRUARY 1

- 7:00 am–1:00 pm **Speakers' Lounge**, Palace I, Emperors Level
- 7:30 am–11:00 am **Registration**, Palace I, Emperors Level
- 7:30 am–1:00 pm **ASHRAE Bookstore**, Palace I, Emperors Level
- 7:30 am–1:00 pm **ASHRAE Member Lounge**, Forum 14-16, and **Spouse Lounge**, Forum 17, Pool Level
- 8:00 am–12:30 pm **Technical Sessions**
See Technical Program on pages 43–80
- 8:00 am–5:00 pm **Committee Meetings**
See listing on pages 81–112
- 10:00 am–4:00 pm **AHR Expo®**, Las Vegas Convention Center, 9800 International Blvd.

Free shuttle buses between the LVCC and Caesars are available and will run on 20 minute intervals from 8:00 a.m. – 6:00 p.m. on Wednesday. See description on page 11

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. Tour tickets may be purchased at the ASHRAE registration desk, Palace I on the Emperors Level of the Conference Center at Caesars Palace.

All tours depart from the Caesars Palace Tour Lobby entrance located in the Forum Casino between the Colosseum Gift Store and Fizz Lounge. This area is adjacent from the Caesars Palace Food Court.

GENERAL TOURS

Hoover Dam Tour

Sunday, January 29

9 a.m.–1:30 p.m.

\$70

Hoover Dam towers above the Colorado River on one side and Lake Mead on the other. Enjoy an up close and personal tour of this man-made wonder of the modern world. Your tour is escorted by a knowledgeable tour guide who will, en route to Hoover Dam, discuss the Las Vegas area in detail. Tour includes a video presentation of "How the West was Won," elevator ride to the Power Plant Generators, and a visit to the exhibit halls and observation deck. It is recommended that you wear comfortable clothes and dress for the weather. Cameras, purses, and small-size backpacks are permitted. All carry-in possessions will be scanned due to security reasons.

Spring Preserves Archaeological History Tour

Monday, January 30

2:30–5 p.m.

\$60

The Springs Preserve is a 180-acre non-gaming cultural and historical attraction designed to commemorate Las Vegas' dynamic history and to provide a vision for a sustainable future. Known as the birthplace of Las Vegas, the site of the Preserve was once home to bubbling springs that were a source of water for Native Americans living here thousands of years ago. This tour highlights archaeological and historical elements found at the Springs Preserve. The archaeology history tour will include a visit to the ORIGEN Experience and a short tour of the trails. This tour involves walking. Participants are encouraged to wear comfortable shoes and dress for the weather.

El Segundo Sol Cooking Demonstration

Tuesday, January 31

8:45 a.m.–12:15 p.m.

\$145 (includes lunch and two alcoholic beverages)

Learn how to cook alongside El Segundo Sol Chef Terry Lynch. Make Nachos with Crab and Poblano, Coconut and Mango Helado and Sizzlin' Shrimp and Carne Fajitas with Oaxacan Black Beans. Once you've learned those recipes, get your own hands dirty as you learn to make El Segundo Sol's world famous guacamole. Upon completion of the class you will enjoy lunch with your colleagues and sample margaritas and Sangria. Tour includes lunch and two alcoholic beverages per person. Lunch includes Paloma with fresh grapefruit & mint, Watermelon-Tomato Salad with guajillo dressing Tacos with house made Chorizo and roasted poblano Fresh Farmers Market Strawberry Margarita Bunuelos with Blackberry & Mango. Participants must wear closed toe shoes for this activity, due to food preparation.

Quirky Las Vegas City Tour

Tuesday, January 31

9 a.m.–2:30 p.m.

\$125

Get a look at the other side of Las Vegas! Tour Highlights include a stop at the art instillation: Seven Magic Mountains, a photo op at the Welcome to Las Vegas sign, game time at the Pinball Hall of Fame, shopping at the World's Largest Gift Shop, and tasting gourmet hotdogs at Haute Doggery with dessert at Sprinkles Cupcakes. Lastly, take a ride on the High Roller observation wheel. This tour involves walking in some locations. Participants are encouraged to wear comfortable shoes and dress for the weather.

Wayne Newton's Casa De Shenandoah

Tuesday, January 31

1–5:30 p.m.

\$90

Wayne Newtown, "Mr. Las Vegas," will open up the gilded gates of his home. Casa de Shenandoah features 52 lush acres of landscaping, natural artesian ponds, waterfalls, freely roaming peacocks, swans, geese, and a variety of exotic birds. Tour includes an introductory video, a visit to the museum area, viewing of the equestrian area and exotic animal collection plus a tour of the interior first level of Wayne Newton's Mansion.

TECHNICAL TOURS

High Roller Central Plant and Observation Wheel

Monday, January 30

2:30–5 p.m.

\$30

First, the tour will guide guests through the 6,000-ton Central Plant, which serves the High Roller, the Linq Promenade, and The Linq Hotel. Next, guests will see the world's largest Observation Wheel which measures 520 feet in diameter. Facing north and south parallel to Las Vegas Boulevard, the wheel takes 30 minutes to complete one full revolution and features broad views of Las Vegas and the Strip.

MGM CityCenter and Central Plant

Tuesday, January 31

1:30–2:30 p.m. AND

2:45–3:45 p.m. AND

4:00–5:00 p.m.

\$30

This will be a tour of the MGM CityCenter central plant, which serves Aria, Veer Towers, Vdara, Mandarin, Monte Carlo, New York New York, and the new T-Mobile Arena. The plant can generate up to 35,000 tons of cooling and utilizes cogeneration to create its own electricity from waste heat.

CityCenter generates its own electricity on site. A state-of-the-art central power plant uses natural gas to create electricity, then captures emitted heat before it enters the atmosphere to meet the domestic hot water needs of all buildings and pools in the complex. This highly efficient cogeneration plant reduces the energy that would otherwise be used by boilers to heat water.

Caesars Palace Central Plant

Tuesday, January 31

1:45 – 2:45 p.m.

\$30

As famous as Las Vegas itself, Caesars Palace is the best-known casino resort in the world. What began as a grand casino honoring the indulgent luxuries of ancient Rome has somehow evolved into something even more spectacular. Take a look behind the scenes with a tour led by the Caesars Palace engineering team. Tour the Central Plant and view the cooling towers, pumps, and chillers as well and a back-of-house view of the primary air handlers and control systems. Attendees will meet in the Registration area in Palace I on the Emperors level 15 minutes before the tour starts.

FUTURE ASHRAE CONFERENCES

Winter	Date	Annual
Las Vegas January 28–February 1	2017	Long Beach June 24–28
Chicago January 20–24	2018	Houston June 23–27
Atlanta January 12–16	2019	Kansas City June 22–26

PAST ASHRAE MEETINGS

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

Las Vegas *Sustainability Project*

The sustainability footprint program was launched by the Salt Lake City Host Committee at the 2008 Annual Conference and encourages members to examine ways to get more involved in their local communities. The goals of the program are to leave a legacy representing ASHRAE's commitment to sustainability and to offset the environmental impact from holding the Conference. It is now customary for the Conference host city to select a project with some funding provided by ASHRAE as seed money.

For the 2017 Winter Conference project, the Southern Nevada Chapter has chosen to aid the Culinary Academy of Las Vegas. The Culinary Academy of Las Vegas is dedicated to reducing poverty and eliminating unemployment by providing employability and vocational skills to youth, adults and displaced workers as a non-profit organization. This project will examine energy efficiency measures by providing the academy with a local utility sanctioned ASHRAE level 2 energy audit and implementing several energy conservation measures. As part of the project, the intention is to provide several new technology upgrades to analyze their impact on the facility and provide standard improvements the facility requires.

After undergoing the preliminary stage of the ASHRAE level 2 energy audit on the existing building, the project team made recommendations to make this facility run efficiently and give the owner the most effective sustainability project possible.

Take a moment to stop by and thank the Las Vegas Host Committee for their efforts. More information about the Culinary Institute can be found here: www.theculinaryacademy.org.



www.theculinaryacademy.org. HOW HOSPITALITY WORKS

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
- 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 www.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 ID, please go to www.ashrae.org and click on the Log In tab at the top of the page. Next, click on "Need a Login?" to request an ID and PIN. You may also use that link if you already have an ASHRAE ID as a non-member.

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.

HOW AND WHY TO JOIN AN ASHRAE PROJECT COMMITTEE

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 on 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:

- Submit a PC Application for Membership to ASHRAE staff at Standards.Section@ashrae.org
- Submit a Bias/Conflict of Interest Statement to ASHRAE staff
- Update or complete an ASHRAE Bio online

After you correctly submit all necessary paperwork:

- 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 www.ashrae.org/standards.

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.

FULL-DAY PROFESSIONAL DEVELOPMENT SEMINARS

Registration fees: \$510 per course; \$415 for ASHRAE members. Completion of each seminar earns 6 PDHs/ AIA LUs or .6 CEUs (*check with your state for their continuing education credit requirements*)

SATURDAY, JANUARY 28, 2017

Cogeneration from the Basics through Operation (code 60)

8:00 a.m.–3:00 p.m., Caesars Palace Las Vegas,

Room: Roman I



This combined heat and power (CHP) survey seminar provides a broad overview of the cogeneration systems from concepts, to improving operational performance and efficiencies. Review the different prime movers, appropriate applications, and the use of thermal equipment. Conducting a CHP feasibility study, the engineering design process (including basic CHP system design), required permitting efforts, and construction efforts are also covered.

Instructor: Lucas Hyman, P.E., Member ASHRAE, BEAP, LEED® AP

Energy Modeling Best Practices and Applications (code 61)

(Co-sponsored by IBPSA-USA)

8:00 a.m.–3:00 p.m., Caesars Palace Las Vegas,

Room: Roman II

Learn how to integrate energy modeling into the design process from the programming stage through post-occupancy and measurement and verification. Modeling principles and tips related to the building envelope, plug loads, lighting systems, and HVAC systems are explained.

Instructors: Joseph Deringer, AIA., Member ASHRAE, LEED® AP; and Samuel Mason, P.E., Member ASHRAE, BEMP, LEED® AP BD+C

Commissioning Process in New & Existing Buildings (code 62)

8:00 a.m.–3:00 p.m., Caesars Palace Las Vegas,

Room: Roman III

Learn how the application of the commissioning process in existing facilities differs from new construction. The seminar covers the benefits of commissioning, the reduction of environmental impact, and the improvement of design and construction quality. Take away compelling information that demonstrate the value of investing in the commissioning process.

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

TUESDAY, JANUARY 31, 2017

Complying with Standard 90.1-2016 (code 75)

9:00 a.m.–4:00 p.m., Las Vegas Convention Center,
Room: N262



The 2016 update to Standard 90.1 is a major revision containing more than 125 changes for the 2013 version. Learn the technical changes to the prescriptive requirements of building envelope, requirements for exterior and interior lighting, energy cost budget (ECB), modeling, mechanical requirements for chilled water plant metering, DOAS and elevator efficiency.

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

Complying with the Requirements of Standard 62.1-2016 (code 76)

9:00 a.m.–4:00 p.m., Las Vegas Convention Center,
Room: N264



Review the requirements of the 2016 standard with emphasis on the practical application of the standard to modern VAV systems. New requirements to the Indoor Air Quality Procedure for determining minimum ventilation rates are covered. In the 2016 version, changes were made in determining air class for laboratory exhaust systems, and the use of sensors for demand control ventilation. Sample calculations for code review and for physical operation using the latest ASHRAE spreadsheet

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

HALF-DAY SHORT COURSES

Registration fees: \$184 per course; \$139 for ASHRAE members. Completion of each course earns 3 PDHs/ AIA LUs or .3 CEUs (*check with your state for their continuing education credit requirements*)

SUNDAY, JANUARY 29, 2017

Laboratory Design: The Basic and Beyond (code 63)

3:30 p.m.–6:30 p.m., Las Vegas Convention Center,
Room: N258

Learn the essential elements of the design process that are unique to laboratory HVAC systems. The course evaluates planning, risk assessment, 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.

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

New ASHRAE-Classified Refrigerants to Meet Society's Changing Needs (code 64)



3:30 p.m.–6:30 p.m., Las Vegas Convention Center,

Room: N260

Understand how the changing needs of society are creating requirements for new refrigerants to be developed and used, and the new safety classifications that are being proposed and some of the ramifications of these new classifications.

Instructor: Thomas Leck, Ph.D., P.E., Member ASHRAE

Understanding & Designing Dedicated Outdoor Air Systems (DOAS) (code 65)

3:30 p.m.–6:30 p.m., Las Vegas Convention Center,

Room: N262

Discover the advantages of separate dedicated outdoor air systems (DOAS) and the disadvantages of delivering the ventilation via single all-air variable air volume (VAV) systems. Review the inherent problems with the energy saving potential of the top HVAC technologies and the engineering design score sheet for a DOAS project.

Instructor: Stanley Mumma, Ph.D., P.E., Fellow/Life Member ASHRAE

Variable Refrigerant Flow System: Design & Application (code 66)



3:30 p.m.–6:30 p.m., Las Vegas Convention Center,

Room: N264

Based on the *2012 ASHRAE HVAC Systems and Equipment Handbook*, the course provides a comprehensive system design application guidance using building specific scenarios. Learn non-manufacturer specific concepts of how to apply VRF systems to buildings.

Instructor: Dermot McMorrow, P.Eng., Member ASHRAE

MONDAY, JANUARY 30, 2017

Air-to-Air Energy Recovery Applications: Best Practices (code 67)

8:30 a.m.–11:30 a.m., Las Vegas Convention Center,

Room: N258

Review real-world examples of where and how air-to-air energy recovery technologies are integrated into some of the most common commercially available systems. Best practices for mechanical design, exchanger selection and control strategies are discussed.

Instructor: Paul Pieper, P.Eng., Member ASHRAE

Designing Toward Net-Zero Energy Commercial Buildings (code 68)

8:30 a.m.–11:30 a.m., Las Vegas Convention Center,

Room: N260

Gain knowledge of the design and operating principles for energy efficient buildings and available technologies and

systems to achieve net-zero energy building design. Building design strategies, review of current policy and regulation, energy efficiency in HVAC, lighting and appliances and on-site renewable energy sources are reviewed.

Instructor: Frank Mills, C.Eng., Member ASHRAE

Energy Management Best Practices (code 69)

8:30 a.m.–11:30 a.m., Las Vegas Convention Center,

Room: N262

Sustained energy management is the quickest, cheapest and cleanest way to expand our world's energy supplies and reduce greenhouse gas emissions. This course weaves together energy management principles of the ASHRAE *Handbook – HVAC Applications*, Energy Star guidelines and practical experience of successful energy managers.

Instructor: Richard Pearson, P.E., Fellow/Life Member ASHRAE

High-Performance Building Design: Applications & Future Trends (code 70)

8:30 a.m.–11:30 a.m., Las Vegas Convention Center,

Room: N264

Learn the applications of new technologies and design concepts to achieve the goal of high-performance buildings, including net-zero or nearly net-zero energy buildings. Discuss the future trends toward high-performance buildings across the globe, and summarize how ASHRAE Standards address them.

Instructor: Tom Lawrence, Ph.D., P.E., Member ASHRAE, LEED® AP

Complying with Standard 90.1-2016 Appendix G (code 71)

2:45 p.m.–5:45 p.m., Las Vegas Convention Center,

Room: N258

Based on ASHRAE *Standard 90.1-2016*, learn the new Appendix G performance path for compliance without meeting the prescriptive requirements of the Standard. Focus is placed on the importance of the recent changes in the lighting and envelope requirements and how they reduce loads on the HVAC systems and on overall energy use. Topics include the significant new mandatory requirements for air barriers and daylighting.

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

Design of Affordable and Efficient Ground Source Heat Pump Systems (code 72)

2:45 p.m.–5:45 p.m., Las Vegas Convention Center,

Room: N260

Examine the economic analysis of ground source vs. more traditional systems and what is necessary to design an effective and efficient ground source systems. Energy



analysis, equipment selection, drilling technologies, testing requirements, hydronic system design and system controls are covered.

Instructor: Steve Kavanaugh, Ph.D., Member ASHRAE

Fundamentals and Application of Standard 55 (code 73)

2:45 p.m.–5:45 p.m., Las Vegas Convention Center,

Room: N262

Based on ANSI/ASHRAE Standard 55, *Thermal Environmental Conditions for Human Occupancy*, this course covers the theory and principles of the standard. It is intended to bridge the gap between the design practitioner's knowledge of the built environment and its thermal relationship to the occupant's physiology and psychology. Using examples, the course illustrates how to achieve compliance with the standard for the purposes of satisfying the requirements of various building performance programs such as LEED®.

Instructors: Peter Alspach, P.E., Member ASHRAE, LEED® AP; Robert Bean, R.E.T., Member ASHRAE and Lawrence Schoen, P.E., Fellow ASHRAE

Successfully Managing the Risk of Legionellosis Using ASHRAE Standard 188-2015 (code 74)

2:45 p.m.–5:45 p.m., Las Vegas Convention Center,

Room: N264

Learn the environmental conditions that promote the growth of Legionella in water systems and the locations where Legionella control measures can be applied in new and existing buildings. A comparison between general compliance and compliance for certain health care facilities are provided. The course focuses on the compliance with Standard 188-2015 to provide a safer and healthier building environment.

Instructors: Michael Patton, P.E., Member ASHRAE and Richard Pearson, P.E., Member ASHRAE

TUESDAY, JANUARY 31, 2017

IT Equipment Design Evolution & Data Center Operation Optimization (code 77)

9:00 a.m.–12:00 p.m., Las Vegas Convention Center,

Room: N258

Learn the ever changing IT equipment and its impact on data center operating condition. Discover the many variables, drivers, methods and processes that facilitate energy efficient data center design and operations, as well as how to plan for future data center needs.

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

ASHRAE Guideline 0: The Commissioning Process (code 78)

9:00 a.m.–12:00 p.m., Las Vegas Convention Center,
Room: N260

Much confusion and misinterpretation exists today about the commissioning process. To alleviate this situation, this course describes the fundamentals of the code-language process of *Standard 202-2013, Commissioning Process for Buildings and Systems*. Learn the ASHRAE commissioning process intent, deliverables and activities. This course complements ASHRAE's *Guideline 0-2003* course, which describes the characteristics and expectations of an ideal commissioning process.

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

Designing High-Performance Healthcare HVAC Systems (code 79)

1:00 p.m.–4:00 p.m., Las Vegas Convention Center,
Room: N258

Discuss in detail the interactions of the key elements of high performance in healthcare, infection control, comfort, reliability, safety, maintenance, energy and sustainability. Numerous energy conservation strategies are discussed in the context of achieving all the goals of a high performing hospital.

Instructor: Daniel Koenigshofer, P.E., Member ASHRAE, HFDP

notes

ASHRAE WINTER CONFERENCE TECHNICAL PROGRAM

Las Vegas – January 2017

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:

Conference Paper Sessions. These sessions present papers 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. PowerPoint presentations with audio descriptions of the presentations are posted online in the Virtual Conference. Preprints of conference papers and an online papers collection are available for purchase in the ASHRAE Bookstore.

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. For a permanent record of the seminar presentations, the Seminar DVD will be available. Orders can be taken in the ASHRAE Bookstore.

Poster Session. Papers presented in this session result from research on fundamental concepts and basic theory. Poster sessions allow attendees to speak directly to authors for further clarification of their data as well as for discussion of pertinent information that may not appear in the written paper.

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 forums.

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.

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.



2017 ASHRAE Winter Conference Papers (online) – \$79



Conference Seminars DVD – \$119



Conference Preprints (individual papers, in print) – \$6 each



ASHRAE Transactions (Print Volume) – \$79



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



GBCI LEED AP CE Credits

Packages: Purchase in the Conference Bookstore

1. 2017 ASHRAE Winter Conference – Papers (online) and Seminars DVD; \$149
2. 2017 ASHRAE Winter Conference – Papers (online) and ASHRAE Transactions; \$124
3. Complete Winter Conference Content Package (2017 ASHRAE Winter Conference – Papers (online), Seminars DVD, and ASHRAE Transactions); \$174

All prices are special conference-only prices.

Sunday, January 29

8:00 AM – 9:00 AM

Conference Paper Session 1 (Intermediate)

Advancements in Ground Source Heat Pump Design

Room: Emperors II

1. The Potential for Integration of Ground Energy from Underground Railway Tunnels (LV-17-C001)

Akos Revesz, London South Bank University, London, United Kingdom

2. Analysis of Heat Source Water Supply Network Between Two Buildings Utilizing Ground Heat and Exhaust Heat (LV-17-C002)

Eikichi Ono, M.D.¹, Katsuhiko Miura, Ph.D., Member¹, Naoyoshi Ichikawa¹, Tomohiro Teranishi¹, Taro Ohno¹ and Takeshi Wada¹, (1) Kajima Technical Research Institute, Tokyo, Japan

3. Metering Measurement Challenges and Monitoring of a Large Scale Ground Source Heat Pump System (LV-17-C003)

Metkel Yebiyo¹, Graeme Maidment, Ph.D., P.E.¹, Paurine Alex, Ph.D.¹ and Tony Day, Ph.D.², (1) London South Bank University, London, United Kingdom, (2) International Energy Research Centre, Cork, United Kingdom



Sunday, January 29

8:00 AM – 9:00 AM

Seminar 1 (Intermediate)

Updating Scientific Evidence about the Effects of Low Humidity on People



Room: Augustus III/IV

1. RP-1630, “Update the Scientific Evidence for Specifying Lower Limit Relative Humidity Levels for Comfort, Health and IEQ in Occupied Spaces”

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

2. 40 Is the New 20, Balanced Air-Hydration for Health!

Stephanie Taylor, M.D., Healthcare Acquired Infections Organization, Boston, MA

3. Limiting Criteria for Human Exposure to Low Humidity

Pawel Wargocki, Technical University of Denmark, Kongens Lyngby, Denmark

8:00 AM – 9:00 AM

Forum 1 (Basic)

10 Minute Opportunities for Industrial Refrigeration Efficiency Improvement

Room: Roman I

8:00 AM – 9:00 AM

Workshop 1 (Basic)

ASHRAE’s New Duct Size Calculator Tool: Where It Came From and How to Use It



Room: Augustus I/II

1. Research Background for ASHRAE’s New Duct Calculator Tool

Charles Culp, Ph.D., Fellow ASHRAE, Texas A&M University, College Station, TX

2. Demonstration of ASHRAE’s New Duct Design Tool

Chris Van Rite, M&M Manufacturing Co, Fort Worth, TX

8:00 AM – 9:00 AM

Workshop 2 (Advanced)

Optimization of Direct AC Systems with Low GWP Refrigerants

Room: Augustus V/VI

1. Study on Properties of Low GWP Refrigerants

Osami Kataoka, Member, Daikin Industries, Ltd., Osaka, Japan

2. Analysis of Test Results on Low GWP Refrigerants

Reinhard Radermacher, Ph.D., Fellow ASHRAE, University of Maryland, College Park, MD

8:00 AM – 9:00 AM

Workshop 3 (Intermediate)

Sitting Around Collecting Dust: Evaluating Industrial Dust Collector Performance



Room: Roman III

1. Standard 199: Ashes to Ashes, Dust to Dust?

Bruce McDonald, P.Eng., Member, Consultant, Minneapolis, MN

2. Dusting Off Some Research: From RP-1284 to Standard 199 Test Results

Bob Burkhead, Blue Heaven Technologies, Louisville, KY

Tech Program

8:00 AM – 9:00 AM

Workshop 4 (Basic)

What Is Renewable Energy?

