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2017 ASHRAE Annual Conference • June 24 – 28 • Long Beach, CA

Your Guide to the ASHRAE



# 2017 Annual Conference

June 24 – 28 | Long Beach, CA

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

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### ASHRAE EVENTS APP

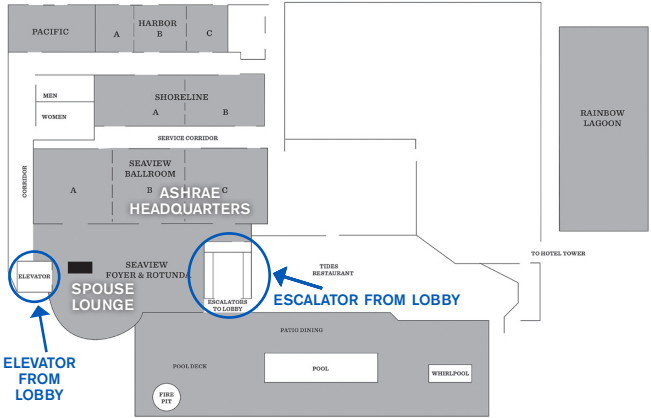
Update your ASHRAE App to access the meeting agenda with venue floor plans, social events and tips for your time in Long Beach. The app also features the ability to view Virtual Conference presentations, a customizable schedule, speaker evaluations, and live audience polling. New this year, message boards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



Get the free mobile app at: [www.ashrae.org/app](http://www.ashrae.org/app)

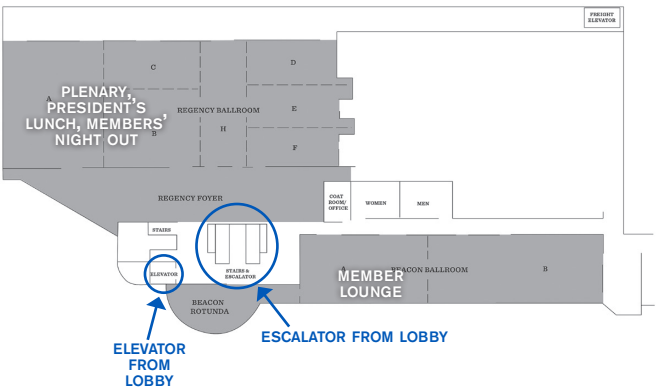
## HYATT REGENCY – LOWER LEVEL (FIRST FLOOR)

From the lobby, take the escalator near The Cove Coffee Bar down to the 1st floor and turn right to access the meeting space on the 1st floor. An elevator is located next to The Cove Lounge in the main lobby that provides access as well to the Lower (1st) and Upper (4th) Levels.



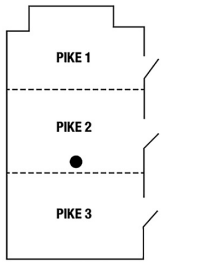
## HYATT REGENCY – UPPER LEVEL (FOURTH FLOOR)

From the main entrance of the hotel, enter the lobby and take the escalator or stairs on your right to access the 4th floor. The first set of escalators stop on the Mezzanine level which will take you to Convention Center.



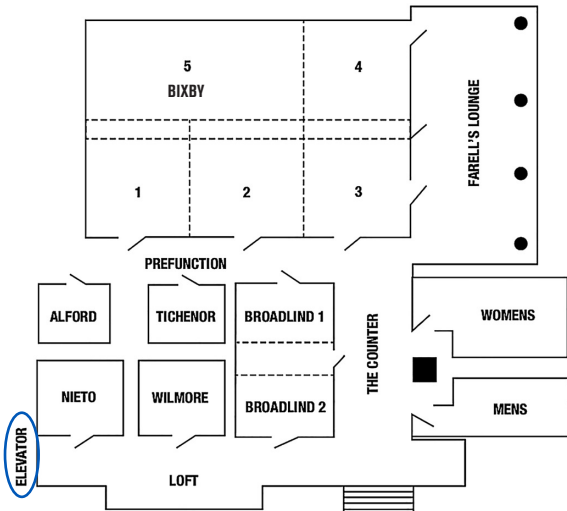
## RENAISSANCE – 1<sup>ST</sup> FLOOR

From the main entrance, go through the lobby and past the Promenade Café and turn left to access the meeting rooms on the 1st floor.