Room: Roman II



1. PV Systems Cannot Be Attached to the Grid and Other Renewable Energy Myths

Paul A. Torcellini, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

2. The Role of Biomass in a Renewable Energy Future

Zia Haq, U.S. Department of Energy, Washington, DC

8:00 AM – 9:00 AM

Workshop 5 (Intermediate)

What Should Be in a New Applications Handbook Chapter Covering Semi-Conductor and Nano-Technology Facilities

Room: Emperors I



1. Safety Aspects of Semi-Conductor Facilities

Deep Ghosh, Member, Southern Co., Atlanta, GA

2. Beyond Supply and Exhaust: What Else Should We be Concerned with in Semi-Conductor Facilities?

Michael Connor, P.E., Member, Connor Engineering Solutions, Alpharetta, GA

9:45 AM – 10:45 AM

Conference Paper Session 2 (Advanced)

Modern Optimization Techniques for Hydronic Systems in Data Centers

Room: Emperors I



1. Energy and Water Environmental Trade-Offs of Data Center Cooling Technologies (LV-17-C004)

Sophia Flucker, CEng¹, Beth Whitehead, Ph.D.¹, Robert Tozer, Ph.D., Member¹ and Deborah Andrews, Ph.D.², (1)Operational Intelligence Ltd., Kingston upon Thames, United Kingdom, (2)London South Bank University, London, United Kingdom

2. Thermosyphon Cooler Hybrid System for Water Savings in an Energy-Efficient HPC Data Center: Modeling and Installation (LV-17-C005)

Thomas Carter, P.E., Member¹, David Sickinger, Associate Member², Zan Liu, Ph.D., Associate Member¹, Kevin Regimbal² and David Martinez³, (1)Johnson Controls, Waynesboro, PA, (2)National Renewable Energy Laboratory, Golden, CO, (3)Sandia National Laboratory, Albuquerque, NM

3. Case Study: Using Simulation Techniques to Optimize Migrations in an Existing Mission Critical Data Center (LV-17-C006)

Christian Pastrana, P.E., Member, Citigroup, New York, NY

9:45 AM – 10:45 AM

Seminar 2 (Basic)

ASHRAE Conference Crash Course

Room: Augustus V/VI



1. The Ins and Outs of ASHRAE

Chris Gray, Ph.D., P.E., Member, Georgia Power Company, Columbus, GA

2. Make the Most of Your Conference Experience

Frank Rivera, P.E., Mechanical Heating Supply, Bronx, NY

9:45 AM – 10:45 AM

Seminar 3 (Basic)

Hydronic Water Flow Measurement

Room: Roman I



- 1. Hydronic Water Flow Measurement: Part 1**
Hooman Daneshmand, P.E., Member, Valve Engineer, Dallas, TX
- 2. Submetering By Using Pumps**
Niels Bidstrup, Ph.D., Member, Grundfos Management A/S, Bjerringbro, Denmark, Bjerringbro, Denmark

9:45 AM – 10:45 AM

Seminar 4 (Intermediate)

Indoor Air Quality and Desiccants

Room: Augustus I/II



- 1. Indoor Air Quality and Liquid Desiccant Dehumidification**
Patrick Leach, Member, Alfa Laval Kathabar, Buffalo, NY
- 2. Field Operation of a Liquid-Desiccant DX Air Conditioner for High Latent Applications**
Andrew Lowenstein, Ph.D., Member, AIL Research, Hopewell, NJ
- 3. Field Test Results of an Air Conditioner with Liquid Desiccant Heat Exchangers**
Eric Kozubal, Member, National Renewable Energy Laboratory, Golden, CO

9:45 AM – 10:45 AM

Seminar 5 (Basic)

**Blue Is the New Green:
What Is the Water-Energy Nexus?**

Room: Roman II



- 1. Thirst for Power: Energy, Water and Human Survival**
Michael Webber, Ph.D., Member, University of Texas, Austin, TX
- 2. Bringing It Home: Overview of the Building Scale Water Energy Nexus**
Calina Ferraro, P.E., Associate Member, Randall Lamb Associates, Inc., La Mesa, CA

9:45 AM – 10:45 AM

Seminar 6 (Intermediate)

Recent Action in Evaporative Cooling

Room: Augustus III/IV



- 1. Does Evaporative Cooling Make Sense in an Arid Climate?**
Nasim Tajmand, Ph.D., Associate Member, UC Davis, Davis, CA
- 2. Proposed ASHRAE Standard 212: Testing the Performance of Evaporative Pre-Coolers**
Jay Madden, P.E., Associate Member, Southern California Edison, Rosemead, CA
- 3. Performance of Indirect Evaporative and Hybrid Cooling Equipment: Findings from Laboratory and Field Testing**
Jonathan Woolley, Member, UC Berkeley Center for the Built Environment, Berkeley, CA
- 4. R-718 to the Rescue**
James Falconer, Member, Affiliated Engineers, San Francisco, CA

9:45 AM – 10:45 AM

Seminar 7 (Intermediate)

Designing for the Future – Planning Today’s Buildings for Tomorrow’s Policies



Room: Roman III

- 1. The Hospital of the Future: Building with Flexibility in Mind**
Daniel Farrow, Palomar Health, San Diego, CA
- 2. Planning for Climate Change Policies at the University of San Diego**
Melissa Plaskonos, University of San Diego, San Diego, CA

11:00 AM – 12:30 PM

Conference Paper Session 3 (Intermediate)

Health Care Design for IAQ Focusing on Pathogen Minimization



Room: Emperors II

- 1. Restoring Acceptable HVAC Performance with Ultra Violet Germicidal Irradiation Coil Treatment (LV-17-C007)**
Timothy Leach¹ and Graham Taylor, P.E.², (1)Steril-Aire, Burbank, CA, (2)Steril-Aire, Inc., Burbank, CA
- 2. Analysis of Airflow Distribution and Contaminant Flow Path in a Hospital Operating Room (LV-17-C008)**
Kishor Khankari, Ph.D., Fellow ASHRAE, AnSight LLC, Ann Arbor, MI
- 3. Proposed Outdoor Air Ventilation Rationale for Health Care Facilities (LV-17-C009)**
Travis R. English, P.E., Member¹, Maya Salabasheva, P.E., Member¹, Heather Platt², Abdel Darwich, P.E., HFDP, Member³ and Erica Stewart, Member⁴, (1)Kaiser Permanente, Oakland, CA, (2)Seneca Construction Management, (3)Guttman & Blaevoet, Sacramento, CA, (4)Kaiser Permanente National EH&S, Pasadena, CA
- 4. Comprehensive Design of a Laminar Flow Newborn Incubator (LV-17-C010)**
M. Zeki Yilmazoglu, Ph.D.¹ and Atilla Biyikoglu, Ph.D., Member¹, (1)Gazi University, Ankara, Turkey

11:00 AM – 12:30 PM

Conference Paper Session 4 (Intermediate)

Improving Energy Exchange in HVAC&R



Room: Emperors I

- 1. Environmental Parameters for Decontamination Room in Sterile Processing Department in U.S. Hospitals (LV-17-C011)**
Maya Salabasheva, P.E., Member¹, Travis R. English, P.E., Member¹ and Erica Stewart, Member², (1)Kaiser Permanente, Oakland, CA, (2)Kaiser Permanente National EH&S, Pasadena, CA
- 2. Sensitivity of Energy and Exergy Performances of Heating and Cooling Systems to Auxiliary Components (LV-17-C012)**
Ongun B. Kazanci, Student Member¹, Masanori Shukuya, Ph.D.² and Bjarne W. Olesen, Ph.D., Fellow ASHRAE³, (1)Technical University of Denmark, Kongens Lyngby, Denmark, (2)Tokyo City University, Tokyo, Japan, (3)Technical University of Denmark, Kgs. Lyngby, Denmark
- 3. Heat Recovery from Industrial Flue Gases with Varied Humidity Ratios Using Liquid Desiccant Technology (LV-17-C013)**
Zhenying Wang¹, Zhen Li¹ and Xiaoyue Zhang¹, (1)Tsinghua university, Beijing, China

Tech Program

Sunday, January 29

4. Metropolitan Integrated Cooling and Heating (LV-17-C014)

Graeme Maidment, Ph.D., P.E.¹, **Nicholas Boot-Handford²**, **Joseph Grice³** and **Gareth F. Davies, Ph.D.¹**, (1)London South Bank University, London, United Kingdom, (2)Transport for London, London, United Kingdom, (3)Islington Council, London, United Kingdom

5. Women in the Refrigeration Industry (LV-17-C015)

Didier Coulomb, London South Bank University, London, United Kingdom

11:00 AM – 12:30 PM

Seminar 8 (Intermediate)

Blue Is the New Green: The Water-Energy “Next Is”?

Room: Roman I

1. Air Cooled vs Water Cooled Chillers

Fred Betz, Ph.D., Member, Affiliated Engineers, Inc., Madison, WI

2. Direct and Indirect Evaporative Cooling Technologies

Ransom Hamrick, P.E., Member, Randall Lamb Associates, Inc., La Mesa, CA

3. Aiming for Net Zero: Onsite Water Treatment Systems

Charles Upshaw, Student Member, University of Texas at Austin, Austin, TX

4. Water Re-Use Options and Opportunities

William J. Worthen Jr., AIA, Urban Fabrick, San Francisco, CA



11:00 AM – 12:30 PM

Seminar 9 (Intermediate)

Fire Safety Operations in Commercial Kitchens

Room: Augustus III/IV

1. The Increasing Fire Risk from Solid Fuel Cooking

Doug Horton, D.J. Horton and Associates, Batavia, IL

2. Kitchen Exhaust Duct Fire Safety: Concerns and Solutions

Michael Morgan, Associate Member, Captive Aire Systems, Inc., Allentown, PA

3. Inspection and Maintenance Operations for Kitchen Exhaust Fire Safety

Bernard Basel, Member, Besal Services, Inc, Atlanta, GA



11:00 AM – 12:30 PM

Seminar 10 (Intermediate)

Performance of Chilled Water Pipe Insulation Systems in Humid Environments: Problems, Solutions, ASHRAE Research and the Use of Hygrothermal Analyses

Room: Roman II

1. Controlling Mold Growth on Chilled Water Pipe Insulation

Ed Light, Member, Building Dynamics, LLC, Ashton, MD

2. Air Conditioned Football Stadium and Convention Center Chilled Water Pipe Insulation Assemblies Failure and Remediation with New Developed Insulation Systems

Willis J. “Bill” Brayman, Brayman Insulation Consultants, Sterrett, AL

3. Recent ASHRAE Research on Thermal Conductivity of Pipe Insulation Systems Working at Below-Ambient Temperature and in Wet Condensing Conditions with Moisture Ingress

Lorenzo Cremaschi, Ph.D., Member, Auburn University, Auburn, AL

4. Hygrothermal Analyses of Four Different Chilled Water Pipe Insulation Systems in a Hot and Humid Climate



Gordon Hart, P.E., Member¹ and **Christian Bludau, Dr.Ing.²**, (1)Artek Engineering, LLC, Shrewsbury, MA, (2)Fraunhofer Institute for Building Physics, Valley, Germany

11:00 AM – 12:30 PM

Seminar 11 (Intermediate)

The Current State-of-the-Art for an Automated Pathway from BIM Building Models Direct to HVAC Heating/Cooling Load Calculations

Room: Augustus V/VI



- 1. Defining the Baseline for BIM Loads Comparison**
Steve Bruning, P.E., Fellow ASHRAE, Newcomb & Boyd, Atlanta, GA
- 2. Heating and Cooling Load Calculations from BIM Using Autodesk Insight 360**
Krishnan Gowri, Ph.D., Member, Autodesk, Bothell, WA
- 3. Performing Load Calculations in Aecosim Energy Simulator Using a gbXML File Exported from Revit**
Don Shirey, Member, Bentley Systems Inc., Titusville, FL
- 4. The Process of Using gbXML to Export the ASHRAE HQ Revit Model to Trace to Perform HVAC Load Calculations**
Stephen Roth, P.E., Member, Carmel Software Corp., San Rafael, CA

11:00 AM – 12:30 PM

Seminar 12 (Basic)

Variable Speed Drives and Chillers – Back to Basics

Room: Augustus I/II

- 1. Variable Speed Drive Basics**
Terry Davies, Danfoss, Jacksonville, FL
- 2. Variable Speed Screw Chiller Basics**
Robert Feduik, Carrier, Syracuse, NY
- 3. Variable Speed Centrifugal Chiller Basics**
Jeb Schreiber, JCI, York, PA

11:00 AM – 12:30 PM

Seminar 13 (Intermediate)

Yes, It Is Your Fault: How Faults Affect Your System's Performance and How to Model the Faults' Effects in Advance

Room: Roman III



- 1. Effect of Heat Pump Commissioning Faults on Annual Energy Use**
Piotr Domanski, Ph.D., Fellow ASHRAE, National Institute of Standards and Technology, Gaithersburg, MD
- 2. Modeling the Effect of Vapor Compression Cycle Faults Using Gray-Box Models**
Alireza Behfar, Student Member, University of Nebraska-Lincoln, Omaha, NE
- 3. Effect of Economizer Faults on Expected Whole-Building Energy Savings**
Brianna Brass, Associate Member, Davis Design, Lincoln, NE
- 4. Generalized Models of Fault Effects on Air Conditioners in Heating and Cooling Mode**
Mehdi Mehrabi, Student Member, University of Nebraska, Omaha, NE

Tech Program

Sunday, January 29

1:00 PM – 2:00 PM

Forum SSPC (Intermediate)

What Challenges Do You Face in Using the IAQ Procedure?

Room: Forum 20

1:00 PM – 2:00 PM

Forum TC

Should ASHRAE Develop a Net Zero Energy Building Standard?

Room: Forum 11

1:30 PM – 3:00 PM

Conference Paper Session 5 (Intermediate)

Designing Energy Efficient Buildings Can Save Money and Provide Better Comfort

Room: Emperors II



1. Thermal Insulation System for Energy Efficient and Green Buildings (LV-17-C016)

Krishna Kumar Mitra, Fellow ASHRAE¹ and Ashish Rakheja, P.E., Member², (1)Lloyd Insulations (India) Limited, New Delhi, India, (2) AEON Integrated Building Design Consultants LLP, Noida, India

2. Experimental Investigation of Potential Energy Savings and Payback Ratio in Renewing Old Split-Type Air Conditioners (LV-17-C017)

Abdullah Alabdulkarem, Ph.D., Member¹, Zeyad Almutairi, Ph.D.¹, Turki Al-Qahtani², Majed AlShahrani² and Khaled AlAwaad², (1)King Saud University, Riyadh, Saudi Arabia, (2)Saudi Standard, Metrology and Quality Organization (SASO), Riyadh, Saudi Arabia

3. Development of a Hardware-in-the-Loop Framework with Modelica for Energy Efficient Buildings (LV-17-C018)

Zheng O'Neill, Ph.D., P.E., Member¹ and Aaron Henry, Student Member¹, (1)University of Alabama, Tuscaloosa, AL

4. Energy Saving with Comfort Guarantee in Hospitality Buildings (LV-17-C019)

Kyung Jae Kim, Ph.D.¹, Hye-Jung Cho, Ph.D.¹, Kwanwoo Song, M.D.², Gunhyuk Park, P.Eng.¹, Dae-eun Yi, M.D.¹, Jungil Seo, P.Eng.², Sangsun Choi, M.D.¹, HyunSuk Min, M.D.¹, Ki Uhn Ahn³ and Cheol-Soo PARK, Ph.D.³, (1)Samsung Electronics, Seoul, South Korea, (2)Samsung Electronics, Suwon, South Korea, (3)SungKyunKwan University, Suwon, Korea, Republic of

5. Best Practices and Lessons Learned in Churches: How Energy Use and Efficiency in Religious Facilities Compares to Other Types of Commercial Buildings (LV-17-C020)

Trevor Terrill¹ and Bryan Rasmussen¹, (1)Texas A&M University, College Station, TX

1:30 PM – 3:00 PM

Conference Paper Session 6 (Intermediate)

Energy Efficient Design for Buildings with an Industrial Focus

Room: Emperors I



1. Performance Assessment of Fanger's PMV in a UK Residential Building in Heating Season (LV-17-C021)

Mahroo Eftekhari, Ph.D., Member¹, Faisal Durrani, Ph.D.², Safwan Samsuddin² and Yoshitaka Uno, CEng³, (1)Loughborough University, Loughborough, United Kingdom, (2)School of Civil & Building Engineering, Loughborough university, Loughborough, United Kingdom, (3)Mitsubishi Electric R&D Centre Europe BV, Livingston, United Kingdom

2. Integrating Energy Efficiency Performance in Processes for the Dairy Industry (LV-17-C022)

Oliver Koenigseder, Associate Member, K2E Koenigseder Energy Engineering, Krefeld, Germany

3. An Application of Energy Conservation Measures to a Middle-Sized Factory Using Energy Management System (LV-17-C023)

Tomohiro Konda¹, Chosei Kaseda¹, Kyoshiro Oto², Nobuyuki Minami³ and Koji Maeda³, (1)Azbil Corporation, Fujisawa, Japan, (2)Azbil Corporation, Hiroshima, Japan, (3)Azbil Kimmon Wakayama Co., Ltd., Gobo, Japan

4. Energy Efficiency in Buildings Inside Oil Refineries (LV-17-C024)

Abdel Darwich, P.E., HFDP, Member, Guttman & Blaevoet, Sacramento, CA

1:30 PM – 3:00 PM

Seminar 14 (Intermediate)

Data Driven Energy Auditing, Measurement and Verification

Room: Augustus III/IV



1. Using Analytics Platforms to Continuously Evaluate Buildings and Drive Persistent Savings

Ryan Hoest, P.E., BEAP, Member, EcoVox, Inc, San Luis Obispo, CA

2. A Smart Data Center Energy Expert System for Automatic Measurement, Energy Audit and Energy Efficiency Improvement

Wenli Yu, BEAP¹ and Liangcai Tan, Ph.D., P.E., BEAP and HBPD, Member², (1)Archimedes Controls Corp, Palo Alto, CA, (2)HDR Architecture Inc, San Francisco, CA

3. Using Advanced Energy Management System for Automatic Energy Audit in China

Hui Li, Ph.D., P.E., BEAP, Member, Shenzhen Secom Tech. Ltd, China, Shenzhen, China

1:30 PM – 3:00 PM

Seminar 15 (Intermediate)

Do the Users Follow the Model?

Room: Roman I



1. Modelling, Measuring and Evaluating Laboratory Energy Efficiency Performance

Gordon Sharp, Member, Aircuity Inc, Newton, MA

2. Wind Response Exhaust Fan Control Case Study

Brad Cochran, P.E., Member, C P P Inc, Fort Collins, CO

3. Energy Model vs. Actual Performance Case Study

Kelley Cramm, P.E., Member, Henderson Engineers, Overland Park, KS

1:30 PM – 3:00 PM

Seminar 16 (Intermediate)

Heat Exchanger Corrosion: Fundamentals to Application

Room: Augustus V/VI



1. Corrosion Mechanisms in All Aluminum Microchannel and Round Tube Plate Fin Heat Exchangers

Seifollah Nasrazadani, University of North Texas, Denton, TX

2. Multifunctional Nanostructured Water Repellent and Anti-Corrosion Coatings

Panos Dastkos, Oak Ridge National Laboratory, Oak Ridge, TN

3. Aluminum Round Tube Applications and Corrosion Resistance Mechanisms

Vikas Somani, Brazeway, Adrian, MI

Tech Program

Sunday, January 29

4. Fundamental Alloying, Processing and Field Application Considerations for Aluminum HVAC&R Heat Exchangers

David Ellerbrock, Sapa, Rockledge, FL

1:30 PM – 3:00 PM

Seminar 17 (Intermediate)

Energy Management: A Crucial Component of Operations and Maintenance

Room: Augustus I/II



1. The OMMP Annual Program and the Impact on Energy Conservation

Terrence Rollins, RHC Global Energy Solutions, Corpus Christi, TX

2. Energy Management in Operations and Maintenance

David Norvell, P.E., Member, University of Central Florida, Orlando, FL

3. Energy and Resources Conservation through O&M

Mohammad Baig, Member, President of ASHRAE NPC, Islamabad, Pakistan

1:30 PM – 3:00 PM

Seminar 18 (Intermediate)

Thermally Driven Devices Are Heating Up: Emerging International Field Studies and Standards for Residential Fuel-Fired Sorption Heat Pumps

Room: Roman II



1. Practical Experience of Field Testing Residential and Light Commercial Gas Absorption Heat Pumps

Axel Albers, Dr.Ing., Bosch Thermotechnik GmbH, Wernau, Germany

2. Field Testing of Residential Gas Absorption Storage Water Heaters

Paul Glanville, P.E., Associate Member, Gas Technology Institute, Des Plaines, IL

3. Existing and Emerging International Standards for Evaluation of Fuel-Fired Sorption Heat Pumps

Ivan Malenkovic, Dr.Ing., Fraunhofer Institute for Solar Energy Systems, Freiburg, Germany

4. Multi-Laboratory Round-Robin Testing of Commercialized Sorption Heat Pumps for Residential Space Heating

Patrizia Melograno, Ph.D., Politecnico di Milano, Milan, Italy

3:00 PM – 6:00 PM

Seminar TC (Basic)

A Better Writer is a Better Engineer: TC 7.3 O&M Management Perspective on Good Communication

Room: Augustus V/VI

3:15 PM – 4:45 PM

Seminar 19 (Intermediate)**Walking the Walk: Delivering a Truly High Performance Building**

Room: Augustus I/II

**1. Architect and Engineer: An Evolving Relationship Required for Synergy within Sustainable Design***Evan Jacob, AIA, Pfau Long Architecture, San Francisco, CA***2. HVAC Design Options: Navigating Owners and Architects through HVAC Systems to Provide Client Specific Solutions***Alyse Falconer, P.E., Member, Interface Engineering, San Francisco, CA***3. Commissioning: Why Designers, Owners and Operators Should Care***Michael Flemming, P.E., Associate Member, Interface Engineering, San Francisco, CA***4. Integrating Energy Analysis into Design: How to Ensure Predicted Energy Utilization Index Values Are Achieved***Anna Brannon, P.E., BEMP, Integral Group, San Francisco, CA***Monday, January 30**

8:00 AM – 9:30 AM

Conference Paper Session 7 (Advanced)**Advances in Building Simulation Tools**

Room: Emperors II

**1. General-Purpose Building Energy Simulation Program BEST for the Energy-Saving Standards in Japan (LV-17-C025)***Iwao Hasegawa, Associate Member¹, Shuzo Murakami, Ph.D., Fellow ASHRAE², Hisaya Ishino, Ph.D., Member³, Fumio Nohara¹, Hiroshi Ninomiya, Member¹ and Reika Iida¹, (1)Nikken Sekkei, Tokyo, Japan, (2)Institute for Building Environment and Energy Conservation, Tokyo, Japan, (3)Tokyo Metropolitan University, Tokyo, Japan***2. Development of Equipment Characteristics Databases of BEST Program (LV-17-C026)***Kohichi Shinagawa¹, Shuzo Murakami, Ph.D., Fellow ASHRAE², Hisaya Ishino, Ph.D., Member³, Takashi Yanai¹ and Yukihiro Kawazu, Ph.D.¹, (1)NIHON SEKKEI, INC., Tokyo, Japan, (2)Institute for Building Environment and Energy Conservation, Tokyo, Japan, (3)Tokyo Metropolitan University, Tokyo, Japan***3. Features and Capabilities of Integrated Building Energy Simulation Program Newly Developed in Japan, BEST (LV-17-C027)***Hisaya Ishino, Ph.D., Member¹, Shuzo Murakami, Ph.D., Fellow ASHRAE², Kimiko Kohri, Ph.D., Member³, Isao Makimura⁴ and Fumio Nohara⁵, (1)Tokyo Metropolitan University, Tokyo, Japan, (2)Institute for Building Environment and Energy Conservation, Tokyo, Japan, (3)Utsunomiya University, Utsunomiya, Japan, (4)Naguwashi E&TP Laboratory, Kawagoe, Japan, (5)Nikken Sekkei, Tokyo, Japan***4. Simulation Method of HVAC Systems Using Self-Adjusting Templates in the BEST (Building Energy Simulation Tool) (LV-17-C028)***Hiroshi Ninomiya, Member¹, Shuzo Murakami, Ph.D., Fellow ASHRAE², Hisaya Ishino, Ph.D., Member³, Tatsuo Nagai⁴, Fumio Nohara¹ and Iwao Hasegawa, Associate Member¹, (1)Nikken Sekkei, Tokyo, Japan, (2)Institute for Building Environment and Energy Conservation, Tokyo, Japan, (3)Tokyo Metropolitan University, Tokyo, Japan, (4)Tokyo University of Science, Tokyo, Japan*

5. Real Time Data Monitoring to Get Operations on Track (LV-17-C029)
*Celeste Cizik, P.E., Member¹ and Matt Cooper, P.E., Associate Member¹,
(1)Group14 Engineering, Inc., Denver, CO*

8:00 AM – 9:30 AM

Conference Paper Session 8 (Advanced)

Designing Hydronic Systems Using Energy and Water Conservation Practices

Room: Emperors I



1. Centrifugal Compressors in Air-Cooled Package Chillers: Coincidence of Market Forces and Technology (LV-17-C030)
Raymond Good Jr., P.E., Member, Danfoss Turbocor Compressors, Inc., Tallahassee, FL

2. A HEAT Pipe Indirect/Direct Evaporative Cooling/Humidification Design for Natatorium IAQ and Energy Savings, Too (LV-17-C031)
*Mike Scofield, P.E., Fellow Life Member¹ and Jeff Stein, P.E., Member²,
(1)Conservation Mechanical Systems, Sebastopol, CA, (2)Taylor Engineering, LLC, Alameda, CA*

3. Sustainability, Energy and Water: Air-Cooled Versus Water-Cooled Heat Rejection (LV-17-C032)
Omar Hawit, P.E., Member¹, Coral Pais¹ and Trevor Jaffe, P.E., Member¹, (1)Westlake Reed Leskosky, Washington, DC

4. Energy Cost of Architectural Screens Around a Cooling Tower (LV-17-C033)
Omer A. Qureshi, Student Member¹ and P.R. Armstrong, Ph.D., Member¹, (1)Masdar Institute of Science and Technology, Abu Dhabi, United Arab Emirates

5. Reuse of Ablution Water for Mosque Air Conditioning Using Indirect/Direct Evaporative Cooling Technology in Saudi Arabia (LV-17-C034)
Kostas Vatopoulos¹, Ayman Youssef, P.E., Member¹ and Adel Hamid, Member¹, (1)Saudi Aramco, Dhahran, Saudi Arabia

8:00 AM – 9:30 AM

Conference Paper Session 9 (Intermediate)

Optimizing Energy and Water Efficiency in Buildings

Room: Roman II



1. Performance Based Outcomes: A Case Study on the Stone 34 Project (LV-17-C035)
Michael Frank, P.E., Associate Member, McKinstry Company, Seattle, WA

2. Results from 20 Field Monitoring Projects on Rack and Flight Conveyor Dishwashers in Commercial Kitchens (LV-17-C036)
Rodney Davis¹, Amin Delagah, Associate Member¹, Michael Slater¹ and Angelo Karas¹, (1)Fisher Nickel Inc., San Ramon, CA

3. The Effects of the Green Walls on Building Energy Use and Rainwater Management (LV-17-C038)
Shaojie Yuan, Student Member¹ and Donghyun Rim, Ph.D., Associate Member¹, (1)Pennsylvania State University, University Park, PA

8:00 AM – 9:30 AM

Seminar 20 (Basic)

Fresh Insights on Building Automation: A Seminar by the YEA Group



Room: Roman I

1. Emerging Smart Building Automation Technologies and Barriers to Implementation

Chris Perry, Member, American Council for an Energy Efficient Economy, Washington, DC

2. Customizing Energy Dashboard Performance Goals Using Predictive Modeling, Historical Data Analysis and Energy-Conservative Logic

Alex Scambos, Member, Randall Lamb Associates, Inc., La Mesa, CA

3. Successful Functional Testing Methods for Building Automation Systems

Israa Ajam, Member, Sebesta, Arlington, VA

8:00 AM – 9:30 AM

Seminar 21 (Basic)

Low Energy LED Lighting Heat Gain Distribution in Buildings (ASHRAE RP-1681)



Room: Augustus I/II

1. Approach, Test Setup and LED Luminaire Selection for Testing LED Lighting Heat Gain Distribution

Ran Liu, Ph.D., Member, China Building Design Consultants, Beijing, China

2. Test Results of LED Lighting Heat Gain Distribution and Comparison to Conventional Lighting

Xiaohui Zhou, Ph.D., P.E., Member, Iowa Energy Center, Ankeny, IA

3. Field Application of LED Lighting Heat Gain Distribution Data

Steven Bruning, P.E., Fellow ASHRAE, Newcomb & Boyd, Atlanta, GA

8:00 AM – 9:30 AM

Seminar 22 (Intermediate)

The Past Present and Future of Combined Heat and Power Systems in Mission Critical Facilities



Room: Augustus III/IV

1. U.S. Department of Energy CHP for Resiliency Accelerator Progress Report

Richard Sweetser, Life Member, Exergy Partners Corp., Herndon, VA

2. Combined Heat and Power: A Robust, Efficient, Economical and Clean Solution for Critical Infrastructure, Microgrids and Resiliency

Burce Hedman, Dr.Eng., Entropy LLC, Alexandria, VA

3. Resilient CHP Design for Mission Critical Facilities while Minimizing the Impact on Energy and Water Usage

Gearoid Foley, Member, Integrated CHP Systems Corp., Princeton Junction, NJ

8:00 AM – 9:30 AM

Seminar 23 (Intermediate)

The Road to Zero Energy Buildings Goes Through Energy Indices: What's Fair and How Do We Get There?



Room: Augustus V/VI

1. An O&M Index Can Help Address EUI Limitations

David Goldstein, Natural Resources Defense Council, San Francisco, CA

Tech Program

Monday, January 30

2. Developing EUI Adjustment Factors for Benchmarking Airport Terminal Buildings

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

3. ERI Adjustments for Standard 90.2 and Other Residential Applications

Philip Fairey, Member, Florida Solar Energy Center, Cocoa, FL

8:00 AM – 9:30 AM

Seminar 24 (Basic)

When Buildings Get Wet...What Does That Mean?