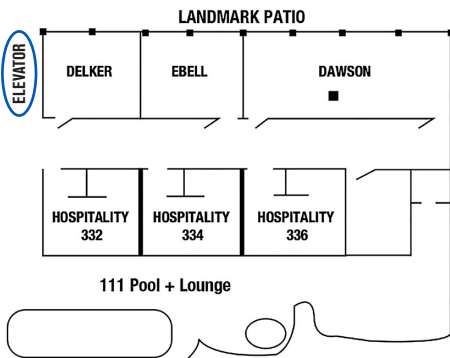
## RENAISSANCE – 2<sup>ND</sup> FLOOR

From the main entrance, take the elevators or stairs on your right to the meeting space on the 2nd floor.



## RENAISSANCE – 3<sup>RD</sup> FLOOR

From the main entrance, take the elevators on your right to the meeting space on the 3rd floor.



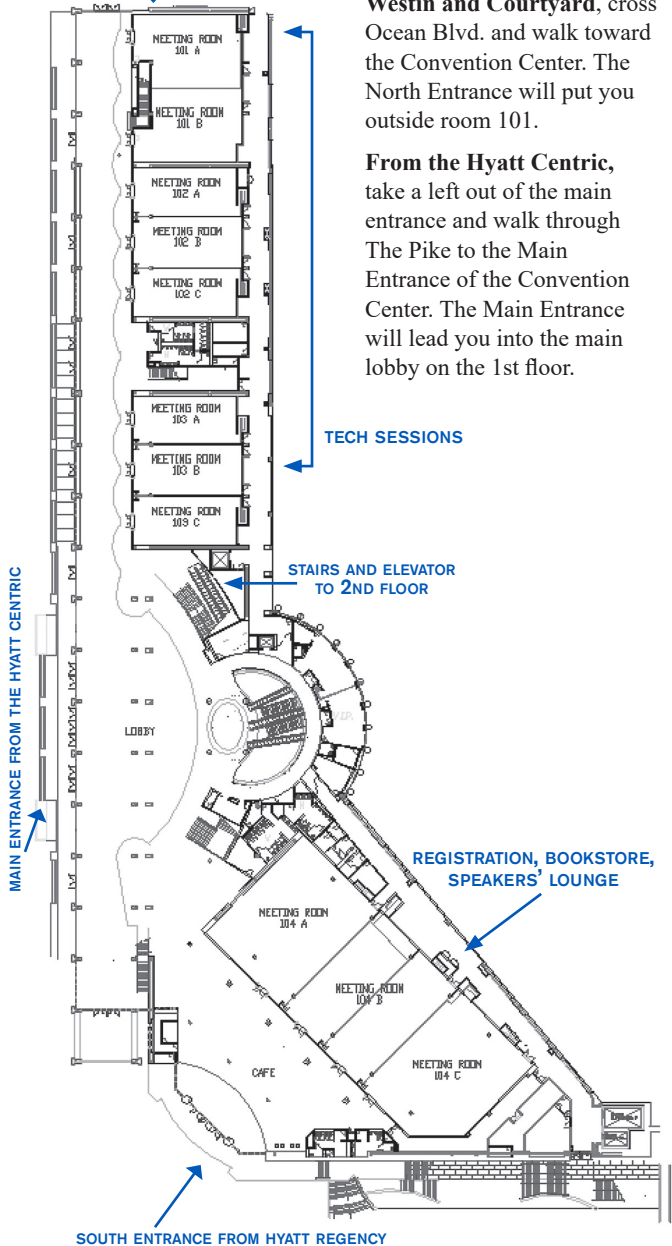
## LONG BEACH CONVENTION AND ENTERTAINMENT CENTER – LEVEL 1

**From the Hyatt Regency**, exit the doors on the Mezzanine level (one floor up from the lobby) and enter the Convention Center door directly across which will put you in front of 104 (Registration, Bookstore and Speakers Lounge).