Room: Roman III



1. New Fundamentals Chapter: Moisture and Buildings – What about Vapor Sources?

Hugo Hens, Ph.D., Fellow ASHRAE, University of Leuven (KU Leuven), Leuven, Belgium

2. New Chapter 62 of Applications Volume: Moisture Management from the School of Hard Knocks

Lew Harriman, Member IAQA, Mason-Grant Consulting, Portsmouth, NH

3. New ASHRAE Guidance for Moisture Management in Buildings

Carl Grimes, Hayward Healthy Home, Monterey, CA

9:45 AM – 10:45 AM

Conference Paper Session 10 (Intermediate)

Climate and Its Effect on HVAC System Performance

Room: Emperors I



1. Energy Demands for Commercial Buildings with Climate Variability and Associated Air Quality Impacts (LV-17-C039)

Carlo Bianchi, Student Member¹, Amanda D. Smith, Ph.D., Associate Member¹, Richard Didier, Student Member¹, Daniel Mendoza, Ph.D.¹ and Tho Dinh “Thomas” Tran¹, (1)University of Utah, Salt Lake City, UT

2. Measured Thermal Comfort and Sensation in Highly Transient Environments (LV-17-C040)

Erin Eckels¹, Steven Eckels, Ph.D., Member¹, Meredith Schlabach, Student Member¹ and Michael Young, Ph.D.¹, (1)Kansas State University, Manhattan, KS

3. Predicting Micro Cogeneration and Envelope Performance in Future Climates (LV-17-C041)

Ryan Milcarek, Student Member¹, Jeongmin Ahn, Ph.D.¹, Jianshun Zhang, Ph.D., Fellow ASHRAE¹, Shaun Turner¹ and Rui Zhang¹, (1) Syracuse University, Syracuse, NY

9:45 AM – 10:45 AM

Conference Paper Session 11 (Intermediate)

Impact of VOCs and Organics on Ventilation System Design

Room: Augustus V/VI



1. Can Using Active UV-C Technology Reduce the Amount of Bacteria and/or Fungus in the Air and Improve Indoor Air Quality? (LV-17-C042)

Linda D. Lee, Ph.D., Member, American Green Technology, South Bend, IN

2. Effects of Air Flow Rates on VOC Removal Performances of Oxidation-Based Air Cleaning Technologies (LV-17-C044)

Chang-Seo Lee, Ph.D., Associate Member¹, Fariborz Haghighat, Ph.D., P.E., Fellow ASHRAE¹ and Ali Bahloul, Ph.D.², (1)Concordia University, Montreal, QC, Canada, (2)IRSST, Montreal, QC, Canada

9:45 AM – 10:45 AM

Seminar 25 (Intermediate)**Wire-to-Air Fan Power Performance and Energy Consumption**

Room: Roman I

**1. Standardizing Fan System Energy Calculation**

Michael Brendel, Ph.D., Member¹ and Helmuth Glatt, P.E.¹, (1)Lau Industries, Dayton, OH

2. Measurement of Fan Component Efficiency

Tim Mathson, Member, Greenheck Fan Corporation, Schofield, WI

9:45 AM – 10:45 AM

Seminar 26 (Basic)**Small Stuff, Big Problems: Origins and Exposures to Nanoparticles**

Room: Roman II

**1. Airborne Nanoparticles in Residential Environments**

Andrew Persily, Ph.D., Member, National Institute of Standards and Technology, Gaithersburg, MD

2. Exposure Pathways for Nanomaterials from the Indoor Environment

Patricia Fritz, Member, New York State Department of Health, Albany, NY

9:45 AM – 10:45 AM

Seminar 27 (Intermediate)**Specifying IoT, Cyber Security and Advanced BAS Sequences and Applications: The Future of Guideline 13**

Room: Augustus I/II

**1. Advanced Control Sequences**

Mark Hydeman, P.E., Fellow ASHRAE, Consultant, San Francisco, CA

2. Fault Detection and Diagnostics

Grant Wichenko, P.Eng., Member, Appin Associates, Winnipeg, MB, Canada

3. Cyber Security

Ron Bernstein, Member, RBCG, LLC, Encinitas, CA

9:45 AM – 10:45 AM

Seminar 28 (Basic)**When Good Valve Sizing Goes Bad**

Room: Augustus III/IV

**1. Basics of Hydronic Control Valve Sizing**

Tricia Bruenn, Member, Belimo Aircontrols USA, Danbury, CT

2. Hydronic Valve Sizing: Behind the Curtain

James Del Monaco, P.E., Member, P2S Engineering, Long Beach, CA

9:45 AM – 10:45 AM

Seminar 29 (Intermediate)**Zero Net-Energy Buildings: Modeled Predictions and Outcomes**

Room: Roman III

**1. ZNE Feasibility and Issues By Building Type and Climate**

Charles Eley, P.E., BEMP, Member, Eley Consulting, San Francisco, CA

2. Comparing Outcomes to Modeling Results

Mark Frankel, AIA, Affiliate, New Buildings Institute, White Salmon, WA

9:45 AM – 10:45 AM

Workshop 6 (Basic)

Food Cold Chain for Developing Countries



Room: *Emperors II*

1. International Policy to Build a Sustainable Cold Chain in Developing Countries

Didier J. Coulomb, Dr. Ing., Member, IIR, Paris, France

2. Refrigeration Industries Projects in Developing Countries

Jon Shaw, CEng, Member, Carrier, Washington, DC

11:00 AM – 12:00 PM

Panel

Fifty Shades of Hydronic Balancing: The His, Hers and Theirs of Flow Control

Room: *Augustus V/VI*

1. Panelist 1 – Mike Trantham, IMI Flow Design, Dallas, TX

2. Panelist 2 – Calina Ferraro, P.E., Associate Member,
Randall Lamb Associates, Inc., La Mesa, CA

3. Panelist 3 – Steven Babin, Emerson Swan, Inc., Randolph, MA

11:00 AM – 12:00 PM

Conference Paper Session 12 (Intermediate)

IAQ in the Airline Industry



Room: *Emperors I*

1. Measurement and Exposure of Airline Staff to Tri-Cresyl Phosphates from Engine Oil (LV-17-C045)

Hans de Ree¹, Huub Agterberg¹, John Havermans², Jan Bos² and Marc Houtzager², (1)KLM Royal Dutch Airlines, Schiphol, Netherlands, (2)TNO, Utrecht, Netherlands

2. The Nature of Particulates in Aircraft Bleed Air Resulting from Oil Contamination (LV-17-C046)

Byron Jones, Ph.D., P.E., Fellow ASHRAE¹, Shahin Nayyeri Amiri, Ph.D.¹, Jake Roth² and Mohammad Hosni, Ph.D., Fellow ASHRAE¹, (1)Kansas State University, Manhattan, KS, (2)Black & Veatch, Overland Park, KS

3. Experimental Determination of the Characteristics of Lubricating Oil Contamination in Bleed Air (LV-17-C047)

David Space, Member¹, Kurt Matthews¹, John Takacs¹, Peter Umino¹, Anil Salgar¹, Jake Roth², Shahin Nayyeri Amiri, Ph.D.³ and Byron Jones, Ph.D., P.E., Fellow ASHRAE³, (1)Boeing, Everett, WA, (2)Black & Veatch, Overland Park, KS, (3)Kansas State University, Manhattan, KS

11:00 AM – 12:00 PM

Conference Paper Session 13 (Intermediate)

Solar Effectiveness from Roofs to Cooling Panels

Room: *Roman I*



1. Field Measurements of Solar Reflectivity for In-Service Single Ply Roof Membranes (LV-17-C048)

Mathew Dupuis, Ph.D., P.E., SRI, Middleton, WI

2. Parametric Analysis of the Control System of Solar Panels for Nocturnal Radiative Cooling Coupled with PCM Ceiling Panels (LV-17-C049)

Eleftherios Bourdakis, Student Member¹, Ongun B. Kazanci, Student Member¹, Thibault Q. Péan¹ and Bjarne W. Olesen, Ph.D., Fellow ASHRAE¹, (1)Technical University of Denmark, Kongens Lyngby, Denmark

3. Comparative Performance Evaluation of Transparent and Opaque BIPV/T Collectors: Roof and Façade Integration (LV-17-C050)

Raghad Kamel, Ph.D., Member¹, Alan S. Fung, P.Eng., Member¹, Navid Ekrami, Student Member¹ and Kaammran Raahemifar¹, (1)Ryerson University, Toronto, ON, Canada

11:00 AM – 12:00 PM

Seminar 30 (Basic)

Electronic Project and Document Management: An Introduction and ASHRAE's System

Room: Augustus III/IV



1. Basecamp Fundamentals

Cynthia Callaway, P2S Engineering Inc, Long Beach, CA

2. ASHRAE Authoring Portal

Mark Owen, Member, ASHRAE, Atlanta, GA

11:00 AM – 12:00 PM

Seminar 31 (Intermediate)

Ref Cooling Water-Saturation Indices: Understanding the Water Balance When Designing and Operating a HVAC System

Room: Roman II



1. Should Your Water be Used As Delivered? Softened? Blended Back? RO? or What? If Blended Back, How Much?

Jeff Boldt, P.E., HBDP, Member, KJWW Engineering Consultants, Madison, WI

2. How Water Treatment Programs Utilize Saturation Indices to Reduce Water Consumption and Protect System Equipment: A Case Study

Joshua Ince, P.Eng., Member, Eldon Water Inc, West Chester, OH

11:00 AM – 12:00 PM

Seminar 32 (Intermediate)

What Fire and Safety Engineers Have Learned Since the MGM Grand Fire in Las Vegas and What Are Present Day Fire and Life Safety Codes and Applications

Room: Roman III



1. The MGM Grand Fire and What Was Learned

John Klote, P.E., Fellow ASHRAE, John Klote Fire and Smoke Consulting, Leesburg, VA

2. What Are the Latest Fire and Life Safety Codes and Regulations for Buildings, Especially Tall, Supertall and Mega-tall Buildings?

Matt Davy, P.E., Member, Buildings and Systems Analytics, Marina Del Rey, CA

11:00 AM – 12:00 PM

Forum 2 (Intermediate)

Identifying a Minimum List of Contaminants of Concern for Utilizing the IAQ Procedure of Standard 62.1

Room: Augustus I/II

11:00 AM – 12:00 PM

Workshop 7 (Intermediate)

Key Impacts of ASHRAE Standards on Waterside Construction and Design



Room: Emperors II

1. Key Impacts of ASHRAE Standards on Waterside Construction and Design

Chris Edmonson, Member, ASHRAE, Greensboro, NC

2. Impact of ASHRAE Standards on Piping Systems

James Fields, Member, Superior Mechanical Services, Inc., Greensboro, NC

2:15 PM – 3:45 PM

Poster Session

Posters



Room: Augustus V/VI

Presentation of ASHRAE Technical Papers by Poster.

ASHRAE Conference Badge Required.

Accounting for Non-Quadratic Behavior of AHU Systems in Determination of Air Flow Rate (LV-17-001)

Mikhail Nudelman¹, Ed Kernerman² and Nicholas Muscolino¹, (1)Aero Building Solutions, Franklin Park, IL, (2)Novosibirsk State Architecture and Construction University, Novosibirsk, Russian Federation

Analysis of Refrigeration and HVAC Impacts on Supermarket Energy Performance (RP-1467) (LV-17-002)

Michael Brandemuehl¹ and Penelope Cole, Member², (1)University of Colorado, Boulder, CO, (2)MKK Consulting Engineers, Inc., Greenwood Village, CO

BIM-Enabled Operations and Maintenance Work Processes (RP-1609) (LV-17-003)

Robert Hitchcock, Ph.D., Member¹, John Butterfield², Elizabeth Ford-Wilkins² and Francisco Forn-Samsó³, (1)Hitchcock Consulting, Kelsey, CA, (2)Hallam ICS, South Burlington, VT, (3)Granlund Oy, Helsinki, Finland

Comparison of Approaches to Deep Energy Retrofit of Buildings with Low and High Internal Loads and Ventilation Requirements (LV-17-004)

Michael Case, Ph.D., Associate Member¹, Alexander M. Zhivov, Ph.D., Member¹, Donald Fisher, P.Eng., Life Member² and Richard Liesen, Ph.D.³, (1)US Army Corps of Engineers, Champaign, IL, (2)Fisher Consultants, Danville, CA, (3)US Army Corps of Engineers, Newark, OH

Deep Energy Retrofit of Presidio Army Barracks (LV-17-005)

Jay Tulley¹, Alexander M. Zhivov, Ph.D., Member², Brian Clark³, Matt Jungclaus, Affiliate⁴, Cara Carmichael⁴, Chris McClurg⁴, Margaret Simmons⁵, Randall Smidt⁶, Kinga Hydras, Member⁷, Sharon Conger⁷, Fred Winter⁷, John Shonder⁸ and Cyrus Nasseri⁹, (1)U.S. Army Garrison, Monterey, CA, (2)US Army Corps of Engineers, Champaign, IL, (3) Engineer Research and Development Center, Construction Engineering Research Laboratory, Champaign, IL, (4)Rocky Mountain Institute, Boulder, CO, (5)U.S. Army Engineering & Support Center, Huntsville, AL, (6)HQ Department of the U.S. Army, Washington D.C., (7)U.S. General Services Administration, Washington, DC, (8)U.S. Department of Energy Sustainability, Washington D.C., (9)US Department of Energy, Washington, DC

Deep Energy Retrofits in Federal Buildings: The Value, Funding Models and Best Practices (LV-17-006)

Matthew Junglaus¹, Margaret Simmons², Randall Smidt³, Cara Carmichael¹, Chris McClurg¹, Alexander M. Zhivov, Ph.D., Member¹, Kinga Porst² and John Shonder⁶, (1)Rocky Mountain Institute, Boulder, CO, (2)U.S. Army Engineering & Support Center, Huntsville, AL, (3)HQ Department of the U.S. Army, Washington D.C., (4)US Army Corps of Engineers, Champaign, IL, (5)Federal High Performance Green Buildings, Washington D.C., (6)U.S. Department of Energy Sustainability, Washington D.C.

Determination of Heat Transfer Coefficient between Heated Floor and Space Using the Principles of ANSI/ASHRAE Standard 138 Test Chamber (LV-17-007)

M. Fatih Evren¹, Abuzer Ozsunar², Atilla Biyikoglu, Ph.D., Member² and Birol Kilkis, Ph.D., Fellow ASHRAE³, (1)Hezarfen Energy Co., Istanbul, Turkey, (2)Gazi University, Ankara, Turkey, (3)Baskent University, Ankara, Turkey

Determination of Solar Heat Gain Coefficient for Semi-Transparent Photovoltaic Windows: An Experimental Methodology (LV-17-008)

Konstantinos Kapsis, Student Member¹ and Andreas K. Athienitis, Ph.D., P.E., Member¹, (1)Concordia University – BCEE, Montreal, QC, Canada

Development of Heat Transfer Model for Ceiling Radiant Cooling Panel through Combined Experimental and Simulation Study (LV-17-009)

Yasin Khan, P.E.¹, Jyotirmay Mathur, Dr.Eng., Member¹, Mahabir Bhandari, Ph.D., Member², Vivek Kumar¹ and Prateek Srivastava¹, (1) Malaviya National Institute of Technology, Jaipur, India, (2)Oak Ridge National Laboratory, Oak Ridge, TN

Diurnal and Seasonal Experimental Performance of a Liquid Desiccant Solar Regenerator (LV-17-010)

Gezahegn Habtamu Tafesse¹, S.C. Mullick² and Sanjeev Jain, Ph.D., Member³, (1)IIT Delhi, New Delhi, India, (2)Indian Institute of Technology Delhi, New Delhi, India, (3)Indian Institute of Technology Delhi, Hauz Khas, New Delhi 110016, New Delhi, India

Effect of Supply Air Temperature on Air Distribution in a Room with Radiant Heating and Mechanical Ventilation (LV-17-011)

Xiaozhou Wu¹, Lei Fang², Bjarne W. Olesen, Ph.D., Fellow ASHRAE², Jianing Zhao³ and Fenghao Wang¹, (1)Xi'an Jiaotong University, China, (2)Technical University of Denmark, Lyngby, Denmark, (3)Harbin Institute of Technology, Heilongjiang, China

Energy Analysis of a LEED Silver Certified Dining Hall on an Academic Campus: A Revisit Three Years after Its Initial Certification (LV-17-012)

Michael M. Ohadi, Ph.D., Fellow ASHRAE¹, Stefan Bangerth, Student Member¹ and Chauncey Jenkins¹, (1)University of Maryland, College Park, MD

Energy Solution for Laboratory Facilities (LV-17-013)

Lawrence R. Meisenzahl, Vortex Hoods, LLC, New Castle, DE

Evaluation of Alternative Refrigerants for Mini-Split Air Conditioners (LV-17-014)

Som Shrestha, Ph.D., BEMP, Member¹ and Omar Abdelaziz, Ph.D., Member¹, (1)Oak Ridge National Laboratory, Oak Ridge, TN

Experimental Comparison of Energy Optimal Coordinated Control Strategies for Heat Pump Systems (LV-17-015)

Chao Wang, Student Member¹, Bryan Rasmussen¹ and Kyaw Wynn², (1)Texas A&M University, College Station, TX, (2)Emerson Climate Technologies, Sidney, OH

Experimental Measurement of Frosting Limits in Cross-Flow Air-to-Air Energy Exchangers (LV-17-016)

Mohammad Rafati Nasr, Student Member¹ and Carey Simonson, Ph.D., P.E., Member¹, (1)University of Saskatchewan, Saskatoon, SK, Canada

Implementation of Advanced DER EPC Business Models in Dormitories in Mannheim/Germany (LV-17-017)

Ruediger Lohse, P.Eng., Leiter Contracting, Karlsruhe, Baden-Württemberg, Germany

Infiltration and Heating Load Analysis of an Apartment with Respect to Window Type, Window Location and Lock Operation (LV-17-018)

Young Il Kim¹, Jong Jun Park¹ and Kwang-Seop Chung¹, (1)Seoul National University of Science and Technology, Seoul, Korea, Republic of

In-Situ Fan Curve Calibration for Virtual Airflow Sensor Implementation in VAV Systems (LV-17-019)

Li Song, Ph.D., P.E.¹, Alejandro Rivas Prieto, Student Member¹, Wesley M. Thomas¹ and Gang Wang, Ph.D., P.E.², (1)University of Oklahoma, Norman, OK, (2)University of Miami, Coral Gables, FL

Measurement and Verification of Efficiency Upgrades in Chilled Water Systems (LV-17-020)

Abdul Qayyum Mohammed¹, Mohamed Tatari¹, Shawn Brown, Ph.D.¹ and John Seryak¹, (1)Go Sustainable Energy LLC, Columbus, OH

Minimizing Training Dataset for Neural Network Modeling of Finned-Tube Condenser (LV-17-021)

Chunlu Zhang¹, Ze-Yu Li¹ and Liang-Liang Shao¹, (1)Tongji University, Shanghai, China

Optimization Under Economic Uncertainty: Effect of Solar Variability on Energy and Economic Indicators (LV-17-022)

Scott Bucking, Ph.D., Member, Carleton University, Ottawa, ON, Canada

Portable Small Scale Multi Nozzle Volumetric Flow Meter with Exit Pressure Control (LV-17-023)

Young Il Kim¹, Sang Taek Oh¹ and Kwang-Seop Chung¹, (1)Seoul National University of Science and Technology, Seoul, Korea, Republic of

Potential of U-Shaped Heat Pipe Heat Exchanger in Tropical Climates for Low Sensible Heat Ratio (LV-17-024)

Amit Sharma, Ph.D.¹, Sanjeev Jain, Ph.D.², S C Kaushik, Ph.D.³ and Amit Kakkar⁴, (1)Deenbandhu Chhotu Ram University of Science and Technology, Murthal, Sonapat, Haryana-131039, India, Sonipat, India, (2)Indian Institute of Technology, New Delhi, India, (3)Indian Institute of Technology Delhi, Hauz Khas, New Delhi-110016, India, New Delhi, India, (4)Rajasthan Public Works Department, Jaipur, Rajasthan, India, Jaipur, India

Reducing the Need for Electrical Storage by Coupling Solar PVs and Precooling in Three Residential Building Types in the Phoenix Climate (LV-17-025)

Reza Arababadi, Student Member¹ and Kristen Parrish, Ph.D.¹, (1)Arizona State University, Tempe, AZ

Sequencing Control of Parallel Pumps in Variable Flow Systems Using Wire-to-Water Efficiency (LV-17-026)

Gang Wang, Ph.D., P.E.¹ and Xuejing Zheng², (1)University of Miami, Coral Gables, FL, (2)Tianjin University, Tianjin, China

Wireless Heating Management System and Tenant Usage Behavior in Bulk-Metered Apartment Buildings: A Case Study (LV-17-028)

Zixiao Shi¹, William O'Brien, Ph.D.¹, Daniel Dicaire² and Yitian Hu¹, (1)Carleton University, Ottawa, ON, Canada, (2)Ottawa Community Housing Corporation, Ottawa, ON, Canada

Tuesday, January 31

8:00 AM – 9:30 AM

Conference Paper Session 14 (Advanced)

Optimizing Energy and Ventilation in Residential Applications

Room: Emperors II



1. Building Impacts of Code Compliant Ventilation in Multi-Family Dwellings (LV-17-C051)

Jesse Fisher, P.E., Member, WB Engineers + Consultants, Washington, DC

2. Life Cycle Cost Optimization of Residential Buildings (LV-17-C052)

Yeonjin Bae, Student Member¹ and Travis Horton, Ph.D., Member¹, (1)Purdue University, West Lafayette, IN

3. Investigation of Potential Energy Savings in Retrofitting a Residential Building at Riyadh's Weather Conditions (LV-17-C053)

Mohamad Alrished¹ and Abdullah Alabdulkarem, Ph.D., Member², (1) Center for Complex Engineering Systems at King Abdulaziz City for Science and Technology, Riyadh, Saudi Arabia, (2)King Saud University, Riyadh, Saudi Arabia

4. Real-World Assessment of Three Residential Variable Capacity Air Conditioners of Varying SEER (LV-17-C054)

Walter E. Hunt, Member¹, Sean Gouw, P.E., Associate Member² and Jerine Ahmed², (1)Electric Power Research Institute, Knoxville, TN, (2) Southern California Edison, Irwindale, CA

5. Comparison of Building Energy Simulation Models for Residential Homes (LV-17-C055)

Henry Liu, Associate Member¹ and A. S. (Ed) Cheng, Ph.D., P.E., Member¹, (1)San Francisco State University, San Francisco, CA

8:00 AM – 9:30 AM

Conference Paper Session 15 (Intermediate)

Ventilation Systems and Their Impact on IAQ and Energy

Room: Emperors I



1. Whole-Building Fault Detection: A Scalable Approach Using Spectral Methods (LV-17-C056)

Michael Georgescu, Ph.D., Member¹, Sophie Loire¹, Don Kasper¹ and Igor Mezic, Ph.D.², (1)Ecorithm, Inc., Santa Barbara, CA, (2)University of California, Santa Barbara, Santa Barbara, CA

2. Indoor Air Quality of Naturally Ventilated Buildings in a Roadside Environment (LV-17-C057)

Zheming Tong, Ph.D., Student Member, Harvard University, Cambridge, MA

3. Ductless Car Park Ventilation: Global Trends and Design Practices (LV-17-C058)

Troy Goldschmidt, Member, Greenheck, Schofield, WI

4. Lessons Learned of Applying Indoor Air Quality Procedure in Commercial Buildings (LV-17-C059)

Marwa Zaatari, Ph.D., Member, enVerid Systems, Boston, MA

5. Experimental Measurement of the Hydrodynamics and Thermal Behavior of Airflow in a "Flex-Duct" Air Distribution System (LV-17-C060)

Samad Gharehdaghi, Student Member¹ and Samir Moujaes, Ph.D., P.E., Member¹, (1)University of Nevada – Las Vegas, Las Vegas, NV

Tuesday, January 31

8:00 AM – 9:30 AM

Seminar 33 (Intermediate)

Considerations in Hydronic Heating System Design and Performance

Room: Augustus I/II



- 1. Considerations in Hydronic Heating Systems Design**
Lucas Wonnell, Harsco Industrial Patterson-Kelley, East Stroudsburg, PA
- 2. “Green” Water Treatment in a Multi-Metal System**
Dave Ritz, TGWT, Longueuil, QC, Canada
- 3. Special Gas Venting Systems Proper System Design for Category IV Appliances**
Michael L. Mommsen, Schebler Chimney Systems, Bettendorf, IA

8:00 AM – 9:30 AM

Seminar 34 (Basic)

Delivering Real Buildings That Meet High Performance Design Ambition

Room: Roman III



- 1. Towards Robust Building Design: A Systematic Approach to Mitigate Design Risk**
Bruno Lee, Ph.D., Associate Member, Concordia University, Montreal, QC, Canada
- 2. The Role of Building Information Modelling Data for Design and Post Design Purposes**
Brian J. Dargan, CEng, Member, BuroHappold Engineering, Los Angeles, CA
- 3. Reinventing the Professional Sports Arena**
Alastair MacGregor, CEng, AECOM, Los Angeles, CA
- 4. Design and Assessment Procedures to Produce Well-Performing Buildings**
John W. Field, CEng, Member, Native-Hue Energy Management, London, United Kingdom

8:00 AM – 9:30 AM

Seminar 35 (Intermediate)

Energy Efficiency Assessment in Industrial Facilities: Case Studies and Lessons

Room: Augustus V/VI



- 1. Identification and Trends of Most Frequent Savings Opportunities Found and Implemented in Energy Audits of Manufacturing Facilities**
Donald Colliver, Ph.D., P.E., Presidential Member, University of Kentucky, Lexington, AL
- 2. Leveraging Control Systems for Energy Savings in Industrial Facilities**
Bryan Rasmussen, Ph.D., P.E., Member, Texas A&M University, College Station, TX
- 3. A Guide to Environmentally Sustainable Manufacturing**
J. Kelly Kissock, Ph.D., P.E., Member, University of Dayton, Dayton, OH

8:00 AM – 9:30 AM

Seminar 36 (Advanced)

Modeling and Control of the Personal Micro-Environment

Room: Roman II



1. Personal Environment Conditioning with Minimum Exergy Loss
Shinsuke Kato, Dr.Ing., Fellow ASHRAE, University of Tokyo Institute of Industrial Science, Tokyo, Japan

2. Delivering Efficient Local Cooling/Heating Using a Micro Environmental Control System (μX)

Meng Kong, Student Member, Syracuse University, Syracuse, NY

3. Control of the Personal Micro-Environment

Arsen Melikov, Ph.D., Fellow ASHRAE, Technical University of Denmark, Kongens Lyngby, Denmark

4. The Role of Thermal Plume in Person-to-Person Contaminant Cross-Transmission

Xudong Yang, Ph.D., Fellow ASHRAE, Tsinghua University, Beijing, China

8:00 AM – 9:30 AM

Seminar 37 (Intermediate)

HVAC Maintenance: Using Field Test Data to Benchmark and Improve System Performance

Room: Roman I



1. Performance Perspective

Rob Falke, Member, National Comfort Institute, Avon Lake, OH

2. Utilities Perspective

Mel Johnson, DEO Consulting, Los Angeles, CA

3. Engineering Perspective

Ben Lipscomb, P.E., Associate Member, NCI, Sheffield Lake, OH

8:00 AM – 9:30 AM

Seminar 38 (Advanced)

The Impact of Uncertainty and Validation Quality on CFD Results

Room: Augustus III/IV



1. Uncertainty Qualification and Validation of a CFD Simulation of Surface Condensation

Duncan Phylfe, Alden Research Laboratory, Alden, MA

2. CFD Modeling Accuracy: Comparative Study of Airflow Around a Thermal Manikin

John Zhai, Ph.D., Member, University of Colorado, Boulder, CO

3. Impact of Grid on CFD Prediction for Industry Applications

Ran Duan, Beijing Tsinghua Tongheng Urban Planning & Design Institute, Beijing, China

9:45 AM – 11:00 AM

Seminar 39 (Intermediate)

Low-GWP Alternative Refrigerants and Their Applications: Part 1

Room: Augustus III/IV



1. Oil Retention of Lower GWP Refrigerants and Lubricant Mixtures and Its Effect on Heat Transfer and Pressure Drop in Microchannel Type Air Conditioning Evaporators

Lorenzo Cremaschi, Ph.D., Member, Auburn University, Auburn, AL

2. Miscibility of POE and PVE Oils with Low-GWP Refrigerant R-1234ze(E)

Man-Hoe Kim, Ph.D., Member, Kyungpook National University, Buk-gu, Daegu, South Korea

9:45 AM – 11:00 AM

Seminar 40 (Intermediate)

Addressing Information Incompatibilities in Building Performance Monitoring

Room: Roman I



1. Real-Time Energy Simulation for Whole Building Performance Monitoring

Zheng O'Neill, P.E., Member, University of Alabama, Dept of Mechanical Engineering, Tuscaloosa, AL

2. BEM-BAS Data Exchange

Robert Hitchcock, Ph.D., Member, Hitchcock Consulting, Kelsey, CA

3. BIM-Based Energy Model Calibration for Evaluating Building Retrofit Opportunities

Krishnan Gowri, Ph.D., Member, Autodesk, Bothell, WA

9:45 AM – 11:00 AM

Seminar 41 (Intermediate)

Saving Water (and Energy) with Solid Geothermal Design and Operation

Room: Augustus I/II



1. The Energy-Water Highway: Getting the Least Use from Evaporative Devices

Cary Smith, Member, Sound Geothermal Corp., Sandy, UT

2. Water Wizards and Water Wasters: Geothermal Exchange Replaces Cooling Towers

Jay Egg, Egg Geothermal, Kissimmee, FL

3. Managing Water in Las Vegas: Keeping the Cats Clean and Cool

Jerry Zupancic, Cashman Equipment, Henderson, NV

9:45 AM – 11:00 AM

Seminar 42 (Intermediate)

Power and Cooling Considerations for Back of Rack Ecosystems within the Data Center

Room: Augustus V/VI



1. Rack Level Power Solutions and Its Associated Challenges and Deployment Best Practices

Jon Fitch, Ph.D., Dell Inc, Round Rock, TX

2. Top of Rack Networking Solutions and Its Associated Challenges and Deployment Best Practices

Dave Moss, Dell Inc., Round Rock, TX

3. IT Equipment Exhaust-Side Deployment Challenges and Considerations

Dustin Demetriou, Ph.D., IBM, Poughkeepsie, NY

9:45 AM – 11:00 AM

Seminar 43 (Intermediate)

Urban-Scale Energy Modeling, Part 3

Room: Roman II



1. A Data and Computing Platform for City and District Scale Building Energy Efficiency

Tianzhen Hong, Ph.D., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

2. Urban Energy

Ralph Muehleisen, Ph.D., P.E., Member, Argonne National Laboratory, Lemont, IL

3. District and City Scale Modeling Using Openstudio

Nicholas Long, Member, National Renewable Energy Laboratory, Golden, CO

9:45 AM – 11:00 AM

Seminar 44 (Intermediate)

Toward a 21st Century Standard for Natural Ventilation: Review of Existing and Presentation of New Research

Room: Roman III



1. What Climatic Conditions and Building Parameters Identify a Commercial Building as a Good Candidate for Natural Ventilation?

Alejandra Menchaca¹ and Travis English, P.E., Member², (1)Payette, Boston, MA, (2)Kaiser Permanente, Anaheim, CA

2. Using Facade Pressures to Predict Wind-Driven Natural Ventilation Rates

Jordan Clark, Ph.D., Associate Member, CPP Wind Engineering and Air Quality Consultants, Fort Collins, CO

3. Review of Indoor Air Quality Considerations for Naturally Ventilated Commercial Buildings

Elliott Gall, Ph.D., Portland State University, Portland, OR

4. Natural Ventilation Design Incorporating Moisture and Air Velocity Control

Peter Simmonds, Ph.D., Fellow ASHRAE, Building and Systems Analytics LLC, Marina Del Rey, CA

9:45 AM – 11:00 AM

Seminar 45 (Intermediate)

Using the IAQ Procedure from ASHRAE Standard 62.1 as an Alternate Compliance Path on LEED Projects: Reports from the Field

Room: Emperors II



1. A Case Study in a High-Performance Office Building By Applying and Comparing LEED IAQ Procedure Pilot Credit to the Conventional Ventilation Procedure

Marwa Zaatari, Ph.D., Member, enVerid Systems, Boston, MA

2. Successful Application of the LEED IAQ Procedure Pilot Credit in a Retail Chain Store

Scott Williams, P.E., Williams Building System Engineering, PC, Golden Valley, MN

3. Prestigious College-Preparatory School Achieves Sustainability Goals and LEED Certification Using the IAQ Procedure from Standard 62.1

Christopher O. Muller, Member, Purafil, Inc., Doraville, GA

9:45 AM – 11:00 AM

Seminar 46 (Basic)

What Do We Know About Energy Use in Agriculture Facilities

Room: Emperors I



1. What Do We Know about Energy Use in Agricultural Buildings

Morgan Hayes, Member, University of Kentucky, Lexington, KY

2. Energy Use in Livestock Production Facility Systems

Joe Zulovich, Member, University of Missouri, Columbia, MO

3. Energy Use in Indoor Plant Production Facilities

Nadia Sabeih, Ph.D., P.E., Member, Guttman & Blaevoyet, Sacramento, CA

The following four sessions will be held Tuesday at the Las Vegas Convention Center in conjunction with the AHR Expo. Badges are not required and PDHs will be earned.

11:00 AM – 12:00 PM

Seminar 48 (Intermediate)

Did It Really Work?: Theory vs. Practice in Residential HVAC

Room: N235/237



- 1. How Dry I'm Not: Measured Humidity Loads vs. Measured Dehumidification By Heat Pumps in Occupied Houses**
Lewis G. Harriman III, Fellow ASHRAE, Mason-Grant Consulting, Portsmouth, NH
- 2. What Works and What Does Not: Measured Residential HVAC Performance and Comfort in Dry Climates**
Rick Chitwood, Chitwood Energy Management, Mt. Shasta, CA

1:00 PM – 2:30 PM

Seminar 49 (Basic)

ASHRAE's Residential Initiative: Why We Care

Room: N235/237



- 1. Getting Our House in Order**
William Bahnfleth, Ph.D., P.E., Presidential Fellow ASHRAE, Pennsylvania State University, University Park, PA
- 2. ASHRAE Standards in the Residential Sector**
Gordon V. R. Holness, P.E., Fellow Life Member, Consulting Engineer, West Palm Beach, FL
- 3. ASHRAE's Advocacy in the Residential Market**
Thomas H. Phoenix, P.E., Member, Moser Mayer Phoenix Associates, Greensboro, NC

2:45 PM – 3:45 PM

Seminar 50 (Basic)

Flex Ducts, Hard Ducts and No Ducts: Migration Patterns for Duct Hunters (or not) in the Land of Thermal Comfort

Room: N235/237



- 1. Flex Duct Doesn't Mean You Can Flex the Rules**
Chris VanRite, Member, M&M Manufacturing, Fort Worth, TX
- 2. Hard Ducts Are Not so Hard**
Allison Bailes, Ph.D., Member, Energy Vanguard LLC, Decatur, GA
- 3. What Ducts? Who Needs Ducts?**
Robert Bean, P.L.(Eng.), Member, Indoor Climate Consultants Inc., Calgary, AB, Canada

4:00 PM – 5:00 PM

Seminar 51 (Intermediate)

International Experience and Contractors Perspectives on Residential Aspects that Need to be Considered on Every Job

Room: N235/237



1. Quantifying Performance and Efficiency Losses Due to Improper HVAC Quality Installation

Glenn Hourahan, P.E., Member, ACCA, Arlington, VA

2. European Deep Energy Retrofit Strategies Applied to North American Homes

P. Marc LaFrance, Member, U.S. Department of Energy, Washington, DC

11:15 AM – 12:45 PM

Conference Paper Session 16 (Intermediate)

Building Operation and Performance with Sustainability in Mind

Room: Emperors II



1. The Social Dynamics of a Project (LV-17-C061)

David Yancosky, Member, P2S Engineering, Long Beach, CA

2. A Comparison of Stochastic and Deterministic Optimization Algorithms on the Virtual In-Situ Sensor Calibration in Building Systems (LV-17-C062)

Sungmin Yoon, Student Member¹ and Yuebin Yu, Ph.D., Associate Member¹, (1)University of Nebraska-Lincoln, Omaha, NE

3. Risk of Condensation Analysis of Common Concrete Balcony Configurations (LV-17-C063)

Farhad Hemmati, Student Member¹, Ali Vaseghi, Student Member¹ and Fitsum Tariku¹, (1)British Columbia Institute of Technology (BCIT), Burnaby, BC, Canada

4. Duck – The Volcano is Coming! (LV-17-C064)

Alexi Miller, P.E., Associate Member¹ and Jim Edelson, Member¹, (1)New Buildings Institute, Portland, OR

5. Infrared Thermography For Building Envelope Analysis (LV-17-C065)

David M. Underwood, Member¹ and Dahtzen Chu, Member², (1)U.S. Army Corps of Engineers, Champaign, IL, (2)Construction Engineering Research Laboratory (CERL), Champaign, IL

11:15 AM – 12:45 PM

Seminar 52 (Intermediate)

College of Fellows Debate: Codes and Standards Help. Alternatively, Do They Inhibit Excellence?

Room: Augustus I/II



1. Team A Speaker 1

Don Beaty, P.E., Fellow ASHRAE, DLB Associates, Eatontown, NJ

2. Team A Speaker 2

Dennis Knight, P.E., BEMP, Fellow ASHRAE, Whole Building Systems, LLC, Charleston, SC

3. Team A Speaker 3

John W. Field, CEng, Member, Native-Hue Energy Management, London, United Kingdom

4. Team B Speaker 1

Steven T. Taylor, P.E., Fellow ASHRAE, Taylor Engineering, LLC, Alameda, CA

Tuesday, January 31

5. Team B Speaker 2

David J. Branson, P.E., Fellow ASHRAE, Compliance Services Group, Inc., Lubbock, TX

6. Team B Speaker 3

Richard Rooley, FREng, OPMP, Presidential Fellow ASHRAE, Project Management Partnership, Stoke Poges, United Kingdom

11:15 AM – 12:45 PM

Seminar 53 (Intermediate)

Commissioning a Central Chilled Water Plant



Room: Augustus III/IV

1. Commissioning Chilled Water and Condenser Water Pumps

David Cohen, P.E., Member, Grumman/Butkus Associates, Evanston, IL

2. Commissioning a Cooling Tower

Stephen Wiggins, Member, Newcomb & Boyd, Atlanta, GA

3. Commissioning a Water-Cooled Chiller

Stephen Wiggins, Member, Newcomb & Boyd, Atlanta, GA

11:15 AM – 12:45 PM

Seminar 54 (Intermediate)

Cutting-Edge Japanese Technologies SHASE Annual Award for HVAC System and Equipment in 2016



Room: Roman III

1. Symbiosis with Nature and the Achievement of Japan's First ZEB
Naofumi Imaida, Shimizu Corporation, Tokyo, Japan

2. Implementation of Environment-Friendly Office Building with High-Efficiency Data Center

Yosuke Mino, P.E., NTT FACILITIES, INC., Tokyo, Japan

3. Corresponding to BCP and Environment Consideration Method for Company's Dormitory

Takeshi Kimura, Obayashi Corporation, Tokyo, Japan

11:15 AM – 12:45 PM

Seminar 55 (Intermediate)

Urban-Scale Energy Modeling, Part 4



Room: Roman II

1. Urban Microclimate for Building Energy Models

Melissa Allen, Ph.D., Oak Ridge National Laboratory, Oak Ridge, TN

2. Urban-Scale Building Energy Modeling: Why Working at Scale Matters

Michael Bobker, Member, CUNY Institute for Urban Systems, New York, NY

3. Application of Building Energy Modeling for Utility Analytics

Haider Khan, ICF International, Toronto, ON, Canada

4. Virtual UMEM: Visualizing, Analyzing and Reporting

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

11:15 AM – 12:45 PM

Seminar 56 (Intermediate)

Low-GWP Alternative Refrigerants and Their Applications, Part 2

Room: Roman I



1. Insights into the Next Generation HVAC&R Refrigerant Future

Stephen Kujak, Member, Trane, Ingersoll Rand, La Crosse, WI

2. Model Validations for Low-GWP Refrigerants in Mini-Split Air-Conditioning Units

*Omar Abdelaziz, Ph.D., Member¹ and Bo Shen, Ph.D., Member¹,
(1)Oak Ridge National Laboratory, Oak Ridge, TN*

3. Experimental Evaluation and Field Trial of Low GWP R404A Replacements for Commercial Refrigeration

Ankit Sethi, Associate Member, Honeywell International, Buffalo, NY

4. Horizontal Convective Boiling of R448A, R449A and R452B within a Micro-Fin Tube

Mark A. Kedzierski, Ph.D., Member, National Institute of Standards and Technology, Gaithersburg, MD

11:15 AM – 12:45 PM

Seminar 57 (Advanced)

Occupant Behavior Driven Building Operation and Maintenance

Room: Emperors I



1. An Introduction of ASHRAE Multidisciplinary Task Group on Occupant Behavior in Buildings

Tianzhen Hong, Ph.D., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

2. Development and Commercialization of Occupant-Centered Building Control Schemes: An Energy Policy Perspective

Marina Sofos, U.S. Department of Energy, Washington, DC

3. Behavior Driven Transactive Energy for Residential Buildings

Amin Mirakhorli, UTSA, San Antonio, TX

4. Occupant Preferences on Indoor Environmental Conditions in an Open Office

Jie Zhao, Delos LLC, New York, NY

11:15 AM – 12:45 PM

Seminar 58 (Intermediate)

Sewage Water Heat Pump Systems: Recovering Heat, Cold and Water

Room: Augustus V/VI



1. Waste Water Heat Recovery with Heat Pumps: Possibilities and Experiences

Jörgen Wallin, Ph.D., KTH (Royal Institute of Technology), Stockholm, Sweden

2. Recycling Water and Energy at the Denver Museum of Nature and Science, Part 1: System Design

Trey Austin, P.E., Member, Geo-Energy Services, Littleton, CO

3. Recycling Water and Energy at the Denver Museum of Nature and Science, Part 2: System Performance

Piljae Im, Ph.D., Member, Oak Ridge National Laboratory, Oak Ridge, TN

1:00 PM – 1:30 PM

Seminar TC (Basic)

Want a Cutting Edge Career? Be in Controls!

An Open Session for YEA Members.

Room: Augustus I/II

Tuesday, January 31

1:30 PM – 3:00 PM

Seminar 59 (Intermediate)

Recent Research in Data Center Cooling

Room: Augustus I/II



1. Does Designing and Operating an Efficient Data Center Guarantee Performance?

Mark Seymour, CEng, Member, Future Facilities Ltd, London, United Kingdom

2. Computer Room Air-Handler Bypass: A Novel Approach for Reducing the Cooling Infrastructure Power Consumption in Air-Cooled Data Centers

H. Ezzat Khalifa, Ph.D., Fellow ASHRAE, Syracuse University, Syracuse, NY

3. Evaluation of Strategies for Uniform Airflow through Perforated Tiles in Data Centers

Cheng-Xian (Charlie) Lin, Ph.D., Member, Florida International University, Miami, FL

4. Thermal Design of Modular Mission Critical Systems

James VanGilder, P.E., Member, Schneider Electric, Andover, MA

3:15 PM – 4:45 PM

Seminar 60 (Advanced)

Blue Is the New Green: ASHRAE Takes the Plunge into Water Use

Room: Augustus I/II



1. Standard 189.1: Standard for Design of High-Performance Green Buildings

Thomas Pape, Alliance for Water Efficiency, Chicago, IL

2. Standard 188: Legionellosis: Risk Management for Building Water Systems

Thomas Watson, P.E., Presidential Fellow ASHRAE, Daikin Applied, Staunton, VA

3. Standard 191: Standard for the Efficient Use of Water in Building, Site and Mechanical Systems

Fred Betz, Ph.D., Member, Affiliated Engineers, Inc., Madison, WI

Wednesday, February 1

8:00 AM – 9:30 AM

Conference Paper Session 17 (Intermediate)

Building Cooling and Heating System Design

Room: Emperors II



1. Experimental Study on Heating Emitters in an Environmental Chamber (LV-17-C066)

Duan Wu, Ph.D., Member, Mitsubishi Electric R&D Center Europe-UK, Livingston, United Kingdom

2. Full and Part Load Performance Evaluation of Variable Refrigerant Flow System Using an Occupancy Simulated Research Building (LV-17-C067)

Piljae Im, Ph.D., Member¹, Mini Malhotra, Associate Member² and Jeffrey Munk, Member¹, (1)Oak Ridge National Laboratory, Oak Ridge, TN, (2)Oak Ridge National Laboratory, Roane County, TN

3. Development of Water-Based Hybrid VRF System for Buildings (LV-17-C068)

Naofumi Takenaka¹, Shinichi Wakamoto¹, Yuji Motomura² and Koji Yamashita, Ph.D.³, (1)Mitsubishi Electric, Amagasaki City, Japan, (2)Mitsubishi Electric, Wakayama City, Japan, (3)Mitsubishi Electric, Tokyo, Japan

4. Influence of Acoustic Ceiling Units on the Cooling Performance of Thermally Activated Building Systems (LV-17-C069)

Luis Marcos Domínguez Lacarte¹, Bjarne W. Olesen, Ph.D., Fellow ASHRAE², Ongun B. Kazanci, Student Member³, Pierre Chigot⁴ and Nils Røge¹, (1)Technical University of Denmark, Copenhagen, Denmark, (2)International Centre for Indoor Environment and Energy, Technical University of Denmark, Lyngby, Denmark, (3)Technical University of Denmark, Kongens Lyngby, Denmark, (4)Saint-Gobain Ecophon, Hillinge, Sweden

5. Modeling and Simulation of Membrane-Based Dehumidification and Energy Recovery Process

Zhiming Gao, Ph.D.¹, Omar Abdelaziz, Ph.D., Member¹ and Ming Qu, Ph.D.², (1)Oak Ridge National Laboratory, Oak Ridge, TN, (2)Purdue University, West Lafayette, IN

8:00 AM – 9:30 AM

Seminar 61 (Intermediate)

Developments in Building Benchmarking and Energy Performance Data: A Program Manager's Perspective

Room: Augustus III/IV



1. CBECS: Highlights from 2012, Looking Ahead to 2017

Joelle Michaels, U.S. Energy Information Administration, Washington, DC

2. EPA's Energy STAR Portfolio Manager: A Consistent Framework to Assess and Learn from Local Data

Leslie Cook, U.S. Environmental Protection Agency, Washington, DC,

3. Using City and State Benchmarking Policies to Improve Energy Efficiency

Jayson Antonoff, Institute for Market Transformation, Washington, DC

8:00 AM – 9:30 AM

Seminar 62 (Intermediate)

Highlights of RP-1404: Measurement, Modeling, Analysis and Reporting Protocols for Short-term M&V of Whole Building Energy Performance

Room: Augustus I/II



1. An Hourly Hybrid Multivariate Change Point Inverse Model Using Short-Term Monitored Data for Annual Prediction of Building Energy Performance: Background and Methodology

Bass Abushakra, Ph.D., Member, Datadigm, LLC, Wauwatosa, WI

2. An Hourly Hybrid Multivariate Change Point Inverse Model Using Short-Term Monitored Data for Annual Prediction of Building Energy Performance: Results and Analysis

Mitch Paulus, P.E., Student Member, Texas A&M University, College Station, TX

3. Predicting Building Energy Use Using Short-Term Monitoring and Daily Time Scales: The DBTA and the HIM-D Methods

T. Agami Reddy, Ph.D., P.E., Fellow ASHRAE, Arizona State University, Tempe, AZ

8:00 AM – 9:30 AM

Seminar 63 (Intermediate)

Inverse Design: A Fast Way to Achieve Your Goal in IAQ

Room: Roman I



**1. Inverse Design of Enclosed Environment
By Adjoint Method**

*Qingyan Chen, Ph.D., Fellow ASHRAE, Purdue University,
West Lafayette, IN*

2. Inverse Modeling for Optimization of Indoor Air Quality
John Zhai, Ph.D., Member, University of Colorado, Boulder, CO

**3. Inverse Design of Cabin Air-Supply Parameters By CFD-Based
Proper Orthogonal Decomposition**

Tengfei Zhang, Dalian University of Technology, Dalian, China

8:00 AM – 9:30 AM

Seminar 64 (Intermediate)

**Research Update on Activities Toward the Safe Use of Low
GWP Flammable Refrigerants**

Room: Roman II



1. AHRTI Research Projects on Flammable Refrigerants
*Xudong Wang, Ph.D., Member, Air-Conditioning, Heating and
Refrigeration Technology Institute, Arlington, VA*

2. ASHRAE Research Projects on Flammable Refrigerants
Kenneth Schultz, Ph.D., Ingersoll Rand, La Crosse, WI

**3. ORNL Research Effort on Charge Limits for Various Types of
Equipment Employing Flammable Refrigerants**

*Omar Abdelaziz, Ph.D., Member, Oak Ridge National Laboratory,
Oak Ridge, TN*

**4. NIST Effort on Modeling Tools for Flammability Ranking of
Low-GWP Refrigerant Blends**

*Gregory Linteris, Ph.D., National Institute of Standards and Technology,
Gaithersburg, MD*

8:00 AM – 9:30 AM

Seminar 65 (Advanced)

**Impacts of Technology and Energy Markets to
the Performance of Absorption Economics**

Room: Roman III



**1. Hybrid Membrane-Based Ionic Liquid Absorption Cycle for
Water Heating, Dehumidification and Cooling**

*Saeed Moghaddam, Ph.D.¹, Devesh Chugh, Associate Member¹, Kyle
Gluesenkamp, Ph.D., Member² and Omar Abdelaziz, Ph.D., Member²,
(1)University of Florida, Nanoengineered Energy Systems (NES)
Laboratories, Gainesville, FL, (2)Oak Ridge National Laboratory,
Oak Ridge, TN*

2. Solar Thermal HEAT Pump/Chiller Debut

*Donald C. Erickson, Associate Member, Energy Concepts Company
LLC, Annapolis, MD*

3. Absorption Systems' Economics

*Ersin Gercek, P.E., CPMP, Associate Member, Real Engineering
Services LLC, Totowa, NJ*

8:00 AM – 9:30 AM

Seminar 66 (Intermediate)

The Best of “Engineer’s Notebook”

Room: Augustus V/VI



1. VAV Box Duct Design

Steven T. Taylor, P.E., Fellow ASHRAE, Taylor Engineering, LLC, Alameda, CA

2. Reverse Return Reexamined

Stephen W. Duda, P.E., BEAP, HBDP and HFDP, Fellow ASHRAE, Ross & Baruzzini, Inc., St. Louis, MO

3. Waterside Economizers and Standard 90.1

Daniel Nall, P.E., BEMP and HBDP, Fellow Life Member, Syska Hennessy Group, New York, NY

4. Improving Central Chilled Water System Performance

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

8:00 AM – 9:30 AM

Seminar 67 (Intermediate)

The Future of Water and Energy Efficiency in Commercial Foodservice

Room: Emperors I



1. Emerging Technologies and the Water-Energy Nexus in the Commercial Kitchens

David Zabrowski, FisherNickel Inc, San Ramon, CA

2. Commercial Ice Machines: Case Studies in Energy/Water Savings Combined with Load Shifting

Don Fisher, P.Eng., Life Member, Food Service Technology Center, San Ramon, CA

3. Optimizing the Design of the Water Heating System in a Full-Service Restaurant: A Retrofit Case Study

Amin Delagah, Associate Member, Fisher Nickel Inc., San Ramon, CA

4. Restaurant Sustainability: Impact on Energy and Water Reduction

Cherish Samuels, Associate Member, McDonald’s USA, Oak Brook, IL

9:45 AM – 10:45 AM

Conference Paper Session 18 (Advanced)

Modeling for Smoke Management Systems

Room: Emperors I



1. Modeling of Stack Effect in High-Rise Buildings Under Winter Conditions: Evaluating the Validity of Field Observations (LV-17-C071)

Steven M. Strege, P.E., Member¹ and Michael J. Ferreira, P.E.¹, (1)JENSEN HUGHES Inc., Baltimore, MD

2. Scale Modeling of Smoke Spread in High-Rise Shafts during Fires (LV-17-C072)

Liangzhu Wang, Ph.D., P.E., Member¹, Dahai Qi, Student Member¹ and Radu Zmeureanu, Ph.D., P.E., Member¹, (1)Concordia University, Montreal, QC, Canada

3. Comparison of COSMO Smoke Management Software and Experimental Measurements of Smoke Properties During a Structural Fire (LV-17-C073)

William Black, Ph.D., P.E., Member¹, Guanchao (Jeremy) Zhao² and Liangzhu Wang, Ph.D., P.E., Member², (1)Georgia Institute of Technology, Atlanta, GA, (2)Concordia University, Montreal, QC, Canada

9:45 AM – 10:45 AM

Conference Paper Session 19 (Intermediate)

Modern Heat Pump Applications



Room: Augustus III/IV

1. Feasibility of Combined Water-Source Heat Pump with Thermal Energy Storage in Multi-Family Dwellings (LV-17-C074)

Mohammad Tehranian, M.D., Student Member¹ and Hessam Taherian, Ph.D., Member¹, (1)University of Alabama at Birmingham, Birmingham, AL

2. The Application of Icephobic Coatings to Air-Source Heat Pumps (LV-17-C075)

Cara Martin, BEMP, Associate Member¹, Song Li, Associate Member¹, Ron Domitrovic, Ph.D., Member², John Bush, P.E., Member² and Paul Oppenheim, Ph.D., P.E., Member³, (1)Optimized Thermal Systems, Inc., Beltsville, MD, (2)Electric Power Research Institute, Knoxville, TN, (3) University of Florida, Gainesville, FL

3. Development of a Low-Cost Gas Absorption Heat Pump (LV-17-C076)

Paul Glanville, P.E., Associate Member¹, Michael Garrabrant², Roger Stout² and Chris Keinath, Ph.D.², (1)Gas Technology Institute, Des Plaines, IL, (2)Stone Mountain Technologies, Inc., Erwin, TN

9:45 AM – 10:45 AM

Conference Paper Session 20 (Intermediate)