**NORTH ENTRANCE FROM RENAISSANCE, WESTIN, AND COURTYARD**

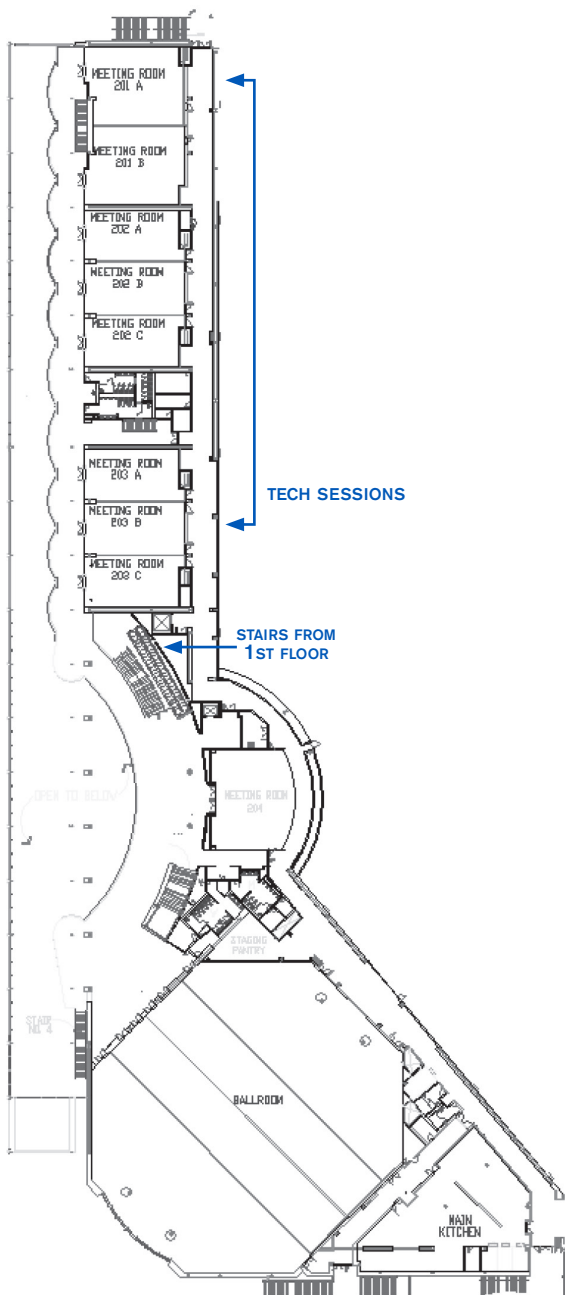
**From the Renaissance, Westin and Courtyard**, cross Ocean Blvd. and walk toward the Convention Center. The North Entrance will put you outside room 101.

**From the Hyatt Centric**, take a left out of the main entrance and walk through The Pike to the Main Entrance of the Convention Center. The Main Entrance will lead you into the main lobby on the 1st floor.



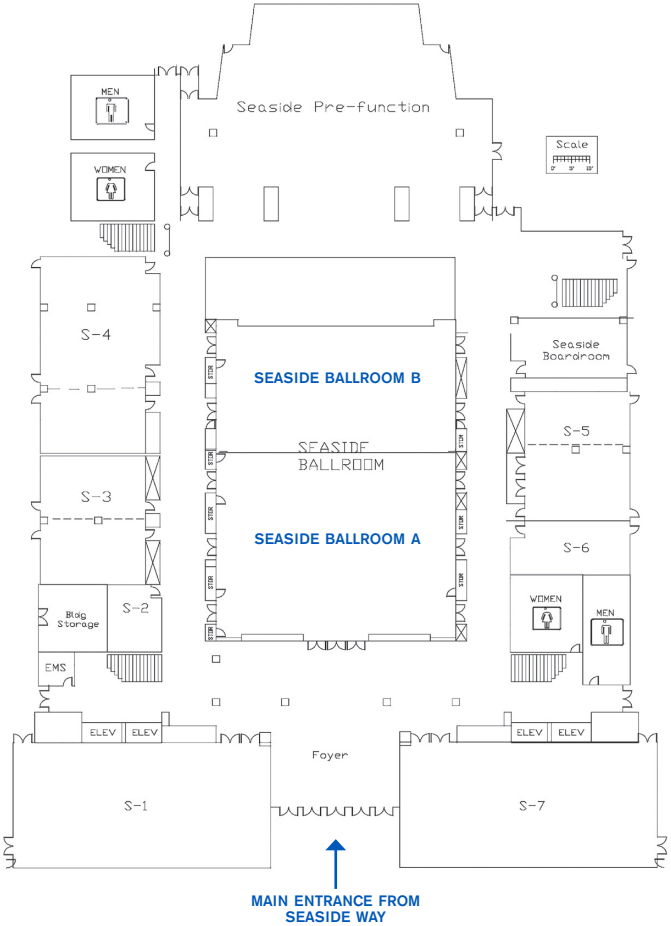
## LONG BEACH CONVENTION AND ENTERTAINMENT CENTER - LEVEL 2

From the first floor take the elevators or stairs located outside of 103 to the 2nd level.

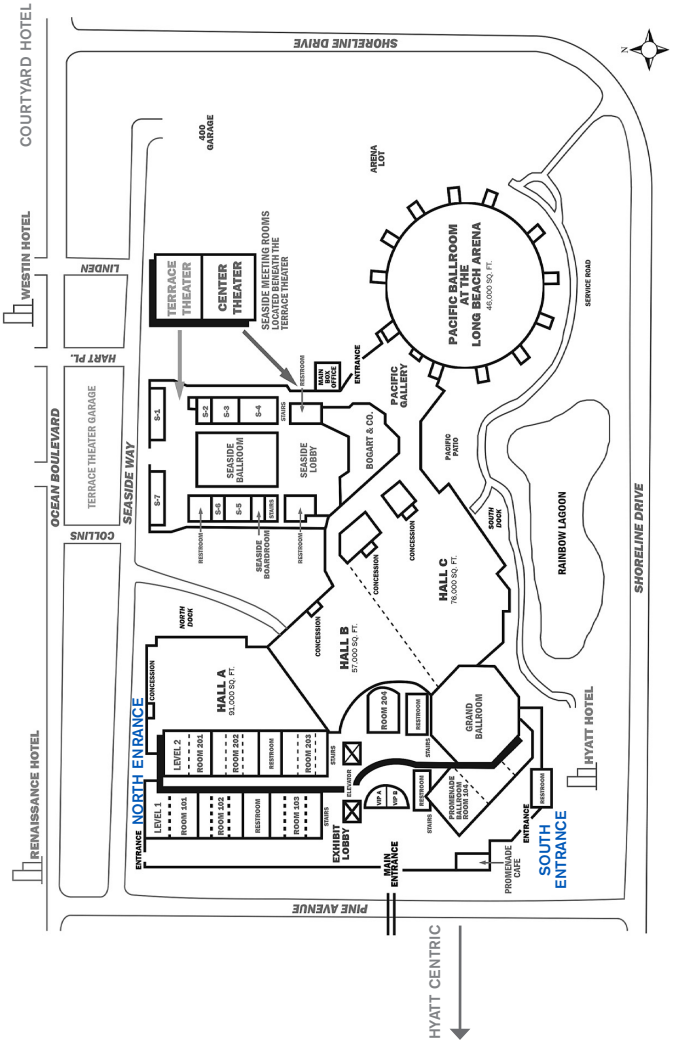


## LONG BEACH CONVENTION AND ENTERTAINMENT CENTER – SEASIDE ROOMS

From the North Entrance of the Convention Center (outside room 100), walk outside and take the stairs on your left down to Seaside Way. Turn right on Seaside way and walk past the loading dock to the Seaside Entrance. Follow the ASHRAE signs to the entrance.