Ventilation System Modeling for Improved IAQ

Room: Emperors II



1. Air Dehumidification Using Desiccant Coated Oblique Fin Plate Frame Structure (LV-17-C077)

Mrunal Jagirdar, Ph.D.¹, Poh Seng Lee, Ph.D.¹ and Ghim Wei Ho, Ph.D.¹, (1)National University of Singapore, Singapore, Singapore

2. Zero-Equation Turbulence Models for Large Electrical and Electronics Enclosure Applications (LV-17-C078)

James VanGilder, P.E., Member¹, Pratik Dhoot², Zachary Pardey¹ and Christopher M. Healey, Ph.D.¹, (1)Schneider Electric, Andover, MA, (2)Northeastern University, Boston, MA

3. Numerical Evaluation of Thermal and Ventilation Performance of Passive Chilled Beams (LV-17-C079)

Wenyu Shan, Student Member, Penn State University, State College, PA

9:45 AM – 10:45 AM

Seminar 68 (Intermediate)

Thermal Comfort Prediction Tools and Outcomes for the Built Environment

Room: Roman III



1. Understanding Thermal Comfort and ASHRAE Standard 55: Free Online Analysis and Visualization Tools

David Heinzerling, Member, Taylor Engineering, Alameda, CA

2. How Comfortable Is Natural Ventilation

Peter Simmonds, Ph.D., Fellow ASHRAE, Buildings and Systems Analytics, Marina Del Rey, CA

9:45 AM – 10:45 AM

Seminar 69 (Intermediate)

Design for IAQ Enhancement in Healthcare and Industrial Buildings using CFD

Room: Augustus V/VI



- 1. Design Analysis of the Intakes Using CFD in Hospitals to Avoid Helicopter Exhaust Fume Entrainment and Improving IAQ**
Reza Ghias, Ph.D., Member¹ and Ramin Rezaei, Affiliate¹, (1)Southland Industries, Dulles, VA
- 2. Design Considerations for Industrial Health and Sustainability in Large Aircraft Painting Facilities**
James Bennett, Ph.D., Member, CDC/NIOSH, Cincinnati, OH
- 3. Using Displacement Ventilation for Airborne Particle Control in an Industrial Space**
Mikhail Koupriyanov, P.Eng., Price Industries Limited, Winnipeg, MB, Canada

9:45 AM – 10:45 AM

Seminar 70 (Intermediate)

The New Laboratory Ventilation Design Guide, What's In It For Me

Room: Augustus I/II



- 1. ASHRAE's Laboratory Design Guide: What's in It for Me?**
Henry Hays, Member, U.S. Department of Agriculture, Severn, MD
- 2. How the Design Guide Serves the Engineer**
Jim Coogan, P.E., Member, Siemens Building Technology, Buffalo Grove, IL

9:45 AM – 10:45 AM

Seminar 71 (Intermediate)

What's New In HVAC Pumping Efficiency? A Look At 90.1-2016 Updates, EU Legislation and U.S. DOE Efficiency Legislation

Room: Roman II



- 1. New Standards from ASHRAE and U.S. DOE for Commercial HVAC and Plumbing Pumps**
Brent Ross, P.Eng., Member, Armstrong Fluid Technology, Toronto, ON, Canada
- 2. Future Pump Performance Regulations in EU and USA**
Niels Bidstrup, Ph.D., Member, Grundfos Management A/S, Bjerringbro, Denmark, Bjerringbro, Denmark

9:45 AM – 10:45 AM

Forum 3 (Intermediate)

Climate Change: The Need for a Hot Climate Building Design Guide Manual

Room: Roman I

11:00 AM – 12:30 PM

Conference Paper Session 21 (Intermediate)

Optimizing Efficiency in Fin Heat Exchangers

Room: Emperors I



1. Revised Indoor-Side Convection Coefficients for Complex Fenestration Systems with Roller Blinds (LV-17-C080)

John Wright, Ph.D., P.E., Member¹, Seyed Sepehr Mohaddes Ferooshani, Student Member¹, Michael Collins, Ph.D., P.E., Member¹ and David Naylor, Ph.D., P.E.², (1)University of Waterloo, Waterloo, ON, Canada, (2)Ryerson University, Toronto, ON, Canada

2. Comparative Study of Optimized Small Diameter Tube-Fin Heat Exchangers vs. Traditional, Larger Diameter Tube-Fin Heat Exchanger Designs (LV-17-C081)

Dennis Nasuta, Associate Member¹, Shekhar Sarpotdar, Ph.D.¹ and Cara Martin, BEMP, Associate Member¹, (1)Optimized Thermal Systems, Inc., Beltsville, MD

3. Correlating Swirl Behavior in Low Reynolds Number Flows in Wavy-Fin Heat Exchanger (LV-17-C082)

Dantong Shi¹, Milind A. Jog, Ph.D.¹ and Raj M. Manglik, Ph.D., Member¹, (1)University of Cincinnati, Cincinnati, OH

4. Computational Study of Laminar Flow Heat Transfer Characteristics of Offset Strip Fin Channels (LV-17-C083)

Chittatosh Bhave¹, Srivatsan Madhavan¹, Raj M. Manglik, Ph.D., Member¹ and Milind A. Jog, Ph.D.¹, (1)University of Cincinnati, Cincinnati, OH

11:00 AM – 12:30 PM

Conference Paper Session 22 (Intermediate)

Refrigeration Systems and Low GWP Refrigerants

Room: Emperors II



1. Refrigerant-Compatible MEMS Pressure and Temperature Sensor Chip (LV-17-C084)

Tom Kwa, Ph.D., Associate Member, DunAn Sensing LLC, San Jose, CA

2. Assessment of Next Generation Refrigerant R514A as Replacement for R123 in Centrifugal Chillers (LV-17-C085)

Kenneth Schultz, Ph.D., Member¹ and Erica Gallant, Member², (1)Ingersoll Rand, La Crosse, WI, (2)Trane, La Crosse, WI

3. Chemical Stability Assessments of R-514A and R-1233zd(E) (LV-17-C086)

Julie Majurin, Associate Member¹, Elyse Sorenson, Associate Member¹, Daryl Steinke¹ and Morgan Herried¹, (1)Trane, Ingersoll Rand, La Crosse, WI

4. Continuous Tuning of Refrigerant Charge to Improve DX Equipment Performance (LV-17-C087)

Michael K. West, Ph.D., P.E., Member, Advantek Consulting Engineering, Melbourne, FL

5. Modeling of Total Equivalent Global Warming Impacts of Supermarket Refrigeration Systems (LV-17-C088)

Meredith Woy¹ and A. S. (Ed) Cheng, Ph.D., P.E., Member¹, (1)San Francisco State University, San Francisco, CA

11:00 AM – 12:30 PM

Seminar 72 (Basic)

Introducing the Guide for Sustainable Refrigerated Facilities and Refrigeration Systems (1634-RP)

Room: Augustus V/VI



1. Refrigeration Systems for Refrigerated Facilities:

The Current Landscape

Douglas Reindl, Ph.D., P.E., Member, University of Wisconsin-Madison, Madison, WI

2. Overview of ASHRAE Design Guide for Refrigerated Facilities

Richard Love, Ph.D., Associate Member, Massey University, Palmerston, New Zealand

3. Applying the ASHRAE Design Guide for Refrigerated Facilities

Todd Jekel, Ph.D., P.E., Member, Industrial Refrigeration Consortium, Madison, WI

11:00 AM – 12:30 PM

Seminar 73 (Intermediate)

Low Energy Building Design Using Exergy Modeling

Room: Roman I



1. A Simplified Exergy Methodology for Net-Zero Buildings Using Rational Exergy Management Model

Siir Kilkis, DSc, Member, The Scientific and Technological Research Council of Turkey, Ankara, Turkey

2. An Exergo-Parametric Study of Hybrid Heating Systems

M. Fatih Evren, Baskent University, Ankara, Turkey

3. Application of Exergy Principles in the Design and Analysis of Heating and Cooling Systems in Buildings

Ongun Berk Kazanci, Technical University of Denmark, Lyngby, Denmark

4. Energy and Exergy Analysis of Water and Air Cooled PVT Systems with Heat Pipe Technology

Birol Kilkis, Ph.D., Fellow ASHRAE, Baskent University, Ankara, Turkey

11:00 AM – 12:30 PM

Seminar 74 (Intermediate)

Pivotal Role of Forward Model and Data Driven Model in Existing Building Performance Enhancement

Room: Roman II



1. Application of Calibrated BEM to the Residential Sector

Haider Khan, ICF International, Toronto, ON, Canada

2. Implications of Inverse and Forward Models to Study Energy Efficiency of Campus Buildings

Mohammad Heidarinejad, Ph.D., Associate Member, University of Maryland, College Park, MD

3. Data-Driven Approach for Predicting Building Energy Usage

Liping Wang, Ph.D., P.E., Member, University of Wyoming, Laramie, WY

4. Calibrated Forward Model vs. Measured Building Energy Use

Xiaohui Zhou, Ph.D., P.E., Member¹ and Jason Steinbock², (1)Iowa Energy Center, Ankeny, IA, (2)The Weidt Group, Minnetonka, MN

11:00 AM – 12:30 PM

Seminar 75 (Intermediate)

Connecting Water and Energy in Facility Management

Room: Roman III



1. Water Usage Data in the Commercial Buildings Energy Consumption Survey

Katie Lewis, Office of Energy Consumption and Efficiency Statistics, U.S. Energy Information Administration, Washington, DC

2. Water Usage Patterns and Metrics in Commercial Buildings

Camilla Dunham¹ and Jonah Schein¹, (1)WaterSense, U.S. Environmental Protection Agency, Washington, DC

3. A Case Study of Water and Energy Conservation

David Sandberg, Noresco, Harleysville, PA

4. Air Conditioning Condensate Recovery and Reuse for Non-Potable Applications

Jennifer Isenbeck, P.E., CPMP, Member, University of Tampa, Tampa, FL

11:00 AM – 12:30 PM

Seminar 76 (Intermediate)

Standard 205 HVAC Energy Simulation Standard Representation in Practice

Room: Augustus III/IV



1. Standard 205P: Overview and Structure

Charles S. Barnaby, BEMP, Life Member, Retired, Moultonborough, NH

2. Chiller Performance Ratings: A Continual Evolution

Michael Zamalis, P.E., Daikin Applied, Staunton, VA

3. Transfer of HVAC Performance Data: The Software Side

Timothy P. McDowell, BEMP, Member, Thermal Energy System Specialists, LLC, Madison, WI

4. Impact of Standard 205 on the Energy Modeling Process

Elyse Malherek, The Weidt Group, Minnetonka, MN

notes

SOCIETY COMMITTEE MEETINGS

All Society committee meetings are located at Caesars Palace in the Conference Center on three levels: the Promenade (PRO), Pool and Emperors (EMP) Levels. The floor levels are indicated in parenthesis in the listing below. Subcommittees are indented. Rooms will be set to accommodate the numbers in parentheses beside the committee, i.e., (20/20) will accommodate at least 20 people at the conference table and at least 20 chairs for the audience. Any audiovisual or electrical ordered will be listed. If AV is not ordered in advance there is no guarantee it will be available onsite.

AEDG Steering Committee (10/10) Electric

Monday (1/30) 2:15 pm–5:00 pm Forum 18 (Pool)

Appointments Roadmap (22/0) Screen/Electric

Sunday (1/29) 7:00 am–8:00 am Trevi (PRO)

ASHRAE Foundation (25/10) Screen/Electric

Monday (1/30) 7:30 am–9:30 am Sicily (EMP)

ASHRAE Foundation Executive Subcommittee (10/5) Electric

Saturday (1/28) 1:30 pm–3:00 pm Sicily (EMP)

ASHRAE/AHRI Joint Expo (25/10) Electric

Sunday (1/29) 9:00 am–11:00 am Pompeian II (PRO)

Associate Society Alliance (65/70) Screen

Monday (1/30) 4:15 pm–6:00 pm Florentine III/IV (PRO)

Associate Society Alliance Subcommittee (40/15) Screen

Sunday (1/29) 1:30 pm–4:30 pm Florentine I (PRO)

Board of Directors (32/75) Screen/Electric

Sunday (1/29) 1:30 pm–5:30 pm Palace III (EMP)

Wednesday (2/1) 2:00 pm–6:00 pm Palace III (EMP)

Building Energy Quotient Committee (15/15) Screen/Electric

Sunday (1/29) 8:30 am–11:30 am Forum 13 (Pool)

bEQ Methodology (10/5) Electric/Screen

Saturday (1/28) 11:00 am–1:00 pm Genoa (PRO)

bEQ Marketing (10/5) Electric/Screen

Saturday (1/28) 1:00 pm–3:00 pm Genoa (PRO)

Building Envelope Committee (30/0)

Monday (1/30) 9:00 am–12:00 pm Verona (PRO)

Certification (12/12) Screen/Electric

Saturday (1/28) 8:00 am–12:00 pm Campania (Pool)

Chapter Technology Transfer Committee (30/15)

Screen/Electric

Friday (1/27) 8:00 am–12:00 pm Pompeian II (PRO)

Saturday (1/28) 9:00 am–12:00 pm Trevi (PRO)

Chapter Technology Transfer Member Services (15/15) Screen

Friday (1/27) 1:00 pm–5:00 pm Genoa (PRO)

Chapter Technology Transfer Operations (10/15) Screen

Friday (1/27) 1:00 pm–5:00 pm Pompeian II (PRO)

Chapter Technology Transfer Mixer (37/15) Screen

Friday (1/27) 5:15 pm–6:30 pm Pompeian II (PRO)

Chapter Technology Transfer Executive Subcommittee (5/0) Screen

Saturday (1/28) 8:00 am–9:00 am Trevi (PRO)

CIBSE/ASHRAE Liaison (25/10) Electric

Wednesday (2/1) 10:00 am–12:30 pm Turin (PRO)

College of Fellows (25/5)

Sunday (1/29) 10:00 am–12:00 pm Sicily (EMP)

College of Fellows: Advisory Committee (15/5)

Sunday (1/29) 9:00 am–10:00 am Sicily (EMP)

Conferences and Expositions Committee (30/10)

Screen/Electric

Saturday (1/28) 8:00 am–3:00 pm Pompeian II (PRO)

Conferences and Expositions Executive (30/5)

Friday (1/27) 1:00 pm–3:00 pm Pompeian III (PRO)

Conferences and Expositions Annual and Winter Meetings (30/5)

Friday (1/27) 3:00 pm–6:00 pm Pompeian III (PRO)

Developing Economies (20/0) Screen

Monday (1/30) 8:00 am–10:00 am Siena (PRO)

Development Committee (24/15) Screen/Electric

Monday (1/30) 9:45 am–11:45 am Sicily (EMP)

Development Committee Excom (4/0)

Friday (1/27) 1:00 pm–2:30 pm Senate BR (PRO)

Director and Regional Chairs (15/20)

Friday (1/27) 11:00 am–1:00 pm Trevi (PRO)

Wednesday (2/1) 12:00 pm–2:00 pm Trevi (PRO)

Director-at-Large Meeting (10/0)

Wednesday (2/1) 12:00 pm–2:00 pm Modena (PRO)

Electronic Communications Committee (13/10) Screen/Electric

Saturday (1/28) 8:00 am–3:00 pm Forum 12 (Pool)

Energy Efficiency in Buildings Position Document

Committee (10/0) Screen

Tuesday (1/31) 3:00 pm–4:00 pm Forum 18 (Pool)

Environmental Health Committee (20/20) Screen

Monday (1/30) 2:15 pm–6:15 pm Anzio (PRO)

Environmental Health Executive (20/20) Screen

Monday (1/30) 7:00 am–8:00 am Anzio (PRO)

Environmental Health Handbook/Policy (20/20) Screen

Monday (1/30) 8:00 am–10:00 am Anzio (PRO)

Environmental Health Program/Research (20/20) Screen

Monday (1/30) 10:00 am–12:00 pm Anzio (PRO)

RP-1663 PMS (10/0)

Tuesday (1/31) 12:00 pm–1:00 pm Anzio (PRO)

Executive Committee (12/22) Screen/Electric

Saturday (1/28) 8:30 am–1:00 pm Anzio (PRO)

Wednesday (2/1) 7:30 am–9:00 am Anzio (PRO)

Thursday (2/2) 7:30 am–11:00 am Anzio (PRO)

Finance Committee (12/15) Electric

Friday (1/27) 8:00 am–12:00 pm Consul BR (PRO)

Finance Investment Subcommittee (4/0)

Thursday (1/26) 5:00 pm–7:00 pm Forum 3 (Pool)

Finance Planning Subcommittee (8/8) Electric

Thursday (1/26) 5:00 pm–7:00 pm Forum 4 (Pool)

Grassroots Government Advocacy Committee (35/30)

Screen/Electric

Saturday (1/28) 8:00 am–12:15 pm Florentine I (PRO)

GGAC: Training (20/10) Screen/Electric

Friday (1/27) 8:00 am–10:00 am Messina (PRO)

GGAC: Executive (20/10) Screen/Electric

Friday (1/27) 10:00 am–12:00 pm Messina (PRO)

GGAC: Active Outreach Subcommittee (15/10) Screen/Electric

Friday (1/27) 1:00 pm–2:30 pm Messina (PRO)

GGAC: Responsive Engagement Subcommittee (15/10) Screen/Electric

Friday (1/27) 1:00 pm–2:30 pm Livorno (PRO)

GGAC: MBO #3 Ad Hoc Committee (15/10) Screen/Electric
 Friday (1/27) 2:45 pm–3:45 pm Livorno (PRO)
 GGAC: MBO #7 Ad Hoc Committees (15/10) Screen/Electric
 Friday (1/27) 2:45 pm–3:45 pm Messina (PRO)
 GGAC: MBO #6 Ad Hoc Committee (15/10) Screen/Electric
 Friday (1/27) 4:00 pm–5:00 pm Messina (PRO)

Handbook Committee (30/15) Screen/Electric

Sunday (1/29) 10:30 am–1:00 pm Pompeian I (PRO)
 Handbook Excom (5/5)
 Saturday (1/28) 1:00 pm–2:00 pm Campania (Pool)
 Handbook Strategic Planning (5/5)
 Saturday (1/28) 2:00 pm–3:00 pm Campania (Pool)
 Handbook Electronic Media (5/0)
 Sunday (1/29) 8:00 am–9:00 am Pompeian I (PRO)
 Handbook Functional (5/0)
 Sunday (1/29) 8:00 am–9:00 am Senate BR (PRO)
 Handbook International (5/0)
 Sunday (1/29) 8:00 am–9:00 am Consul BR (PRO)
 Handbook Training Workshop (50/0) Screen
 Sunday (1/29) 8:00 am–9:00 am Turin (PRO)
 Handbook 2018 Refrigeration TCs/Volume Subcommittee (15/0)
 Sunday (1/29) 9:00 am–10:00 am Forum 19 (Pool)
 Handbook 2019 HVAC Applications TCs/Volume Subcommittee (15/0)
 Sunday (1/29) 9:00 am–10:00 am Forum 3 (Pool)
 Handbook 2020 HVAC Systems and Equipment TCs/Volume
 Subcommittee (15/0)
 Sunday (1/29) 9:00 am–10:00 am Forum 18 (Pool)
 Handbook Volume Subcommittees (25/0) Screen/Electric
 Sunday (1/29) 10:00 am–10:30 am Pompeian I (PRO)

Historical Committee (20/0) Screen

Sunday (1/29) 8:30 am–12:00 pm Venice (EMP)

Honors & Awards (15/5) Screen/Electric

Sunday (1/29) 1:00 pm–5:00 pm Pompeian II (PRO)
 Monday (1/30) 2:15 pm–5:30 pm Pompeian II (PRO)

IEQ-GA (20/0) Screen/Electric

Tuesday (1/31) 4:00 pm–5:30 pm Forum 6 (Pool)

Indoor Air Quality PD (10/0) Screen/Electric

Tuesday (1/31) 9:00 am–10:00 am Forum 2 (Pool)

Journal Advertising Sales Subcommittee (8/0) Screen

Sunday (1/29) 7:00 am–8:00 am Forum 18 (Pool)

Life Member Executive Board Meeting (10/0)

Tuesday (1/31) 9:00 am–11:00 am Siena (PRO)

Members Council (32/40) Electric

Tuesday (1/31) 8:15 am–12:00 pm Milano III (PRO)
 Members Council Planning Subcommittee (12/10) Electric
 Saturday (1/28) 8:00 am–12:00 pm Livorno (PRO)
 Members Council Region Operations Subcommittee (12/10) Electric
 Sunday (1/29) 8:00 am–12:00 pm Livorno (PRO)
 Members Council PAOE Subcommittee (11/0) Electric
 Monday (1/30) 8:00 am–10:00 am Florentine I (PRO)

Membership Promotion (24/15) Screen/Electric

Saturday (1/28) 8:00 am–4:00 pm Pompeian I (PRO)
 Membership Promotion Subcommittees (20/10) Screen/Electric
 Friday (1/27) 1:00 pm–6:00 pm Pompeian IV (PRO)

Nominating (48/0) Electric

Sunday (1/29) 7:30 am–12:00 pm Florentine I (PRO)

PEAC (20/10) Screen/Electric

Tuesday (1/31) 12:00 pm–2:00 pm Pisa (PRO)

Planning (21/40) Screen/Electric

Friday (1/27) 1:00 pm–6:00 pm Florentine II (PRO)

Professional Development (15/15) Screen/Electric

Monday (1/30) 8:00 am–12:00 pm Pisa (PRO)

Publications Committee (12/10) Screen/Electric

Sunday (1/29) 8:00 am–12:00 pm Campania (Pool)

Publications Planning Subcommittee (5/5)

Saturday (1/28) 10:00 am–12:00 pm Consul BR (PRO)

Publishing and Education Council (35/30) Screen/Electric

Tuesday (1/31) 8:00 am–12:00 pm Florentine II (PRO)

Publishing and Education Council E-Learning (12/0) Screen

Saturday (1/28) 1:00 pm–3:00 pm Forum 13 (Pool)

Publishing and Education Council Research Journal Subcommittee (10/0)

Monday (1/30) 11:00 am–12:00 pm Forum 18 (Pool)

Publishing and Education Council Fiscal (17/8) Screen

Monday (1/30) 2:00 pm–3:30 pm Livorno (PRO)

Publishing and Education Council Functional (17/8) Screen

Monday (1/30) 3:30 pm–5:00 pm Livorno (PRO)

Refrigeration Committee (20/20) Screen

Sunday (1/29) 8:00 am–12:00 pm Capri (PRO)

Refrigeration Excom (20/20) Screen

Sunday (1/29) 7:00 am–8:00 am Capri (PRO)

Refrigeration PMS for RP-1634 (15/0) Screen

Monday (1/30) 4:30 pm–6:30 pm Forum 21 (Pool)

Region-at-Large (40/0) Screen

Monday (1/30) 2:15 pm–4:15 pm Florentine I (PRO)

REHVA/ASHRAE MOU Coordination Group (16/6)

Sunday (1/29) 11:00 am–12:00 pm Forum 23 (Pool)

Research Administration Committee (25/20) Screen/Electric

Friday (1/27) 3:00 pm–7:00 pm Forum 5 (Pool)

Saturday (1/28) 8:00 am–3:00 pm Pompeian IV (PRO)

Wednesday (2/1) 7:00 am–11:00 am Pompeian IV (PRO)

RAC Excom (6/0) Screen

Friday (1/27) 1:00 pm–2:30 pm Forum 5 (Pool)

Research Promotion (25/5)

Saturday (1/28) 7:30 am–1:00 pm Sicily (EMP)

Research Promotion Executive (10/0)

Friday (1/27) 2:00 pm–6:00 pm Forum 19 (Pool)

Research Promotion Subcommittee (10/0)

Saturday (1/28) 2:00 pm–3:00 pm Venice (EMP)

Residential Building Committee (16/10) Screen/Electric

Monday (1/30) 9:00 am–12:00 pm Consul BR (PRO)

Residential Building Committee: Conferences Subcommittee (8/5)

Sunday (1/29) 8:30 am–9:30 am Siena (PRO)

Residential Building Committee: Programs Subcommittee (8/5)

Sunday (1/29) 9:30 am–10:30 am Siena (PRO)

Residential Building Committee: Technical Subcommittee (8/5)

Sunday (1/29) 10:30 am–11:30 am Siena (PRO)

Residential Building Committee: Publications Subcommittee (8/5)

Sunday (1/29) 1:00 pm–2:00 pm Siena (PRO)

Residential Building Committee: Stakeholders Subcommittee (8/5)

Sunday (1/29) 2:00 pm–4:00 pm Siena (PRO)

Scholarship Trustees (10/3) Screen/Electric

Tuesday (1/31) 8:00 am–12:00 pm Consul BR (PRO)

Society Rules (10/20) Screen/Electric

Tuesday (1/31) 2:00 pm–6:00 pm Anzio (PRO)

Standards Committee (30/20) Screen/Electric

Saturday (1/28) 8:00 am–1:00 pm Florentine II (PRO)

Wednesday (2/1) 8:00 am–10:00 am Palace III (EMP)

Standards: Executive Committee (10/10)	Screen/Electric	
Friday (1/27)	8:00 am–12:00 pm	Campania (Pool)
StdC Training Adhoc (10/10)	Screen/Electric	
Friday (1/27)	12:00 pm–1:00 pm	Campania (Pool)
Standards: ILS/ISAS (10/3)	Screen/Electric	
Friday (1/27)	1:00 pm–4:00 pm	Abruzzi (Pool)
Standards: PPIS (6/10)	Screen/Electric	
Friday (1/27)	2:00 pm–6:00 pm	Campania (Pool)
Standards: SPLS (20/20)	Screen/Electric	
Friday (1/27)	2:00 pm–6:00 pm	Calabria (Pool)
Standards: Code Interaction Subcommittee (12/10)	Screen/Electric	
Sunday (1/29)	5:00 pm–6:30 pm	Livorno (PRO)
Standards PPIS (6/10)	Screen/Electric	
Tuesday (1/31)	11:00 am–2:00 pm	Calabria (Pool)
Standards SPLS (20/10)	Screen/Electric	
Tuesday (1/31)	2:00 pm–4:00 pm	Calabria (Pool)
Standards SRS (8/4)	Electric	
Tuesday (1/31)	5:00 pm–6:00 pm	Calabria (Pool)
Student Activities Committee (25/10)	Screen/Electric	
Saturday (1/28)	8:00 am–3:00 pm	Capri (PRO)
Student Activities Centralized Training (10/5)	Screen/Electric	
Friday (1/27)	8:30 am–9:30 am	Anzio (PRO)
Student Activities Executive (10/5)	Screen/Electric	
Friday (1/27)	9:30 am–11:30 am	Anzio (PRO)
Student Activities K-12/STEM (20/5)	Screen/Electric	
Friday (1/27)	12:00 pm–2:00 pm	Anzio (PRO)
Student Activities Post High (20/5)	Screen/Electric	
Friday (1/27)	2:00 pm–4:00 pm	Anzio (PRO)
Student Activities ABET (15/5)	Screen/Electric	
Friday (1/27)	2:00 pm–4:00 pm	Capri (PRO)
Student Activities Design Competition (15/5)	Screen/Electric	
Friday (1/27)	4:00 pm–6:00 pm	Anzio (PRO)
Student Activities Grants (15/5)	Screen/Electric	
Friday (1/27)	4:00 pm–6:00 pm	Capri (PRO)
Student Branch Advisor Congress (30/0)	Screen	
Monday (1/30)	10:00 am–11:45 am	Florentine I (PRO)
Student Congress (30/0)	Screen	
Monday (1/30)	10:00 am–11:45 am	Florentine I (PRO)
Student Welcome and Orientation (300/0)	Screen	
Saturday (1/28)	1:30 pm–3:00 pm	Augustus III/IV (EMP)
Student/YEA Mixer (300/0)		
Saturday (1/28)	5:00 pm–6:30 pm	Augustus III/IV (EMP)
Student Program (400/0)	Screen	
Sunday (1/29)	9:00 am–2:00 pm	Milano I-IV (PRO)
TC/TG Chair's Training Workshop		
Sunday (1/29)	9:45 am–10:45 am	Roman I (PRO)
Technical Activities Committee (25/20)	Screen	
Saturday (1/28)	8:00 am–3:00 pm	Pompeian III (PRO)
Wednesday (2/1)	7:00 am–10:00 am	Pompeian III (PRO)
TAC/Standing Committee Executive Interface (25/20)	Screen	
Saturday (1/28)	7:00 am–8:00 am	Pompeian III (PRO)
TAC/TC/SSPC 90.1 Interface/Liaison Session (50/0)	Screen	
Monday (1/30)	2:15 pm–4:15 pm	Augustus III/IV
Technology Council (37/20)	Screen/Electric	
Wednesday (2/1)	9:00 am–12:00 pm	Milano III (PRO)
Technology Council: Operations Subcommittee (25/15)	Screen/Electric	
Tuesday (1/31)	7:30 am–9:00 am	Florentine I (PRO)
Technology Council Special Projects (10/5)	Screen/Electric	
Tuesday (1/31)	9:00 am–10:30 am	Florentine I (PRO)

Technology Council: Document Review Subcommittee (10/10)
Screen/Electric

Tuesday (1/31) 10:30 am–12:00 pm Florentine I (PRO)

UNEP ASHRAE Coordinating Committee (12/6) Screen

Friday (1/27) 9:00 am–11:00 am Modena (PRO)

UNEP ASHRAE Fisheries Conference (12/6) Screen/Electric

Sunday (1/29) 1:00 pm–4:00 pm Patrician (Pool)

Young Engineers in ASHRAE Committee (20/15) Electric

Saturday (1/28) 8:00 am–3:00 pm Messina (PRO)

YEA Subcommittees (20/0) Electric

Friday (1/27) 1:00 pm–3:00 pm Siena (PRO)

YEA Hospitality (125/0)

Sunday (1/29) 4:00 pm–6:00 pm Florentine III/IV

TC/TG/SPC MEETINGS

The ASHRAE Technical Committees, Project Committees, Task Groups and Technical Resource Groups listed below usually meet at each Society Winter and Annual Conference. 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:

GPC = Guideline Project Committee

MTG = Multidisciplinary Task Group

RP = Research Project

SPC = Standard Project Committee

SSPC = Standing Standard Project Committee

TC = Technical Committee

TG = Task Group

TRG = Technical Research Group

Finding your Meeting Location:

Society committee meetings are located at Caesars Palace in the Conference Center. 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 Payard Patisserie. The Conference Center can also be accessed by the elevator for guests staying in the Palace Tower.