# LONG BEACH CONVENTION AND ENTERTAINMENT CENTER – CAMPUS MAP





## CONFERENCE SPONSORS

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



**Globally Recognized. Industry Respected.**

Sponsor of the ASHRAE Bookstore



Sponsor of Lanyards

## **CHAPTER AND SOCIETY OFFICIALS**

*A special thanks to all the members in the Orange Empire and Southern California Chapters who helped make the 2017 ASHRAE Annual Conference a success!*

### **ORANGE EMPIRE CHAPTER OFFICERS**

Eric Decker, President  
Ken Golovko, President-Elect  
Carlton Marcus Haywood, Secretary  
Greg Glover, Treasurer

### **SOUTHERN CALIFORNIA CHAPTER OFFICERS**

Jay Madden, President  
Omar Rojas, President-Elect  
Ricson Chude, PE, Secretary  
Brian James, Treasurer

### **LONG BEACH HOST COMMITTEE**

General Chair, Jeff Conrad  
Vice Chair, Ricson Chude  
Sessions, Rob Fried and Steve Linn  
Entertainment, Lee Riback  
Hospitality, Homeria Movahedi  
Information, Ben Chesser, Ana Gutierrez, Heather Schopplein  
Tours, John Sawyer  
Sustainability Project and Women in ASHRAE Happy Hour,  
Joanne Choi

### **ASHRAE OFFICERS**

Timothy G. Wentz, P.E., Fellow ASHRAE, HBDP, President  
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Sheila J. Hayter, P.E., Fellow ASHRAE, Treasurer  
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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**

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Dennis L. Alejandro	Robert (Alan) Neely
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Charlie D. Curlin, Jr.	Frank H. Schambach
Gary C. Debes	Leon Shapiro
Jason W. DeGraw	Sarah E. Maston, Consultant
Melanie Derby	William K. Klock, BOD Ex-Officio
Joseph T. Firrantello	Bjarne W. Olesen, Coordinating Officer
Jennifer E. Leach	
James F. Liston, Jr.	

## 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. 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.

### VENUE ADDRESSES, TELEPHONE

#### **Long Beach Convention and Entertainment Center (LBCC)**

300 E Ocean Blvd, Long Beach, CA 90802  
562-436-3636

#### **Hyatt Regency Long Beach**

200 S. Pine Ave., Long Beach, CA 90802  
562-491-1234

#### **Renaissance Long Beach**

111 East Ocean Blvd, Long Beach, CA 90802  
562-437-5900

#### **Hyatt Centric at The Pike Long Beach**

285 Bay St., Long Beach, CA 90802  
562-432-1234

#### **The Westin Long Beach**

333 East Ocean Blvd., Long Beach, CA 90802  
562-436-3000

#### **Courtyard Long Beach**

500 East First Street, Long Beach, CA 90802  
562-435-8511

### 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 room 104 on the 1st floor of the LBCC. 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 at the Hyatt Regency, Renaissance and LBCC. Due to the number of users, please limit usage to functions that do not use excessive bandwidth such as Facebook, YouTube, streaming videos, etc.

The credentials are the same for the Hyatt and the Renaissance:

**Network: PSAV\_High\_Speed**

**Passcode: ashrae2017**

*\*network and passcode are case sensitive*

The credentials for the Long Beach Convention Center (LBCC) are:

**Network: ashrae2017**

**Password: longbeach**

*\*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 Long Beach. App features also include the capability to view Virtual Conference presentations from your mobile device, a customizable schedule, an attendee list, and speaker evaluations. ***New this year, message boards to interact with attendees!***

To download the app, visit [www.ashrae.org/app](http://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 the Hyatt Regency nor the Renaissance.

## **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 Annual Conference. By registering for this conference, you agree to allow ASHRAE to use your photo in any ASHRAE-related publications or website.



## WHAT TO WEAR

Business casual attire is appropriate for meetings and social events; however, Members' Night Out will be beach attire.

## LOST AND FOUND

Items found during the conference should be turned into the staff in the ASHRAE headquarters room, Seaview BC, 1st Floor of the Hyatt or ASHRAE registration located in room 104, 1st floor of the LBCC. The ASHRAE App also has a Message Board called "Lost and Found" where attendees can post about items lost or found while at the Conference.

## 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](mailto: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.

## CONFERENCE PAPERS

During the Annual and Winter Conferences, papers presented in the technical and conference paper sessions can be purchased in the ASHRAE Bookstore onsite, as individual hard copies or a collection of downloadable PDFs. After the conference, all papers can be purchased in the ASHRAE Bookstore online ([ashrae.org/bookstore](http://ashrae.org/bookstore)). Final technical papers are published with discussion in ASHRAE Transactions. Papers are not available for seminars, forums, panels or debates. All papers published between the years 1980–1997 may be searched online in the Abstract Archive Center. Access to the Abstract Archives is a member benefit. For ordering information, contact ASHRAE Customer Service at 1-800-527-4723 or [cservice@ashrae.org](mailto:cservice@ashrae.org).

## 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 Long Beach Virtual Conference allows you to view presentations and to interact with an online audience through a discussion board.

If you registered for the complete Conference, as an attendee you should have or will receive an email with login information to access the Virtual Conference. One-day conference attendees you will also receive an email with login information to access the Virtual Conference for the single-day purchased. The email will include a link to the Long Beach Virtual Conference. If you do not have your password, go to [www.ashrae.org/longbeachvirtual](http://www.ashrae.org/longbeachvirtual) 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, July 12. Presentations available online for 18 months.

A full slate of technical programs will be posted beginning Monday, June 26, of the sessions that were presented the previous day, with additional content posted through Thursday, June 29.

Access to the Long Beach Virtual Conference is free with your conference registration. To register only for the Virtual Conference, go to ASHRAE Registration in 104, 1st floor of LBCC, or register online.

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

**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. If you plan to participate in the city's "Show Your Badge" program (*see page 17 for details*) to receive discounts at local restaurants and attractions, just simply take your badge with you.

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, follow the instructions below based on your location:

### **Long Beach Convention Center (LBCC)**

Upon occurrence of a medical emergency, dial 515 immediately from any beige house phone to be connected to the on-duty personnel responsible for treatment as well as any outside emergency agencies deemed necessary. This allows for better control over the speed and accuracy of information given to authorities when a timely response is necessary. The Security Office is 24/7 and is located in the service corridor behind Hall C. An EMT will be onsite during the Conference and located at the bottom of the exhibit hall escalators on the right side. Escalators are located in the center of the lobby.

### **Hyatt Regency**

The in-house number to call for emergencies is ext. 55. This may be called from any house phone in the hotel. Security operates 24-hours per day. Regularly scheduled patrols of the hotel take place. Long Beach police, fire, and paramedics will be contacted by hotel security when necessary.

### **Renaissance**

From any house phone, dial 9 + 911 to reach the fire department or police. Dial 0 to call the hotel operator or 2675 for hotel security.

The closest hospital is St. Mary's Hospital located at 1050 Linden Avenue. The phone number is 562-491-9000.

## **FIRE EMERGENCY... PREPAREDNESS IN HOTELS**

In case of a fire, follow the instructions below based on your location. It is important not to panic. If a fire emergency does in fact happen, take all cues from security and hotel staff.

### **Long Beach Convention Center (LBCC)**

In the event that we experience a fire alarm, strobe lights and alarm horns will be activated. The Security Department will make a general announcement over the PA system to acknowledge the activation of the alarm, to inform everyone that the Fire Department is responding and to advise them to stand by for further instructions. After the Fire Department has investigated the source of the alarm, there will be an announcement declaring any necessary action with follow up announcements as required. If no action is necessary, as in the case of a false alarm, an announcement will follow stating that all areas are clear and systems are operational.

### **Hyatt Regency**

In case of a fire, the fire alarm will sound and instructions will be announced over the PA system. The PA system services the entire hotel including meeting space and guest rooms.

## **Renaissance**

Familiarize yourself with the meeting space and make sure you are aware of the closest emergency exits. In the event of a fire, an alarm will sound.

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.

## **MOTHERS ROOM**

Stop by the registration desk located in room 104 at LBCC for more information about a room available for nursing mothers.