All meetings are on three levels of the Caesars Palace Conference Center: the Promenade, Pool and Emperors Levels. The floor levels are indicated in parenthesis in the listing below. Subcommittees are indented. Rooms will be set to accommodate the numbers in the parentheses beside

the committee, i.e., (20/20) will accommodate at least 20 people at the conference table and at least 20 chairs for the audience. Any audiovisual or electrical ordered will be listed. If AV is not ordered in advance there is no guarantee it will be available onsite.

Color Codes: If the meeting has not been listed in color it was NOT confirmed prior to the meeting.

TECHNICAL COMMITTEES (TC)

TC/TG Chair's Breakfast Section 1 (27/4)

Sunday (1/29) 6:30 am–8:00 am Forum 11 (Pool)

TC/TG Chair's Breakfast Section 2 (21/4)

Sunday (1/29) 6:30 am–8:00 am Abruzzi (Pool)

TC/TG Chair's Breakfast Section 3 (13/4)

Sunday (1/29) 6:30 am–8:00 am Forum 3 (Pool)

TC/TG Chair's Breakfast Section 4 (17/4)

Sunday (1/29) 6:30 am–8:00 am Forum 13 (Pool)

TC/TG Chair's Breakfast Section 5 (23/4)

Sunday (1/29) 6:30 am–8:00 am Forum 20 (Pool)

TC/TG Chair's Breakfast Section 6 (19/4)

Sunday (1/29) 6:30 am–8:00 am Tribune (Pool)

TC/TG Chair's Breakfast Section 7 (19/4)

Sunday (1/29) 6:30 am–8:00 am Forum 12 (Pool)

TC/TG Chair's Breakfast Section 8 (25/4)

Sunday (1/29) 6:30 am–8:00 am Forum 5 (Pool)

TC/TG Chair's Breakfast Section 9 (23/4)

Sunday (1/29) 6:30 am–8:00 am Forum 4 (Pool)

TC/TG Chair's Breakfast Section 10 (15/4)

Sunday (1/29) 6:30 am–8:00 am Forum 6 (Pool)

MTG Chair's Breakfast Section MTG (11/4)

Sunday (1/29) 6:30 am–8:00 am Forum 19 (Pool)

TC/TG Chair's Training Workshop

Sunday (1/29) 9:45 am–10:45 am Roman I (PRO)

TC Program Subcommittee Training (30/0) Screen

Tuesday (1/31) 11:15 am–12:00 pm Forum 5 (Pool)

Research Subcommittee Chairs (121/0) Screen

Monday (1/30) 6:30 am–9:00 am Palace III (EMP)

TC 1.1 Thermodynamics & Psychrometrics (10/15)

Monday (1/30) 2:15 pm–4:15 pm Emperors I (EMP)

TC 1.2 Instruments & Measurements (15/0)

Tuesday (1/31) 1:00 pm–3:30 pm Forum 23 (Pool)

TC 1.2 Handbook (Fundamentals) Chap. 36 (6/4)
Monday (1/30) 4:15 pm–6:30 pm Forum 23 (Pool)

TC 1.3 Heat Transfer & Fluid Flow (25/25)

Tuesday (1/31) 1:00 pm–3:30 pm Emperors I(EMP)

TC 1.3/8.5 Research Review (20/30) Screen/Electric

Sunday (1/29) 3:00 pm–7:00 pm Emperors I (EMP)

TC 1.4 Control Theory & Application (20/80) Screen

Tuesday (1/31) 1:00 pm–3:30 pm Augustus III/IV (EMP)

TC 1.4 YEA/Education (15/5) Screen

Sunday (1/29) 2:00 pm–3:00 pm Sicily (EMP)

TC 1.4 Control Components and Applications (15/5) Screen

Sunday (1/29) 3:00 pm–4:00 pm Sicily (EMP)

TC 1.4 Programs (15/5) Screen

Sunday (1/29) 4:00 pm–5:30 pm Sicily (EMP)

TC 1.4 Research (20/10) Screen

Monday (1/30) 2:30 pm–4:30 pm Siena (PRO)

TC 1.4 Handbook (10/15) Screen

Monday (1/30) 4:30 pm–6:30 pm Siena (PRO)

TC 1.4 RP 1746 (6/5) Screen

Monday (1/30) 6:30 pm–8:00 pm Siena (PRO)

TC 1.4 Executive (10/0) Screen

Tuesday (1/31) 7:00 am–8:00 am Sicily (EMP)

TC 1.5 Computer Applications (25/25) Screen/Electric

Monday (1/30) 6:30 pm–9:00 pm Forum 4 (Pool)

TC 1.5 DBOSS (20/10) Electric

Sunday (1/29) 3:00 pm–4:00 pm Capri (PRO)

TC 1.5 Cyber Security (20/10) Electric

Sunday (1/29) 4:00 pm–5:00 pm Capri (PRO)

TC 1.5 Emerging Applications (20/15) Electric

Sunday (1/29) 5:00 pm–6:00 pm Capri (PRO)

TC 1.5 Research (20/15) Electric

Sunday (1/29) 6:00 pm–7:00 pm Capri (PRO)

TC 1.5 Program (20/15) Electric

Sunday (1/29) 7:00 pm–8:00 pm Capri (PRO)

TC 1.5 Handbook (14/4) Electric

Monday (1/30) 6:00 pm–6:30 pm Forum 12 (Pool)

TC 1.6 ASHRAE Terminology (10/1) Screen/Electric

Monday (1/30) 4:15 pm–6:30 pm Messina (PRO)

TC 1.6 Terminology Development (10/1) Screen/Electric

Monday (1/30) 9:00 am–12:00 pm Forum 3 (Pool)

TC 1.7 Business, Management & General Legal Education (20/5)

Monday (1/30) 10:15 am–12:00 pm Turin (PRO)

TC 1.8 Mechanical Systems Insulation (6/6)

Monday (1/30) 4:15 pm–6:30 pm Forum 19 (Pool)

TC 1.8 Research (10/2)

Sunday (1/29) 8:00 am–9:00 am Genoa (PRO)

TC 1.8 Program (10/2)

Sunday (1/29) 9:00 am–10:00 am Genoa (PRO)

TC 1.8 Handbook (10/2)

Sunday (1/29) 10:00 am–11:00 am Genoa (PRO)

TC 1.9 Electrical Systems (8/4)

Tuesday (1/31) 3:30 pm–6:00 pm Patrician (Pool)

TC 1.10 Cogeneration Systems (20/8)

Tuesday (1/31) 2:30 pm–6:00 pm Forum 11 (Pool)

TC 1.10 Handbook, Program, Research, CTTC, Membership (20/8)

Tuesday (1/31) 1:00 pm–2:30 pm Forum 11 (Pool)

TC 1.11 Electric Motors and Motor Control (13/7)

Tuesday (1/31) 1:00 pm–3:30 pm Patrician (Pool)

TC 1.12 Moisture Management in Buildings (20/20) Screen/Electric

Saturday (1/28) 1:00 pm–3:00 pm Forum 19 (Pool)

TC 1.12 Research/Program/Standards (15/10) Screen/Electric

Saturday (1/28) 8:00 am–12:00 pm Forum 19 (Pool)

TC 1.13 Optimization (20/5)

Sunday (1/29) 1:00 pm–3:00 pm Turin (PRO)

TC 2.1 Physiology & Human Environment (12/18)

Tuesday (1/31) 1:00 pm–5:00 pm Forum 21 (Pool)

TC 2.1 Research (12/12) Electric

Sunday (1/29) 1:30 pm–3:30 pm Forum 23 (Pool)

TC 2.1 Programs (12/12) Electric

Sunday (1/29) 3:30 pm–4:30 pm Forum 23 (Pool)

TC 2.1 Handbook (13/7) Screen

Sunday (1/29) 4:30 pm–5:30 pm Forum 23 (Pool)

TC 2.2 Plant and Animal Environment (10/5)**Screen/Electric**

Monday (1/30) 4:15 pm–6:30 pm Forum 4 (Pool)

TC 2.3 Gaseous Air Contaminants /Removal Equip. (30/30) Screen

Tuesday (1/31) 1:00 pm–3:30 pm PompeianII (PRO)

TC 2.3 Research (20/10) Screen

Sunday (1/29) 5:00 pm–7:00 pm Messina (PRO)

TC 2.3 Standards (20/10) Screen

Monday (1/30) 2:15 pm–3:15 pm Sicily (EMP)

TC 2.3 Publications (20/10) Screen

Monday (1/30) 3:15 pm–4:15 pm Sicily (EMP)

TC 2.3 Handbook (5/5) Screen

Monday (1/30) 4:15 pm–6:00 pm Venice (EMP)

TC 2.3 Planning (15/5) Screen

Tuesday (1/31) 6:30 am–8:00 am Pompeian II (PRO)

TC 2.3 Programs (20/10) Screen

Tuesday (1/31) 12:00 pm–12:45 pm Pompeian II (PRO)

TC 2.4 Particulate Air Contaminants / Removal Equipment (18/40) Screen

Tuesday (1/31) 3:30 pm–6:00 pm Pompeian II (PRO)

TC 2.4 Handbook (10/10) Screen/Electric

Saturday (1/28) 1:00 pm–2:30 pm Anzio (PRO)

TC 2.4 1649-RP PMS (5/20) Screen/Electric

Saturday (1/28) 1:30 pm–2:30 pm Florentine II (PRO)

- TC 2.4 Research (20/20) Screen/Electric
 Sunday (1/29) 3:00 pm–5:00 pm Messina (PRO)
 TC 2.4 Publications (10/20) Screen/Electric
 Monday (1/30) 3:15 pm–4:15 pm Sicily (EMP)
 TC 2.4 Standards (20/20) Screen/Electric
 Monday (1/30) 4:15 pm–5:15 pm Sicily (EMP)
 TC 2.4 Program (10/20) Screen/Electric
 Tuesday (1/31) 10:00 am–11:00 am Pisa (PRO)

TC 2.5 Global Climate Change (20/10)

Tuesday (1/31) 1:30 pm–3:30 pm Roman II (PRO)

TC 2.6 Sound and Vibration Control (25/45) Screen/ Electric

**Monday (1/30) 2:15 pm–4:15 pm Pompeian IV
(PRO)**

- TC 2.6 Vibration Isolation (25/25) Screen /Electric
 Sunday (1/29) 9:00 am–10:00 am Pompeian IV (PRO)
 TC 2.6 RP 1408 (25/25) Screen/Electric
 Sunday (1/29) 10:00 am–11:00 am Pompeian IV (PRO)
 TC 2.6 Programs (25/25) Screen/Electric
 Sunday (1/29) 11:00 am–12:00 pm Pompeian IV (PRO)
 TC 2.6 Hot Topic 1 (25/25) Screen/Electric
 Sunday (1/29) 3:00 pm–4:00 pm Pompeian IV (PRO)
 TC 2.6 Hot Topic 2 (25/25) Screen/Electric
 Sunday (1/29) 4:00 pm–5:00 pm Pompeian IV(PRO)
 TC 2.6 Executive Committee (25/25) Screen/Electric
 Sunday (1/29) 5:00 pm–6:00 pm Pompeian IV (PRO)
 TC 2.6 Publications (25/25) Screen/Electric
 Monday (1/30) 9:00 am–10:00 am Pompeian IV (PRO)
 TC 2.6 Research (25/25) Screen/Electric
 Monday (1/30) 10:00 am–11:00 am Pompeian IV (PRO)
 TC 2.6 Standards/Criteria (25/25) Screen/Electric
 Monday (1/30) 11:00 am–12:00 pm Pompeian IV (PRO)

TC 2.7 Seismic and Wind Restraint Design (17/24) Screen/Electric

**Tuesday (1/31) 3:30 pm–6:00 pm Emperors II
(EMP)**

- TC 2.7 Research, Publications, Programs and Long Range
 Planning (17/20) Screen
 Tuesday (1/31) 1:00 pm–3:30 pm Emperors II (EMP)

TC 2.8 Building Environmental Impacts and Sustainability (15/30) Screen/Electric

Sunday (1/29) 5:30 pm–7:00 pm Forum 11 (Pool)

- TC 2.8 Green Guide (10/10) Screen/Electric
 Sunday (1/29) 12:00 pm–1:00 pm Forum 11 (Pool)
 TC 2.8 Forum on Net Zero Energy Building Standards
 (10/30) Screen/Electric
 Sunday (1/29) 1:00 pm–2:00 pm Forum 11 (Pool)
 TC 2.8 Existing & Future Building Challenges (5/10)
 Screen/Electric
 Sunday (1/29) 2:00 pm–2:30 pm Forum 11 (Pool)
 TC 2.8 International (5/10) Screen/Electric
 Sunday (1/29) 2:30 pm–3:00 pm Forum 11 (Pool)

- TC 2.8 Water-Energy Nexus (5/10) Screen/Electric
 Sunday (1/29) 3:00 pm–3:30 pm Forum 11 (Pool)
 TC 2.8 Research (5/5) Screen/Electric
 Sunday (1/29) 3:30 pm–4:00 pm Forum 11 (Pool)
 TC 2.8 Handbook (5/5) Screen/Electric
 Sunday (1/29) 4:00 pm–4:30 pm Forum 11 (Pool)
 TC 2.8 Programs (10/10) Screen/Electric
 Sunday (1/29) 4:30 pm–5:00 pm Forum 11 (Pool)

TC 2.9 Ultraviolet Air and Surface Treatment (10/20)

Monday (1/30) 10:00 am–12:00 pm Pompeian I (PRO)

- TC 2.9 Programs (8/5)
 Sunday (1/29) 8:00 am–10:00 am Modena (PRO)
 TC 2.9 Handbook (5/5)
 Sunday (1/29) 10:00 am–12:00 pm Modena (PRO)
 TC 2.9 Standards (6/6)
 Sunday (1/29) 1:00 pm–3:00 pm Modena (PRO)
 TC 2.9 Research (10/8)
 Monday (1/30) 8:00 am–10:00 am Pompeian I (PRO)

TC 3.1 Refrigerants & Secondary Coolants (10/30) Screen/Electric

Monday (1/30) 4:15 pm–6:30 pm Florentine II (PRO)

- TC 3.1 Research and Program (10/40) Screen/Electric
 Monday (1/30) 10:30 am–12:00 pm Trevi (PRO)
 TC 3.1 Handbook (10/30)
 Monday (1/30) 3:00 pm–4:00 pm Florentine II (PRO)

TC 3.2 Refrigerant System Chemistry (12/40) Screen/Electric

Monday (1/30) 2:15 pm–4:15 pm Emperors II(EMP)

- TC 3.2 Research (12/15)
 Sunday (1/29) 4:00 pm–4:30 pm Modena (PRO)

TC 3.3 Refrigerant Contaminant Control (14/25)

Tuesday (1/31) 3:30 pm–6:00 pm Messina (PRO)

- TC 3.3 Research (12/15)
 Sunday (1/29) 4:30 pm–5:00 pm Modena (PRO)

TC 3.4 Lubrication (30/15) Screen/Electric

Tuesday (1/31) 1:30 pm–3:30 pm Messina (PRO)

- TC 3.4 Research (12/15)
 Sunday (1/29) 5:00 pm–6:00 pm Modena (PRO)

TC 3.6 Water Treatment (18/10)

Tuesday (1/31) 1:00 pm–3:30 pm Forum 1 (Pool)

- TC 3.6 Handbook/Program/Research (12/10) Electric
 Sunday (1/29) 3:00 pm–5:00 pm Forum 22 (Pool)

TC 3.8 Refrigerant Containment (9/5)

Monday (1/30) 4:15 pm–6:30 pm Consul BR (PRO)

TC 4.1 Load Calculation Data and Procedures (20/10)

Monday (1/30) 2:15 pm–4:15 pm Turin (PRO)

- TC 4.1 RP-1729 PMS (15/10)
 Sunday (1/29) 10:00 am–11:00 am Consul BR (PRO)
 TC 4.1 RP-1742 PMS (15/10) Screen
 Sunday (1/29) 11:00 am–12:00 pm Consul BR (PRO)

TC 4.1 Handbook (15/10)		
Sunday (1/29)	3:00 pm–4:00 pm	Consul BR (PRO)
TC 4.1 Research (15/10)		
Sunday (1/29)	4:00 pm–5:00 pm	Consul BR (PRO)
TC 4.1 Programs (15/10)		
Sunday (1/29)	5:00 pm–6:00 pm	Consul BR (PRO)
TC 4.1 Standards (15/10)		
Sunday (1/29)	6:00 pm–7:00 pm	Consul BR (PRO)

TC 4.2 Climatic Information (20/10) Screen/Electric

Tuesday (1/31) 1:00 pm–3:30 pm Forum 7 (Pool)

TC 4.2 Handbook (15/10) Screen		
Sunday (1/29)	2:00 pm–3:00 pm	Tribune (Pool)
TC 4.2 Program (15/10) Screen/Electric		
Sunday (1/29)	3:00 pm–4:00 pm	Tribune (Pool)
TC 4.2 Research (15/10) Screen		
Monday (1/30)	4:15 pm–6:30 pm	Pompeian IV (PRO)

TC 4.3 Ventilation and Infiltration (10/40) Screen/Electric

Monday (1/30) 4:15 pm–6:30 pm Emperors I (EMP)

TC 4.3/4.1 PMS for RP1747 Implementation of DCV for Multiple Zone Systems (12/0) Screen		
Tuesday (1/31)	1:00 pm–2:00 pm	Venice (EMP)

TC 4.4 Building Materials and Building Envelope Performance (40/10) Screen/Electric

Monday (1/30) 2:15 pm–4:15 pm Roman IV (PRO)

TC 4.4 PMS 1696-RP (20/10) Screen/Electric		
Sunday (1/29)	11:00 am–12:30 pm	Verona (PRO)
TC 4.4 Program (25/15) Screen/Electric		
Sunday (1/29)	1:00 pm–2:30 pm	Verona (PRO)
TC 4.4 Handbook (25/15) Screen/Electric		
Sunday (1/29)	2:30 pm–3:30 pm	Verona (PRO)
TC 4.4 Research (25/15) Screen/Electric		
Sunday (1/29)	3:30 pm–5:00 pm	Verona (PRO)
TC 4.4 Standards (25/15) Screen/Electric		
Sunday (1/29)	5:00 pm–5:30 pm	Verona (PRO)

TC 4.5 Fenestration Systems (15/15) Screen

Tuesday (1/31) 2:00 pm–4:00 pm Forum 2 (Pool)

TC 4.5 Research (10/10)		
Monday (1/30)	2:15 pm–3:15 pm	Forum 22 (Pool)
TC 4.5 Program (10/10)		
Monday (1/30)	3:15 pm–4:15 pm	Forum 22 (Pool)
TC 4.5 Handbook (10/10)		
Monday (1/30)	4:15 pm–5:30 pm	Forum 22 (Pool)
TC 4.5 Calculation Methods (15/10) Screen		
Tuesday (1/31)	1:00 pm–2:00 pm	Forum 2 (Pool)

TC 4.7 Energy Calculations (25/50) Screen

Tuesday (1/31) 6:00 pm–8:30 pm Roman II (PRO)

TC 4.7 Simulation and Component Models (20/20) Screen/Electric		
Monday (1/30)	6:00 pm–7:30 pm	Pompeian II (PRO)
TC 4.7 Data-Driven Models (20/20) Screen/Electric		
Monday (1/30)	7:30 pm–9:00 pm	Pompeian II (PRO)

TC 4.7 Applications (20/10) Screen/Electric

Tuesday (1/31) 3:30 pm–5:00 pm Roman II (PRO)

TC 4.7 Handbook (20/10) Screen/Electric

Tuesday (1/31) 5:00 pm–6:00 pm Roman II (PRO)

TC 4.10 Indoor Environmental Modeling (20/20) Screen

Monday (1/30) 2:15 pm–4:15 pm Augustus I/II (EMP)

TC 4.10 RP-1675 PMS (5/10) Screen/Electric

Sunday (1/29) 2:00 pm–3:00 pm Campania (Pool)

TC 4.10 Program (12/10) Electric

Sunday (1/29) 3:00 pm–4:00 pm Campania (Pool)

TC 4.10 Handbook (12/10) Electric

Sunday (1/29) 4:00 pm–5:00 pm Campania (Pool)

TC 4.10 Research (12/10) Electric

Sunday (1/29) 5:00 pm–6:00 pm Campania (Pool)

TC 5.1 Fans (20/20) Screen

Monday (1/30) 4:15 pm–6:30 pm Forum 7 (Pool)

TC 5.1 Handbook (10/15) Screen/Electric

Sunday (1/29) 2:00 pm–3:00 pm Forum 7 (Pool)

TC 5.1 Research (10/15) Screen

Sunday (1/29) 3:00 pm–4:00 pm Forum 7 (Pool)

TC 5.1 Program (10/15) Screen/Electric

Sunday (1/29) 4:00 pm–4:30 pm Forum 7 (Pool)

TC 5.1 Hot Topics (20/20) Screen

Sunday (1/29) 4:30 pm–6:00 pm Forum 7 (Pool)

TC 5.2 Duct Design (12/20)

Tuesday (1/31) 3:30 pm–6:00 pm Pompeian III (PRO)

TC 5.2 Duct Design Subcommittees (30/20) Screen/Electric

Sunday (1/29) 8:00 am–12:00 pm Forum 20 (Pool)

TC 5.3 Room Air Distribution (30/30) Screen/Electric

Tuesday (1/31) 1:00 pm–3:30 pm Milano IV (PRO)

TC 5.3 Handbook (20/0) Screen/Electric

Friday (1/27) 12:00 pm–5:00 pm Pompeian I (PRO)

TC 5.3 Handbook (20/0) Screen/Electric

Saturday (1/28) 8:00 am–3:00 pm Abruzzi (Pool)

TC 5.3 Fan Coils (25/0) Screen/Electric

Sunday (1/29) 8:00 am–9:00 am Pompeian III (PRO)

TC 5.3 Chilled Beams (30/0) Screen/Electric

Sunday (1/29) 9:00 am–10:00 am Pompeian III (PRO)

TC 5.3 RP 1666 PMS (10/0)

Sunday (1/29) 9:00 am–10:00 am Forum 11 (Pool)

TC 5.3 Air Curtains (25/0) Screen/Electric

Sunday (1/29) 10:00 am–10:45 am Pompeian III (PRO)

TC 5.3 RP- 1629 Testing and Modeling Energy Performance

of Active Chilled Beams systems (8/10)

Sunday (1/29) 10:00 am–11:00 am Forum 11 (Pool)

TC 5.3 Underfloor Air Distribution (30/0) Screen/Electric

Sunday (1/29) 10:45 am–11:45 am Pompeian III (PRO)

TC 5.3 Research/Program (30/0) Screen/Electric

Sunday (1/29) 12:15 pm–2:00 pm Pompeian III (PRO)

TC 5.4 Industrial Process Air Cleaning (11/6)

Monday (1/30) 2:15 pm–4:15 pm Forum 23 (Pool)

TC 5.5 Air-to-Air Energy Recovery (30/10)

Tuesday (1/31) 3:30 pm–6:00 pm Pisa (PRO)

TC 5.5 Handbook, Program, Research (12/15) Screen/Electric

Monday (1/30) 3:30 pm–5:30 pm Abruzzi (Pool)

TC 5.6 Control of Fire & Smoke (23/30)

Monday (1/30) 4:15 pm–6:30 pm Emperors II (EMP)

TC 5.6 Program (13/20)

Sunday (1/29) 3:00 pm–4:00 pm Emperors II (EMP)

TC 5.6 Research (13/20)

Sunday (1/29) 4:00 pm–5:30 pm Emperors II (EMP)

TC 5.6 Handbook (13/20)

Sunday (1/29) 5:30 pm–7:00 pm Emperors II (EMP)

TC 5.7 Evaporative Cooling (20/10)