## **MEALS**

Meals are not included in your conference registration, however, we know that sometimes you have limited time to grab a quick meal between meetings and technical sessions. Here are few grab-and-go options, as well as other dining options, in and nearby our Conference venues. See page 17 for more information on discounts at local restaurants with the Show Your Badge Program.

### **Hyatt Regency**

#### **COVE Coffee Bar**

5:30 am – 8:00 pm

Located in the main lobby, COVE Coffee Bar serves Starbucks coffee and offers grab-and-go options for a quick breakfast, lunch and dinner.

#### **COVE Lounge**

4:00 pm – Midnight

Located in the main lobby, behind COVE Coffee Bar, COVE Lounge serves local micro-brews on tap and appetizers. Dinner menus also available.

#### **Tides Restaurant**

Breakfast served 6:00 am – 11:30 am and Lunch served from 11:30 am -2:00 pm.

### **Long Beach Convention Center**

#### **Pacific Cafe**

Saturday/Sunday: 7:00 am – 2:00 pm

Monday: 7:00 am – 6:00 pm

Tuesday: 7:00 am – 5:00 pm

Wednesday: 7:00 am – 1:00 pm

Located in the main lobby of LBCC, near room 104, the Pacific Café offers Starbucks Specialty Coffee, Pastries, Grab-and-Go, Flat Bread Pizza, Paninis, Assorted Beverages, Chips, & Candy.



### **Food Cart in Seaside Foyer**

Sunday-Tuesday: 7:00 am – 2:00 pm

A food cart will be set up in the Seaside rooms at the Convention Center which will include Starbucks coffee, Grab-and-Go sandwiches and salads, assorted beverages, chips and candy.

### **Food Trucks**

Sunday – Tuesday: 11:00 am – 3:00 pm

Food Trucks, although not guaranteed, are often regular attendees at LBCC. Food trucks typically park around lunch time at the Promenade Plaza, near the main entrance to the LBCC. Most food trucks in Long Beach accept both cash and credit cards.

## **Renaissance**

### **Starbucks**

5:30 am – 4:00 pm (Mon-Fri) and

6:00 am -4:00 pm (Sat-Sun)

Starbucks is located in the main lobby and coffee, pastries and other grab-and-go items.

### **Promenade Café**

6:00 am – 10:00 am (Mon-Fri) and

7:00 am – 11:00 am (Sat-Sun)

Promenade Café is located on the lobby level and is typically open for breakfast only.

### **SIP Bar + Lounge**

11:00 am – 11:00 pm (Sun-Thurs) and

11:00 am – Midnight (Fri-Sat)

Enjoy a cocktail, apps and light lunch and dinner items.

SIP is located on the lobby level.

## **THINGS TO DO IN LONG BEACH**

The Long Beach Host Committee put together an interactive map highlighting great restaurants, fun attractions, and other things to do and places to see while you are in Long Beach.

You can scan the QR code below to access the interactive map.



Stop by the Host Committee desk in room 104 at the LBCC to get more information.

## SHOW YOUR BADGE PROGRAM

Thanks to the Long Beach Convention and Visitors Bureau (LBCVB), a program has been created called "Show Your Badge" specifically for conference attendees to enjoy your time in Long Beach with discounts at restaurants, attractions, shopping and more. All you have to do is take your ASHRAE Conference badge with you and show it at certain local businesses to receive discounts. Check out the ASHRAE app or stop by the Host Committee desk located in room 104 at the Long Beach Convention Center for specific details related to offered discounts.