Monday (1/30) 4:15 pm–6:30 pm Tribune (Pool)

TC 5.8 Industrial Ventilation (20/5) Screen/Electric

Monday (1/30) 4:15 pm–6:30 pm Forum 1 (Pool)

TC 5.9 Enclosed Vehicular Facilities (40/20)

Screen/Electric

Tuesday (1/31) 3:30 pm–6:00 pm Florentine II (PRO)

TC 5.9 Program, Standards, Handbook, Research (40/20)

Screen/Electric

Tuesday (1/31) 1:00 pm–3:30 pm Florentine II (PRO)

TC 5.10 Kitchen Ventilation (20/15) Screen

Monday (1/30) 6:00 pm–7:00 pm Verona (PRO)

TC 5.10 Handbook (20/15) Screen/Electric

Monday (1/30) 2:00 pm–3:30 pm Verona (PRO)

TC 5.10 Program (20/15) Screen/Electric

Monday (1/30) 3:30 pm–4:30 pm Verona (PRO)

TC 5.10 Research (20/15) Screen/Electric

Monday (1/30) 4:30 pm–6:00 pm Verona (PRO)

TC 5.11 Humidifying Equipment (10/3)

Monday (1/30) 2:15 pm–4:15 pm Genoa (PRO)

TC 5.11 Humidifying Equipment Research Subcommittee (12/0) Screen/Electric

Sunday (1/29) 3:00 pm–5:00 pm Forum 6 (Pool)

TC 6.1 Hydronic and Steam Equipment and Systems (20/25) Screen/Electric

Tuesday (1/31) 1:00 pm–3:30 pm Augustus V/VI (EMP)

TC 6.1 Chilled Water Plant (12/10) Screen/Electric

Sunday (1/29) 5:00 pm–6:00 pm Trevi (PRO)

TC 6.1 Program (12/8) Screen/Electric

Monday (1/30) 2:15 pm–3:15 pm Forum 7 (Pool)

TC 6.1 Research (12/8) Screen/Electric

Monday (1/30) 3:15 pm–4:15 pm Forum 7 (Pool)

TC 6.2 District Energy (20/10)

Sunday (1/29) 3:00 pm–5:00 pm Livorno (PRO)

TC 6.2 Programs, Research, Handbook (8/26) Electric

Sunday (1/29) 1:00 pm–3:00 pm Livorno (PRO)

TC 6.3 Central Forced Air Htg. & Cooling Sys (20/12)

Tuesday (1/31) 1:00 pm–3:30 pm Capri (PRO)

TC 6.5 Radiant Heating and Cooling (17/10)

Monday (1/30) 2:15 pm–4:15 pm Forum 19 (Pool)

TC 6.5 Research, Special Pubs, Journal, Program, Handbook
(15/20) Screen/Electric

Sunday (1/29) 3:00 pm–5:00 pm Roman II (PRO)

TC 6.6 Service Water Heating Systems (18/15)

Monday (1/30) 4:15 pm–6:30 pm Calabria (Pool)

TC 6.6 Research, Handbook, and Program (20/10)
Screen/Electric

Monday (1/30) 2:15 pm–4:15 pm Calabria (Pool)

TC 6.7 Solar Energy Utilization (20/55) Screen

Tuesday (1/31) 1:00 pm–3:30 pm Roman I (PRO)

TC 6.7 Research, Standards, Programs and Handbook (15/10)
Screen/Electric

Monday (1/30) 4:15 pm–8:30 pm Turin (PRO)

TC 6.8 Geothermal Heat Pump and Energy Recovery Applications (16/25) Screen/Electric

Tuesday (1/31) 3:30 pm–6:00 pm Forum 5 (Pool)

TC 6.8 Handbook: Geothermal Energy (10/10) Screen/Electric

Sunday (1/29) 3:00 pm–5:00 pm Forum 5 (Pool)

TC 6.8 Research, Programs, Standards (15/10) Screen/Electric

Sunday (1/29) 5:00 pm–7:00 pm Forum 5 (Pool)

TC 6.9 Thermal Storage (11/30) Screen/Electric

Monday (1/30) 4:30 pm–6:00 pm Forum 12 (Pool)

TC 6.9 Standards/SPC 150 (15/10)

Monday (1/30) 2:15 pm–2:40 pm Forum 12 (Pool)

TC 6.9 Programs (15/10)

Monday (1/30) 2:40 pm–3:10 pm Forum 12 (Pool)

TC 6.9 Handbook (15/10)

Monday (1/30) 3:10 pm–3:30 pm Forum 12 (Pool)

TC 6.9 Long Range Planning and Website (15/10)

Monday (1/30) 3:30 pm–3:50 pm Forum 12 (Pool)

TC 6.9 Research (15/10)

Monday (1/30) 3:50 pm–4:10 pm Forum 12 (Pool)

TC 6.10 Fuels & Combustion (20/10) Screen /Electric

Tuesday (1/31) 3:30 pm–6:00 pm Abruzzi (Pool)

TC 6.10 Handbook (11/3) Screen/Electric

Monday (1/30) 2:15 pm–4:15 pm Patrician (Pool)

TC 7.1 Integrated Building Design (25/10)

Monday (1/30) 8:15 am–10:00 am Florentine II (PRO)

TC 7.1 Research (15/5)

Sunday (1/29) 5:00 pm–6:00 pm Patrician (Pool)

TC 7.1 Programs (15/5)

Sunday (1/29) 6:00 pm–7:00 pm Patrician (Pool)

TC 7.2 HVAC Construction and Design Build Technology (10/5)

Sunday (1/29) 10:00 am–12:00 pm Forum 19 (Pool)

TC 7.3 Operations & Maintenance Management (25/7) Screen/Electric

Tuesday (1/31) 1:00 pm–3:30 pm Forum 4 (Pool)

TC 7.3 Education & Training (15/10) Screen/Electric

Sunday (1/29) 3:00 pm–6:00 pm Augustus V/VI
(EMP)

TC 7.3 Standards & Program (15/10) Screen/Electric

Monday (1/30) 2:15 pm–4:15 pm Forum 5 (Pool)

TC 7.3 Research & Handbook (15/10) Screen/Electric

Monday (1/30) 4:15 pm–5:45 pm Forum 5 (Pool)

TC 7.3 RP-1650 PMS (6/0)

Tuesday (1/31) 8:00 am–9:00 am Venice (EMP)

TC 7.4 Exergy Analysis for Sustainable Buildings (14/8)

Sunday (1/29) 8:00 am–10:00 am Forum 23 (Pool)

TC 7.5 Smart Building Systems (11/50) Screen

**Tuesday (1/31) 3:30 pm–6:00 pm Augustus V/VI
(EMP)**

TC 7.5 Fault Detection & Diagnosis (11/50) Electric

Sunday (1/29) 2:30 pm–3:15 pm Pompeian III (PRO)

TC 7.5 Enabling Technologies (11/50)

Sunday (1/29) 3:15 pm–4:00 pm Pompeian III (PRO)

TC 7.5 Smart Grid (11/50)

Sunday (1/29) 4:00 pm–4:45 pm Pompeian III (PRO)

TC 7.5 Handbook (11/50)

Sunday (1/29) 4:45 pm–5:30 pm Pompeian III (PRO)

TC 7.5 Program (11/50)

Sunday (1/29) 5:30 pm–6:00 pm Pompeian III (PRO)

TC 7.5 Buildings Operations and Dynamics (11/50)

Monday (1/30) 4:30 pm–5:15 pm Augustus III/IV(EMP)

TC 7.5 Research (11/50)

Monday (1/30) 5:15 pm–6:00 pm Augustus III/IV
(EMP)

TC 7.6 Building Energy Performance (15/30)

Tuesday (1/31) 1:00 pm–3:30 pm Trevi (PRO)

TC 7.6 Federal Buildings (25/25)

Saturday (1/28) 9:00 am–3:00 pm Forum 4 (Pool)

Sunday (1/29) 9:00 am–12:00 pm Forum 4 (Pool)

TC 7.6 Project Monitoring Committee for 1702-RP (8/0)

Sunday (1/29) 11:30 am–1:00 pm Senate BR (PRO)

TC 7.6 Research (10/10)

Sunday (1/29) 1:00 pm–2:00 pm Trevi (PRO)

TC 7.6 Commercial Building Energy Audit (10/15)

Sunday (1/29) 2:00 pm–3:00 pm Trevi (PRO)

TC 7.6 Handbook (10/10)

Sunday (1/29) 3:00 pm–4:00 pm Trevi (PRO)

TC 7.6 Monitoring and Energy Performance (10/30)

Monday (1/30) 2:15 pm–4:15 pm Forum 11 (Pool)

TC 7.6 Energy Management (10/15)

Monday (1/30) 4:15 pm–5:15 pm Forum 11 (Pool)

TC 7.6 Standards and Programs (10/10)

Monday (1/30) 5:15 pm–6:15 pm Forum 11 (Pool)

TC 7.6 Executive (10/10)

Monday (1/30) 6:15 pm–7:00 pm Forum 11 (Pool)

TC 7.7 Testing & Balancing (20/30)

Monday (1/30) 2:15 pm–4:15 pm Roman II (PRO)

TC 7.7 Program, Handbook, Research (6/4) Electric

Saturday (1/28) 1:00 pm–3:00 pm Forum 18 (Pool)

TC 7.8 Owning & Operating Costs (20/5) Electric

Monday (1/30) 2:15 pm–4:15 pm Forum 4 (Pool)

TC 7.8 Handbook, Program, Research (10/8) Electric

Sunday (1/29) 3:00 pm–5:00 pm Senate BR (PRO)

TC 7.8 Subcommittee Meetings (10/8) Electric

Sunday (1/29) 5:00 pm–7:00 pm Senate BR (PRO)

TC 7.9 Building Commissioning (40/20) Screen/Electric

Sunday (1/29) 3:00 pm–5:00 pm Forum 4 (Pool)

TC 7.9 Handbook, Research, Program (12/20) Screen/Electric

Saturday (1/28) 8:00 am–10:00 am Calabria (Pool)

TC 8.1 Positive Displacement Compressors (12/14)

Tuesday (1/31) 3:30 pm–6:00 pm Forum 7 (Pool)

TC 8.1 Research/Program (5/5) Electric

Sunday (1/29) 4:00 pm–5:00 pm Anzio (PRO)

TC 8.2 Centrifugal Machines (20/8)

Monday (1/30) 2:15 pm–4:15 pm Venice (EMP)

TC 8.2 Programs, Research, and Handbook (17/3) Screen/
Electric

Sunday (1/29) 5:00 pm–7:00 pm Genoa (PRO)

TC 8.3 Absorption and Heat Operated Machines (20/10)

Monday (1/30) 3:30 pm–6:00 pm Pompeian I (PRO)

TC 8.3 Research/Handbook (12/20)

Monday (1/30) 2:15 pm–3:30 pm Pompeian I (PRO)

TC 8.4 Air-to-Refrigerant Heat Transfer Equipment (20/10) Screen/Electric

Tuesday (1/31) 3:30 pm–6:00 pm Forum 4 (Pool)

TC 8.4 Research/Standards/Handbook (50/10)

Monday (1/30) 6:30 pm–9:30 pm Florentine III/IV
(PRO)

TC 8.5 Liquid to Refrigerant Heat Exchangers (47/18) Screen

Monday (1/30) 4:15 pm–6:30 pm Florentine I (PRO)

TC 8.6 Cooling Towers and Evaporative Condensers (20/5)

Monday (1/30) 2:15 pm–4:15 pm Trevi (PRO)

TC 8.6 Handbook/Research/Programs (8/0)

Monday (1/30) 9:00 am–10:00 am Modena (PRO)

TC 8.7 Variable Refrigerant Flow (20/30)

Monday (1/30) 4:15 pm–6:30 pm Augustus V/VI (EMP)

TC 8.7 Programs (5/5) Electric

Sunday (1/29) 3:00 pm–4:00 pm Anzio (PRO)

TC 8.8 Refrigerant System Controls & Accessories (10/10) Screen/Electric

Tuesday (1/31) 1:00 pm–3:30 pm Forum 6 (Pool)
TC 8.8 Research, Program, Handbook (5/5)
Sunday (1/29) 6:30 pm–7:30 pm Forum 6 (Pool)

TC 8.9 Residential Refrigerators and Food Freezers (6/10)

Monday (1/30) 2:15 pm–4:15 pm Messina (PRO)
TC 8.9 Program/Handbook/Research (11/4) Electric
Sunday (1/29) 3:00 pm–5:00 pm Augustus III/IV (EMP)

TC 8.10 Mechanical Dehumidifiers & Heat Pipes (16/10)

Tuesday (1/31) 3:30 pm–6:00 pm Tribune (Pool)
TC 8.10 Program/Handbook/Research/Standards (20/5) Electric
Tuesday (1/31) 1:00 pm–3:30 pm Tribune (Pool)

TC 8.11 Unitary and Room Air Conditioners and Heat Pumps (20/30)

Monday (1/30) 4:15 pm–6:30 pm Roman II (PRO)
TC 8.11 Handbook/Program/Research (20/15)
Sunday (1/29) 3:00 pm–5:00 pm Roman I (PRO)

TC 8.12 Desiccant Dehumidification Equipment and Components (15/15)

Monday (1/30) 2:15 pm–4:15 pm Forum 1 (Pool)

TC 9.1 Large Building Air-Conditioning Systems (14/15) Screen/Electric

Tuesday (1/31) 1:00 pm–3:30 pm Siena (PRO)
TC 9.1 Program/Handbook (13/5) Screen/Electric
Tuesday (1/31) 12:00 pm–1:00 pm Siena (PRO)

TC 9.2 Industrial Air Conditioning (25/10) Screen/Electric

Tuesday (1/31) 1:00 pm–3:30 pm Forum 5 (Pool)
TC 9.2 Industrial Air Conditioning Programs/Research/Handbook (12/2)
Sunday (1/29) 4:00 pm–6:00 pm Pompeian I (PRO)
TC 9.2 Nuclear Subcommittee (15/5) Screen/Electric
Monday (1/30) 2:15 pm–4:15 pm Forum 21 (Pool)

TC 9.3 Transportation Air Conditioning (14/20) Screen/Electric

Monday (1/30) 6:15 pm–7:30 pm Pisa (PRO)
GPC 23/TC 9.3 Rail Subcommittee (14/20) Screen/Electric
Monday (1/30) 2:15 pm–3:30 pm Pisa (PRO)
TC 9.3 Research Final Report Presentation RP 1262-2 (14/20) Screen/Electric
Monday (1/30) 3:30 pm–4:45 pm Pisa (PRO)
TC 9.3 Research Subcommittee (14/20) Screen/Electric
Monday (1/30) 4:45 pm–5:30 pm Pisa (PRO)
TC 9.3 Handbook Subcommittee (14/20) Screen/Electric
Monday (1/30) 5:30 pm–6:15 pm Pisa (PRO)

TC 9.4 Justice Facilities (15/3) Screen/Electric

Sunday (1/29) 8:00 am–10:00 am Forum 2 (Pool)

TC 9.4 Handbook & Design Guide (10/3)
Sunday (1/29) 1:30 pm–3:30 pm Forum 19 (Pool)

TC 9.6 Healthcare Facilities (20/60) Screen/Electric

Sunday (1/29) 5:00 pm–7:00 pm Roman III (PRO)

TC 9.6 Healthcare Water (30/15) Screen/Electric
Sunday (1/29) 9:00 am–10:00 am Pisa (PRO)

TC 9.6 Infectious Diseases (30/15) Screen/Electric
Sunday (1/29) 10:00 am–12:00 pm Pisa (PRO)

TC 9.6 Research (30/15) Screen/Electric
Sunday (1/29) 1:00 pm–2:00 pm Pisa (PRO)

TC 9.6 Handbook (30/15) Screen/Electric
Sunday (1/29) 2:00 pm–3:00 pm Pisa (PRO)

TC 9.6 Healthcare Energy (30/15) Screen/Electric
Sunday (1/29) 3:00 pm–4:00 pm Pisa (PRO)

TC 9.6 Program (30/15) Screen/Electric
Sunday (1/29) 4:00 pm–5:00 pm Pisa (PRO)

TC 9.7 Educational Facilities (13/10)

Sunday (1/29) 1:00 pm–3:00 pm Senate BR (PRO)

TC 9.8 Large Building Air-Conditioning Applications (20/10)

Monday (1/30) 2:15 pm–4:15 pm Tribune (Pool)

TC 9.8 Handbook (10/5) Electric
Monday (1/30) 9:00 am–10:30 am Senate BR (PRO)

TC 9.8 Programs (10/5) Electric
Monday (1/30) 10:30 am–12:00 pm Senate BR (PRO)

TC 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment (25/75) Screen

Monday (1/30) 2:15 pm–6:30 pm Roman I (PRO)

TC 9.9 Programs, Handbook and Research (40/20)
Screen/Electric
Sunday (1/29) 5:00 pm–7:00 pm Augustus III/IV (EMP)

TC 9.10 Laboratory Systems (30/15) Screen/Electric

Tuesday (1/31) 3:30 pm–5:30 pm Verona (PRO)

TC 9.10 Standards (30/15) Screen/Electric
Sunday (1/29) 3:00 pm–3:45 pm Turin (PRO)

TC 9.10 Research (30/15) Screen/Electric
Sunday (1/29) 3:45 pm–4:30 pm Turin (PRO)

TC 9.10 Program (30/15) Screen/Electric
Sunday (1/29) 4:30 pm–5:15 pm Turin (PRO)

TC 9.10 Lab Classifications (30/15) Screen/Electric
Sunday (1/29) 5:15 pm–7:00 pm Turin (PRO)

TC 9.10 Labs Energy Efficiency (30/15) Screen/Electric
Tuesday (1/31) 1:00 pm–2:30 pm Verona (PRO)

TC 9.10 Handbook (30/15) Screen/Electric
Tuesday (1/31) 2:30 pm–3:30 pm Verona (PRO)

TC 9.11 Clean Spaces (30/10) Screen/Electric

Monday (1/30) 3:00 pm–4:15 pm Roman III (PRO)

TC 9.11 Research (9/5) Screen/Electric
Monday (1/30) 2:15 pm–3:00 pm Roman III (PRO)

TC 9.11 Cleanroom Energy Efficiency (9/5) Screen/Electric
 Monday (1/30) 4:15 pm–5:00 pm Roman III (PRO)
 TC 9.11 Handbook (9/5) Screen/Electric
 Monday (1/30) 5:00 pm–5:30 pm Roman III (PRO)
 TC 9.11 Design Guide (9/5) Screen/Electric
 Monday (1/30) 5:30 pm–6:00 pm Roman III (PRO)

TC 9.12 Tall Buildings (8/8) Screen/Electric

Sunday (1/29) 12:15 pm–2:00 pm Forum 18 (Pool)

TC 10.1 Custom Engineered Refrigeration Systems (30/10)

Monday (1/30) 2:15 pm–4:15 pm Florentine III/IV (PRO)

TC 10.2 Automatic Ice Making Plants/Skating Rinks (12/3) Screen/Electric

Monday (1/30) 4:30 pm–6:30 pm Trevi (PRO)

TC 10.3 Refrigerant Piping, Controls and Accessories (20/10) Screen

Tuesday (1/31) 1:00 pm–3:30 pm Sicily (EMP)

TC 10.3 RP-1569 PMS (15/0) Screen/Electric

Tuesday (1/31) 8:00 am–10:00 am Forum 6 (Pool)

TC 10.5 Refrigerated Processing and Storage (15/10)

Tuesday (1/31) 3:30 pm–6:00 pm Capri (PRO)

TC 10.6 Transport Refrigeration (8/10) Screen/Electric

Monday (1/30) 4:45 pm–7:00 pm Forum 3 (Pool)

TC 10.6 Handbook (5/5) Screen/Electric

Monday (1/30) 2:15 pm–4:15 pm Forum 3 (Pool)

TC 10.7 Commercial Food and Beverage Refrigeration Equipment (24/30)

Monday (1/30) 2:15 pm–4:15 pm Pompeian III (PRO)

TC 10.7 Program (20/20)

Sunday (1/29) 5:15 pm–6:00 pm Pisa (PRO)

TC 10.7 Research (20/20)

Sunday (1/29) 6:00 pm–6:45 pm Pisa (PRO)

TC 10.7 Handbook (20/20)

Sunday (1/29) 6:45 pm–7:30 pm Pisa (PRO)

TC 10.8 Refrigeration Load Calculations (10/10)

Sunday (1/29) 3:00 pm–5:00 pm Roman III (PRO)

TASK GROUPS (TG), TECHNICAL RESOURCE GROUPS (TRG), AND MULTIDISCIPLINARY TASK GROUPS (MTG)

TG2 HVAC Security (20/6)

Tuesday (1/31) 9:00 am–12:00 pm Venice (EMP)

TRG4.IAQP–Indoor Air Quality Procedure (15/20) Screen/Electric

Sunday (1/29) 10:30 am–12:00 pm Messina (PRO)

MTG.O&MEE, Operations and Maintenance Activities That Impact Energy Efficiency (25/10) Electric

Sunday (1/29) 7:30 am–8:15 am Pisa (PRO)

MTG Hot Climate Design Guide (20/0)

Sunday (1/29) 8:00 am–9:00 am Tribune (Pool)

MTG Low GWP Refrigerants (25/36) Screen/Electric

Sunday (1/29) 5:00 pm–6:00 pm Forum 4 (Pool)

Wednesday (2/1) 10:00 am–12:00 pm Forum 4 (Pool)

MTG Occupant Behavior in Buildings (30/10) Screen

Monday (1/30) 8:00 am–10:00 am Pompeian II (PRO)

MTG Building Information Modeling (20/0) Screen

Monday (1/30) 10:15 am–12:00 pm Tribune (Pool)

MTG.LowGWP Codes & Standards Subcommittee (20/10) Screen/Electric

Tuesday (1/31) 1:00 pm–3:30 pm Modena (PRO)

MTG Cold Climate Building Design Guide (12/3) Screen/Electric

Wednesday (2/1) 9:00 am–11:00 am Forum 3 (Pool)

STANDARD PROJECT COMMITTEES (SPC), AND STANDING STANDARD PROJECT COMMITTEES (SSPC)

PC Chairs Training Breakfast (104/0) Screen

Sunday (1/29) 7:30 am–9:00 am Florentine III/IV (PRO)

SSPC 15 Safety Standard for Refrigeration Systems (20/25) Screen

Sunday (1/29) 1:00 pm–5:00 pm Roman IV (PRO)

SSPC 15 Safety Standards for Refrigeration Systems Rewrite (20/25) Screen

Saturday (1/28) 1:00 pm–3:00 pm Florentine I (PRO)

SSPC 15 Safety Standards for Refrigeration Systems Ad Hoc and Rewrite (20/25) Screen

Sunday (1/29) 8:00 am–12:00 pm Roman IV (PRO)

SSPC 15 Subcommittee 15.2 Safety Standard for Refrigeration Systems in Residential Applications (15/15) Screen/Electric

Tuesday (1/31) 8:00 am–12:00 pm Modena (PRO)

SPC 20 Methods of Laboratory Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers (6/2) Screen/Electric

Sunday (1/29) 12:00 pm–2:00 pm Forum 6 (Pool)

SPC 23.1 MOT for Rating Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Pressures of the Refrigerant (13/8) Screen/Electric

Monday (1/30) 2:15 pm–6:15 pm Modena (PRO)

SPC 24 Methods of Testing for Rating Liquid Coolers (6/10) Screen/Electric

Tuesday (1/31) 8:00 am–10:00 am Calabria (Pool)

SPC 25-2001R, Methods of Testing Forced Convection and Natural Convection Air Coolers for Refrigeration (5/4) Electric

Monday (1/30) 7:00 pm–10:00 pm Patrician (Pool)

SPC 28 MOT Flow Capacity of Refrigerant Capillary Tubes (5/5)

Sunday (1/29) 5:00 pm–7:00 pm Forum 19(Pool)

SPC 30 MOT Liquid Chillers (7/10) Screen/Electric

Monday (1/30) 8:00 am–11:00 am Forum 23 (Pool)

SPC 32.2 Methods of Testing for Rating Pre-Mix and Post-Mix Beverage Dispensing Equipment (6/2) Screen

Tuesday (1/31) 8:00 am–12:00 pm Forum 13 (Pool)

SSPC 34 Designation and Safety Classification of Refrigerants (15/45) Screen /Electric

Monday (1/30) 6:30 pm–10:00 pm Florentine II (PRO)

SSPC 34 Designation and Nomenclature Subcommittee (8/40) Screen/Electric

Saturday (1/28) 7:00 am–10:00 am Florentine IV (PRO)

SSPC 34 Flammability Subcommittee (18/40) Screen/Electric

Saturday (1/28) 10:00 am–3:00 pm Florentine IV (PRO)

SSPC 34 Toxicity Subcommittee (10/30) Screen/Electric

Sunday (1/29) 6:30 pm–10:00 pm Florentine I (PRO)

SSPC 34 Executive Committee (7/0) Screen/Electric

Monday (1/30) 9:00 am–10:30 am Forum 20 (Pool)

SPC 37 MOT for Rating Electrically Driven Unitary Air-Conditioners and Heat Pump Equipment (15/25) Screen/Electric

Wednesday (2/1) 8:00 am–12:00 pm Pompeian II(PRO)

SSPC 41 Standard Methods for Measurement (18/10) Electric

Sunday (1/29) 1:00 pm–3:00 pm Pompeian I (PRO)

SSPC 41, Standard Methods for Measurement–Uncertainty Ad Hoc Committee (9/5) Electric

Sunday (1/29) 3:00 pm–4:00 pm Pompeian I (PRO)

41.10, Standard Methods for Refrigerant Mass Flow

Measurement Using Flowmeters (10/5) Screen/Electric

Tuesday (1/31) 8:00 am–10:00 am Patrician (Pool)

41.1, Standard Methods for Temperature Measurement (10/5) Screen/Electric

Tuesday (1/31) 10:00 am–12:00 pm Patrician (Pool)

SSPC 52.2 Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size (16/45) Screen/Electric

Saturday (1/28) 8:00 am–12:00 pm Forum 11 (Pool)

SSPC 55 Thermal Environmental Conditions for Human Occupancy (12/4) Screen/Electric

Saturday (1/28) 8:00 am–3:00 pm Forum 7 (Pool)

Sunday (1/29) 8:00 am–12:00 pm Forum 5 (Pool)

SSPC 62.1 Ventilation for Acceptable Indoor Air Quality (30/30) Screen/Electric

Saturday (1/28) 8:00 am–12:00 pm Forum 20 (Pool)

Sunday (1/29) 1:00 pm–7:00 pm Forum 20 (Pool)

SSPC 62.1 IAQ Guideline Subcommittee (12/12) Screen/Electric

Friday (1/27) 8:00 am–12:00 pm Tribune (Pool)

SSPC 62.1 Administration Subcommittee (10/10) Screen/Electric

Friday (1/27) 1:00 pm–3:00 pm Patrician (Pool)

Saturday (1/28) 1:00 pm–3:00 pm Forum 20 (Pool)

SSPC 62.1 Research and Education Subcommittee (12/12) Screen/Electric

Friday (1/27) 1:00 pm–3:00 pm Tribune (Pool)

Saturday (1/28) 1:00 pm–3:00 pm Forum 21 (Pool)

SSPC 62.1 Buildings, Systems and Equipment (11/11) Screen/Electric

Friday (1/27) 3:00 pm–5:00 pm Tribune (Pool)

Saturday (1/28) 1:00 pm–3:00 pm Tribune (Pool)

SSPC 62.1 Ventilation Subcommittee (14/14) Screen/Electric

Friday (1/27) 3:00 pm–5:00 pm Patrician (Pool)

Saturday (1/28) 1:00 pm–3:00 pm Patrician (Pool)

SSPC 62.1 Natural Ventilation Working Group (15/30) Screen/Electric

Monday (1/30) 8:00 am–12:00 pm Forum 5 (Pool)

SSPC 62.2 Ventilation and Acceptable IAQ in Residential Buildings (30/15) Screen/Electric

Friday (1/27) 9:00 am–2:30 pm Turin (PRO)

Saturday (1/28) 8:00 am–3:00 pm Turin (PRO)

SSPC 62.2 Envelope Subcommittee (20/2) Screen

Friday (1/27) 2:30 pm–5:00 pm Modena (PRO)

SSPC 62.2 IAQ Subcommittee (12/20) Screen

Friday (1/27) 2:30 pm–5:00 pm Trevi (PRO)

SSPC 62.2 System Subcommittee (12/2) Screen

Friday (1/27) 2:30 pm–5:00 pm Turin (PRO)

SPC 63.1 Method of Testing Liquid Line Filter Driers (6/4) Screen/Electric

Sunday (1/29) 6:00 pm–10:00 pm Anzio (PRO)

SPC 63.2 MOT Liquid Line Filter for Filtration Capability (9/3) Screen/Electric

Sunday (1/29) 2:00 pm–3:00 pm Forum I (Pool)

SPC 64 Methods of Lab Testing Remote Mechanical-Draft Evaporative Refrigerant Condensers (6/5)

Monday (1/30) 10:00 am–11:00 am Modena (PRO)

SPC 70 Method of Testing the Performance of Air Outlets and Air Inlets (11/10) Screen/Electric

Monday (1/30) 8:00 am–12:00 pm Genoa (PRO)

SSPC 72 Standard 72-2014, Method of Testing Open and Closed Commercial Refrigerators and Freezers (15/12) Screen/Electric

Sunday (1/29) 1:00 pm–5:00 pm Venice (EMP)

SPC 78 Method of Testing Flow Capacity of Suction Line Filters and Filter Driers (5/5) Screen/Electric

Sunday (1/29) 3:00 pm–4:00 pm Modena (PRO)

SPC 84 Method of Testing Air-to-Air Heat/Energy Exchangers (20/0) Screen/Electric

Sunday (1/29) 4:15 pm–6:30 pm Tribune (Pool)

SSPC 90.1 Energy Eff. Design of New Bldg. (50/60) Screen/Electric

Saturday (1/28) 8:00 am–12:00 pm Roman IV (PRO)

Sunday (1/29) 9:00 am–12:00 pm FlorentineII (PRO)

Monday (1/30) 8:00 am–12:00 pm Roman IV (PRO)

SSPC 90.1 Envelope Subcommittee (15/30) Screen/Electric

Friday (1/27) 9:00 am–10:00 pm Forum 12 (Pool)

Saturday (1/28) 1:00 pm–8:00 pm Livorno (PRO)

Sunday (1/29) 1:00 pm–8:00 pm Forum 12 (Pool)

SSPC 90.1 Envelope Subcommittee Working Group (10/20) Screen/Electric

Friday (1/27) 4:00 pm–6:00 pm Forum 7 (Pool)

Saturday (1/28) 4:00 pm–6:00 pm Anzio (PRO)

SSPC 90.1 Lighting Subcommittee (12/10) Screen/Electric

Friday (1/27) 9:00 am–10:00 pm Forum 13 (Pool)

Saturday (1/28) 1:00 pm–7:00 pm Consul BR (PRO)

Sunday (1/29) 1:00 pm–8:00 pm Forum 13 (Pool)

SSPC 90.1 Mechanical Subcommittee (25/25) Screen/Electric

Friday (1/27) 9:00 am–10:00 pm Forum 11 (Pool)

Saturday (1/28) 1:00 pm–7:00 pm Roman IV (PRO)

Sunday (1/29) 1:00 pm–8:00 pm Florentine II (PRO)

SSPC 90.1 ECB Subcommittee (12/18) Screen/Electric

Friday (1/27) 3:00 pm–8:00 pm Forum 17 (Pool)

Saturday (1/28) 1:00 pm–5:00 pm Siena (PRO)

Sunday (1/29) 1:00 pm–4:00 pm Forum 2 (Pool)

SSPC 90.1 Format & Compliance Subcommittee (6/6) Screen/Electric

Friday (1/27) 5:00 pm–10:00 pm Forum 18 (Pool)

Saturday (1/28) 1:00 pm–5:00 pm Senate BR (PRO)

Sunday (1/29) 4:00 pm–7:00 pm Forum 2 (Pool)

SSPC 90.2 Energy Eff. Design of New Low Rise Res. Bldg. (22/10) Screen/Electric

Monday (1/30) 2:15 pm–6:15 pm Forum 20 (Pool)

Tuesday (1/31) 1:00 pm–5:00 pm Forum 20 (Pool)

SSPC 90.2 Envelope (12/8) Screen/Electric

Monday (1/30) 6:30 pm–9:30 pm Forum 20 (Pool)

Tuesday (1/31) 8:00 am–12:00 pm Forum 20 (Pool)

SSPC 90.2 Lighting (4/4) Screen/Electric

Monday (1/30) 6:30 pm–9:30 pm Forum 21 (Pool)

Tuesday (1/31) 8:00 am–12:00 pm Forum 21 (Pool)

SSPC 90.2 Mechanical (6/4) Screen/Electric

Monday (1/30) 6:30 pm–9:30 pm Forum 22 (Pool)

Tuesday (1/31) 8:00 am–12:00 pm Forum 22 (Pool)

SPC 90.4 Energy Standard for Data Centers and Telecommunications Buildings (17/20) Screen/Electric

Saturday (1/28) 9:00 am–1:00 pm Venice (EMP)

Monday (1/30) 7:30 am–11:30 am Venice (EMP)

SPC 97 Sealed Glass Tube Method to Test the Chemical Stability of Materials for Use Within Refrigerant Systems (9/6) Screen/Electric

Tuesday (1/31) 9:30 am–11:00 am Forum 18 (Pool)

SSPC 100 Energy Efficiency in Existing Buildings (20/10) Screen/Electric

Tuesday (1/31) 8:00 am–12:00 pm Forum 4 (Pool)

SSPC 100 Alternative to EUI (WG5) (16/10) Screen/Electric

Sunday (1/29) 12:00 pm–2:00 pm Forum 21 (Pool)

SSPC 100 International Target Table and Climate Zones (WG4) (4/5) Screen/Electric

Sunday (1/29) 4:00 pm–6:00 pm Forum 21 (Pool)

SSPC 100 Site/Source and Boundary (WG2) (20/10)

Screen/Electric

Monday (1/30) 6:30 pm–8:30 pm Abruzzi (Pool)

SPC 111 Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation and Air-Conditioning Systems (12) (8/6)

Tuesday (1/31) 8:00 am–12:00 pm Campania (Pool)

SPC 113 Method of Testing for Room Air Diffusion (10/10)

Tuesday (1/31) 3:30 pm–5:00 pm Sicily (EMP)

SPC 118.1 Method of Testing for Rating Commercial Gas, Electric and Oil Service Water Heating Equipment (15/20) Screen/Electric

Sunday (1/29) 9:00 am–11:00 am Senate BR (PRO)

SPC 118.2 Method of Testing for Rating Residential Water Heaters (15/15) Electric

Tuesday (1/31) 1:00 pm–5:00 pm Forum 3 (Pool)

SPC 124 MOT/Rating Combinations Space-Heating and Water Heating Appliances (15/12) Electric

Tuesday (1/31) 8:00 am–12:00 pm Trevi (PRO)

SPC 127 Method of Testing for Rating Air Conditioning Units Serving Data Center (DC) and Other Information Technology Equipment (ITE) Spaces (12/8) Screen/Electric

Tuesday (1/31) 8:00 am–12:00 pm Turin (PRO)

SPC 128 Method of Rating Portable Air Conditioners (6/0)

Sunday (1/29) 2:00 pm–3:00 pm Forum 21(Pool)

SPC 130 MOT/for Rating Ducted Air Terminal Units (20/20) Screen /Electric

Sunday (1/29) 2:00 pm–4:00 pm Forum 18 (Pool)

SSPC 135 BACnet (15/5) Electric

Thursday (1/26) 8:00 am–5:00 pm Forum 4 (Pool)

SSPC 135 BACnet (25/5) Electric

Friday (1/27) 8:00 am–5:00 pm Florentine IV
(PRO)

SSPC 135 BACnet Working Group (25/5) Electric

Friday (1/27) 8:00 am–5:00 pm FlorentineIII
(PRO)

SSPC 135 BACnet (40/10) Electric

Saturday (1/28) 8:00 am–3:30pm FlorentineIII
(PRO)

SSPC 135 BACnet (20/5) Electric

Sunday (1/29) 8:00 am–5:00 pm Abruzzi (Pool)

Sunday (1/29) 8:00 am–5:00 pm Calabria (Pool)

SSPC 135 BACnet (40/10) Electric

Monday (1/30) 8:00 am–12:00 pm Milano IV (PRO)

**SSPC 140: Standard Method of Test for the Evaluation
of Building Energy Analysis Computer Programs
(15/12) Screen/Electric**

Monday (1/30) 2:15 pm–6:15 pm Campania (Pool)

**SSPC 145 Test Method for Assessing the Performance of
Gas Phase Air Cleaning Equipment (10/15) Screen/Electric**

Sunday (1/29) 12:00 pm–3:00 pm Messina (PRO)

**SPC 146 Method of Testing and Rating (Pool) Heaters
(6/6) Electric**

Tuesday (1/31) 8:00 am–12:00 pm Livorno (PRO)

**SPC 147 Reducing the Release of Halogenated
Refrigerants from Refrigerating and Air-Conditioning
Equipment (10/5)**

Tuesday (1/31) 8:00 am–12:00 pm Forum 23 (Pool)

**SSPC 154 Ventilation for Commercial Cooking
Operations (15/10) Screen/Electric**

Sunday (1/29) 8:00 am–12:00 pm Forum 1 (Pool)

**SPC 155P MOT for Rating Commercial Space Heating
Boiler Systems (8/8) Screen/Electric**

Sunday (1/29) 1:00 pm–5:00 pm Forum 3 (Pool)

**SPC 158.1 MOT Capacity of Refrigerant Solenoid
Valves (5/5) Electric**

Sunday (1/29) 5:00 pm–7:00 pm Forum 19 (Pool)

**SPC 158.2 MOT Capacity of Refrigerant Pressure
Regulators (5/5) Electric**

Sunday (1/29) 5:00 pm–7:00 pm Forum 19 (Pool)

**SSPC 160 Criteria for Moisture Control Design
Analysis in Buildings (20/5) Screen/Electric**

Tuesday (1/31) 8:00 am–12:00 pm Capri (PRO)

**SSPC 161 Air Quality within Commercial Aircraft (14/6)
Screen/Electric**

Monday (1/30) 7:45 am–10:45 am Messina (PRO)

**SPC 164 Method of Test for Humidifiers (12/8) Screen/
Electric**

Monday (1/30) 9:00 am–11:00 am Forum 6 (Pool)

**SSPC 169 Climatic Data for Building Design Standards
(6/10) Screen/Electric**

Monday (1/30) 10:00 am–12:00 pm Abruzzi (Pool)

**SSPC 170 Ventilation of Healthcare Facilities (25/25)
Screen/Electric**

Monday (1/30) 4:00 pm–6:00 pm Capri (PRO)

**Tuesday (1/31) 8:00 am–1:00 pm Pompeian IV
(PRO)**

SSPC 170 Ventilation of Health Care Facilities, Natural
Ventilation Work Group (15/0) Screen/Electric

Monday (1/30) 2:00 pm–4:00 pm Capri (PRO)

**SPC 171 Method of Testing Rating Seismic and Wind
Restraints (17/10) Electric**

Tuesday (1/31) 8:00 am–12:00 pm Genoa (PRO)

**SPC 172P Method of Test for Insoluble Materials in
Synthetic Lubricants and HFC Refrigerant Systems
(8/3) Electric**

Tuesday (1/31) 8:00 am–12:00 pm Verona (PRO)

SPC 174P (6/4)

Monday (1/30) 10:00 am–11:00 am Forum 13 (Pool)

**SPC 180 Standard Practice for Inspection and
Maintenance of Commercial-Building HVAC Systems
(20/10) Screen/Electric**

Friday (1/27) 2:00 pm–6:00 pm Forum 4 (Pool)

**SPC 182 MOT Absorption Water-Chilling and Water-
Heating Packages (5/5) /Electric**

Monday (1/30) 11:00 am–12:00 pm Forum 20 (Pool)

**SPC 184P: Method of Test for Field Performance of
Liquid Chilling Systems (13/6) Screen/Electric**

Tuesday (1/31) 8:00 am–12:00 pm Forum 7 (Pool)

**SSPC 185 Methods of Test to Inactivate Micro-
organisms in HVAC Systems with UV-C Lights (7/7)
Screen/Electric**

Saturday (1/28) 8:00 am–11:00 am Forum 22 (Pool)

**SSPC 188 Legionellosis: Risk Management for Building
Water Systems (47/20) Screen**

Tuesday (1/31) 8:00 am–12:00 pm Milano IV (PRO)

Tuesday (1/31) 3:45 pm–5:45 pm Milano IV (PRO)

Wednesday (2/1) 8:00 am–12:00 pm FlorentineII (PRO)

SSPC 189.1 ASHRAE/USGBC/IES Standard for the Design of High-Performance Green Buildings except Low-Rise Residential Buildings (67/50) Screen/Electric

Tuesday (1/31) 8:00am–10:00am Florentine III/IV (PRO)

Wednesday (2/1) 8:00 am–12:00 pm Florentine III/IV (PRO)

SSPC 189.1 Working Group 6 (Water Use) (30/20) Screen/
Electric

Tuesday (1/31) 10:00 am–12:30 pm Roman IV (PRO)

SSPC 189.1 Working Group 7 (Energy Efficiency) (67/30)
Screen/Electric

Tuesday (1/31) 10:00 am–1:00 pm Florentine III/IV (PRO)

SSPC 189.1 Working Group 9 (Materials and Resources)
(30/20) Screen/Electric

Tuesday (1/31) 1:00 pm–3:00 pm Roman IV (PRO)

SSPC 189.1 Working Group 8 (IEQ) (30/30) Screen/Electric

Tuesday (1/31) 1:00 pm–4:00 pm Roman III (PRO)

SSPC 189.1 Working Group 7.5 (30/30) Screen/Electric

Tuesday (1/31) 1:30 pm–4:30 pm Florentine III/IV (PRO)

SSPC 189.1 Working Group 5 (Site Sustainability) (30/20)
Screen/Electric

Tuesday (1/31) 4:00 pm–6:00 pm Roman III (PRO)

SSPC 189.1 Working Group 10 (20/20) Screen /Electric

Tuesday (1/31) 5:00 pm–7:00 pm Roman IV (PRO)

SPC 189.3P Design, Construction and Operation of Sustainable High Performance Health Care Facilities (15/15) Screen/Electric

Monday (1/30) 8:00 am–12:00 pm Forum 7 (Pool)

SPC 191 Standard for the Efficient Use of Water in Building and Mechanical Systems (10/4) Screen/Electric

Sunday (1/29) 3:00 pm–5:00 pm Forum 1 (Pool)

SPC 194 Method of Test for Direct Expansion Ground Source Heat Pumps (5/10) Screen/Electric

Sunday (1/29) 1:00 pm–3:00 pm Forum 4 (Pool)

SPC 195 Method of Test for Rating Air Terminal Unit Controls (5/4)

Tuesday (1/31) 10:00 am–12:00 pm Forum 6 (Pool)

SPC 196P MOT/ Measuring Refrigerant Leak Rates (7/10) Screen/Electric

Sunday (1/29) 6:00 pm–10:00 pm Forum 18 (Pool)

SPC 199P Method of Testing the Performance of Industrial Pulse Cleaned Dust Collectors (14/6)

Sunday (1/29) 8:00 am–12:00 pm Patrician (Pool)

SPC 200-2015R Methods of Testing Chilled Beams (10/10) Electric

Monday (1/30) 8:00 am–12:00 pm Livorno (PRO)

SSPC 202 Commissioning Process for Buildings and Systems (25/10) Screen/Electric

Monday (1/30) 8:00 am–12:00 pm Calabria (Pool)

SSPC 202 Subcommittee: GLD 0-2013 The Commissioning Process (10/10) Screen/Electric

Saturday (1/28) 10:00 am–12:00 pm Calabria (Pool)

SSPC 202 Subcommittee: GLD 1.1 The HVAC&R Technical Requirements for Commissioning Process (10/10)

Screen/Electric

Saturday (1/28) 12:00 pm–2:00 pm Calabria (Pool)

SSPC 202 Subcommittee for STD 202 (15/10) Screen/Electric

Saturday (1/28) 2:00 pm–3:00 pm Calabria (Pool)

SPC 204P MOT/Rating Micro Combined Heat and Power Devices (15/10)

Monday (1/30) 6:30 pm–9:30 pm Genoa (PRO)

SPC 205 Standard Representation of Performance Simulation Data for HVAC&R and Other Facilities (20/20) Screen/Electric

Tuesday (1/31) 8:00 am–12:00 pm Pompeian III (PRO)

SPC 205 Working Groups (20/5) Screen/Electric

Sunday (1/29) 9:00 am–12:00 pm Tribune (Pool)

SPC 207P Laboratory Method of Test of Fault Detection and Diagnostics Applied Commercial Air-Cooled Packaged Systems (20/20) Screen

Monday (1/30) 8:00 am–10:00 am Pompeian III (PRO)

SPC 207 Airflow Working Group (20/0) Screen/

Monday (1/30) 10:00 am–12:00 pm Pompeian III (PRO)

SPC 207 Economizer Working Group (20/0) Screen

Monday (1/30) 4:30 pm–6:30 pm Pompeian III (PRO)

SPC 207 Refrigerant Working Group (20/0) Screen

Monday (1/30) 6:30 pm–8:30 pm Pompeian III (PRO)

SPC 208P Method of Test for Determining Hydronic System Balance Valve Capacity (10/5)

Tuesday (1/31) 7:00 am–9:00 am Tribune (Pool)

SPC 209P Energy Simulation Aided Design (45/14) Screen/Electric

Monday (1/30) 2:15 pm–6:15 pm Milano IV (PRO)

SPC 209P Construction/Operation Subcommittee (10/5)

Sunday (1/29) 6:00 pm–10:00 pm Forum 22 (Pool)

SPC 209P Design Development/Construction Documents Subcommittee (10/5)

Sunday (1/29) 6:00 pm–10:00 pm Forum 23 (Pool)

SPC 209P Predesign Subcommittee (10/5)

Sunday (1/29) 6:00 pm–10:00 pm Forum 21 (Pool)

SPC 209P Conceptual/Schematic Design Subcommittee (10/5)

Monday (1/30) 8:00 am–12:00 pm Forum 21 (Pool)

SPC 209P Resources Subcommittee (10/5)

Monday (1/30) 8:00 am–12:00 pm Forum 22 (Pool)

SPC 210 Method of Testing for Rating Commercial Walk in Coolers and Freezers (6/20) Screen/Electric

Monday (1/30) 8:00 am–12:00 pm Forum 11 (Pool)

**SPC 211 Commercial Building Energy Audits (18/15)
Screen/Electric**

Monday (1/30) 8:00 am–12:00 pm Forum 1 (Pool)

SPC 212P Method of Test for Determining Energy Performance and Water-Use Efficiency of Add-On Evaporative Pre-Coolers for Unitary Air Conditioning Equipment (7/5) Screen/Electric

Tuesday (1/31) 8:00 am–12:00 pm Forum 3 (Pool)

SPC 213P Method of Calculating Moist Air Thermodynamic Properties (8/5)

Tuesday (1/31) 8:00 am–12:00 pm Forum 12 (Pool)

SPC 214P Standard for Measuring and Expressing Building Energy Performance in a Rating Program (14/10) Screen/Electric

Monday (1/30) 2:15 pm–6:15 pm Forum 13

SPC 215P Method of Test to Determine Leakage of Operating HVAC Air-Distribution Systems (15/15) Screen /Electric

Monday (1/30) 2:15 pm–6:15 pm Forum 2 (Pool)

SPC 216 MOT for Determining Application Data of Overhead Circulator Fans (12/10) Screen/Electric

Monday (1/30) 2:15 pm–5:15 pm Forum 6 (Pool)

SPC 217 Non-Emergency Ventilation in Enclosed Road, Rail and Mass Transit Facilities (15/5) Screen/Electric

Tuesday (1/31) 7:30 am–12:00 pm Forum 1 (Pool)

SPC 218P–MOT for Lubricant and Refrigerant Miscibility Determination (9/6) Screen/Electric

Monday (1/30) 8:00 am–10:00 am Forum 18 (Pool)

SPC 219 Method of Testing the Ability of Liquid Line Filter Driers or Absorbents to Remove Organic Acid (5/3) Screen/Electric

Monday (1/30) 10:00 am–12:00 pm Siena (PRO)

SPC 220P Method of Testing for Rating Small Commercial Blast Chillers, Chiller Freezers and Freezers (8/6) Electric

Monday (1/30) 5:15 pm–6:15 pm Forum 6 (Pool)

SPC 221 Test Method to Measure and Score the Operating Performance of an Installed Constant Volume Unitary HVAC System (18/10) Screen/Electric

Tuesday (1/31) 3:30 pm–5:30 pm Forum 1 (Pool)

SPC 222P Method of Test for Electric Power Drive Systems (5/3) Electric

Tuesday (1/31) 8:00 am–12:00 pm Forum 11 (Pool)

GUIDELINE PROJECT COMMITTEES (GPC) AND (SGPC)

GPC 1.2 The Commissioning Process for Existing HVAC&R Systems (18/6) Screen/Electric

Friday (1/27) 8:00 am–12:00 pm Siena (PRO)

GPC 1.3 Building Operation and Maintenance Training for the HVAC&R Commissioning Process (8/2) Electric

Tuesday (1/31) 1:00 pm–5:00 pm Consul BR (PRO)

GPC 4-2008R Preparation of Operating and Maintenance Documentation for HVAC&R Systems (6/2)

Sunday (1/29) 8:00 am–12:00 pm Forum 12 (Pool)

GPC 11 Field Testing of HVAC Controls Components (7/5) Screen/Electric

Saturday (1/28) 9:00 am–12:00 pm Forum 18 (Pool)

GPC 22 Instrumentation for Monitoring Central Chilled Water Plants (6/6) Screen/Electric

Tuesday (1/31) 10:00 am–12:00 pm Forum 2 (Pool)

GPC 23/TC 9.3 Rail Subcommittee (14/20) Screen/Electric

Monday (1/30) 2:15 pm–3:30 pm Pisa (PRO)

GPC 27P Measurement Procedures for Gaseous Contaminants in Indoor Environments (7/4) Electric

Sunday (1/29) 1:00 pm–3:00 pm Capri (PRO)

GPC 29 Guideline for Risk Management (6/4)

Sunday (1/29) 1:00 pm–5:00 pm Genoa (PRO)

GPC 35 Method for Determining the Energy Consumption Caused By Air-Cleaning and Filtration Devices (10/40) Screen/Electric

Monday (1/30) 8:00 am–12:00 pm Forum 12 (Pool)

GPC 36P High Performance Sequences of Operation for HVAC Systems (30/20) Screen/Electric

Monday (1/30) 8:00 am–12:00 pm Forum 4 (Pool)

GPC 37 Upper Room Ultraviolet Germicidal (UV-C) Devices to Control the Transmission of Airborne Pathogens (7/7) Screen/Electric

Saturday (1/28) 12:00 pm–3:00 pm Forum 22 (Pool)

GPC 38P Guideline for Using Metal Pressure Vessels to Test Materials Used in Refrigeration Systems (7/5)

Monday (1/30) 4:15 pm–6:15 pm Patrician (Pool)

GPC 40P Refrigerant Oil Description (6/6) Screen/Electric

Tuesday (1/31) 8:00 am–9:30 am Forum 18 (Pool)

GPC 41 Design, Installation and Commissioning of VRF Systems (8/16) Screen/Electric

Monday (1/30) 8:00 am–12:00 pm Forum 2 (Pool)

SGPC 10 Interaction Affecting the Achievement of Acceptable Indoor Environments (10/10) Electric
Sunday (1/29) 9:00 am–12:00 pm Forum 22 (Pool)

SGPC 13 Specifying Building Automation Systems (9/10) Screen /Electric
Saturday (1/28) 8:00 am–12:00 pm Forum 13 (Pool)

US TAG to ISO/TC 86 (20/10) Screen/Electric
Monday (1/30) 8:00 am–10:00 am Turin (PRO)

US TAG to ISO/TC 142 Cleaning Equipment for Air and other Gases (30/30) Screen/Electric
Saturday (1/28) 2:30 pm–3:15 pm Florentine II (PRO)

US TAG to ISO/TC 163 Thermal Performance and Energy in a Building Environment (18/11) Screen/Electric
Tuesday (1/31) 3:00 pm–4:30 pm Pompeian IV (PRO)

ISO/TC 142 WG 1 (10/5) Screen/Electric
Tuesday (1/31) 8:00 am–10:00 am Pisa (PRO)

JWG ISO/TC 163/WG4 and ISO/TC 205 (18/11) Screen/Electric
Tuesday (1/31) 2:30 pm–3:00 pm Pompeian IV (PRO)

US Tag to ISO/TC 205 (22/12) Screen/Electric
Tuesday (1/31) 1:00 pm–2:30 pm Pompeian IV (PRO)

ISO 817 MA (23/11) Screen/Electric
Tuesday (1/31) 8:00 am–12:00 pm Abruzzi (Pool)

ISO 817 MA-Flammability (15/10) Screen/Electric
Monday (1/30) 8:00 am–9:00 am Tribune (Pool)

ISO 817 MA-Toxicity (15/10) Screen/Electric
Monday (1/30) 8:00 am–10:00 am Abruzzi (Pool)

ISO 817 MA–Design and Nomenclature (15/10) Screen/Electric
Monday (1/30) 9:00 am–10:00 am Tribune (Pool)

ISO 17584 (15/10) Screen
Wednesday (2/1) 7:00 am–10:00 am Messina (PRO)

OTHER

gbXML (10/0)
Tuesday (1/31) 12:00 pm–1:00 pm Patrician (Pool)

USNC/IIR (20/20)
Tuesday (1/31) 2:00 pm–4:00 pm Forum 12 (Pool)

USNT/IEA (20/10)
Tuesday (1/31) 4:00 pm–6:00 pm Forum 12 (Pool)

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