### The following local businesses are participating:

#### Attractions

Harbor Breeze Cruises  
International City Theatre  
Long Beach Boat Rentals  
Sunseeker Tours  
The Laugh Factory  
Wheel Fun Rentals  
Long Beach Segway Tours

#### Dining

Alegria Cocina Latina  
Berlin Bistro  
BO Beau Kitchen + Roof Tap  
Bubba Gump  
Buono's Pizzeria  
District Wine  
Fuego at the Maya  
George's Greek Café  
Gladstone's  
Long Beach Café  
Michael's Pizzeria  
P.F. Chang's China Bistro  
Parkers Lighthouse  
Rock Bottom Brewery  
Sevilla

Shannon's on Pine  
The Sky Room  
The Spoon Bistro  
Utopia Restaurant  
The Pie Bar  
Modica's  
The Brass Lamp

#### Shopping

Raindance  
Village Treasures  
World Trade Office Supplies

#### Other

Dapper Barber & Shop  
Secure Sedan  
Shore Business Center  
Reserve Limo

*\*All offers subject to availability and change per the CVB. Discounts do not include sales tax, gratuity or alcoholic beverages unless otherwise specified.*

## GUEST GUIDE

### ASHRAE MEMBER LOUNGE

#### Beacon A, 4th Floor, Hyatt Regency

The ASHRAE Member Lounge is open daily for all individuals who are registered for the Conference. Light refreshments are available in the morning each day and beverages are available all afternoon. Members of the Long Beach 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 room 104, 1st floor, LBCC.

### SPOUSE LOUNGE

#### Seaview Rotunda, 1st Floor, Hyatt Regency

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.

#### Hours:

Saturday, June 24	7:30 a.m.–3:00 p.m.
Sunday, June 25	7:30 a.m.–4:00 p.m.
Monday, June 26	7:30 a.m.–4:00 p.m.
Tuesday, June 27	7:30 a.m.–4:00 p.m.
Wednesday, June 28	7:30 a.m.–1:00 p.m.

Use the ASHRAE App's new "Let's Hang Out" discussion board to connect with other guests. Download the ASHRAE app at [www.ashrae.org/app](http://www.ashrae.org/app).

### MEET AND GREET

#### Beacon Rotunda, 4th Floor, Hyatt Regency

Monday, June 26

9:30-11 a.m.

The Meet and Greet, open to all registered guests, gives guests an opportunity to meet with old friends and greet new ones. The Meet and Greet features a special lecture on the interwar era Art Deco architecture of Long Beach by expert and enthusiast John Thomas, historic preservation consultant and co-author of Long Beach Art Deco and past president of the Art Deco Society of Los Angeles. The lecture is entitled "A New Deal for Long Beach Architecture: Art Deco, Streamline Moderne, and the Influence of the Modern Design Movement, 1925–1940."

John will discuss the design influences of Art Deco, and its variant Streamline Moderne, which shaped Long Beach during the period of rapid growth from 1925 through 1940. Using both vintage and contemporary photography he will bring to life the use of "modern" architecture in Public Works Administration and related New Deal Projects. The lecture will also include an overview of the legendary RMS Queen Mary oceanliner.

*Light refreshments will be served.*

## SOCIAL EVENTS

### PLENARY SESSION KEYNOTE SPEAKER – DERRECK KAYONGO

Regency Ballroom, 4th Floor, Hyatt Regency  
Saturday, June 24  
3:15 – 5:30 p.m.

Derreck Kayongo will share his courageous story of survival and discovery with undeniable charm, palpable passion, and endearing wit at the Conference Plenary, Saturday June 24. Kayongo, CEO of the Center for Civil and Human Rights & Founder of the Global Soap Project, brings his story and guiding principles, coined as S.E.L.F. (Service, Education, Leadership and Faith) to life in emotionally packed presentations that stay with you long after his closing remarks.

### WELCOME PARTY

Aquarium of the Pacific  
Saturday, June 24  
7:00 – 9:00 p.m.  
Cost: \$60

This is a Welcome Party you don't want to miss! The event takes place at the Aquarium of the Pacific. Enjoy a cocktail and hors d'oeuvres while catching up with old friends with a background of colorful, underwater views as the Conference kicks off with the traditional Welcome Party. The entire Aquarium will be open during the party with access to over 11,000 animals and over 50 exhibits. You may even be greeted by a special animal guest. Two Sea Otter shows will take place during the party.

Attendees are encouraged to take a 10 minute stroll on the boardwalk from partner hotels to the Aquarium. Host Committee members will be scattered along the path from the Hyatt to help you find your way. Limited shuttle service will be available from the main entrance of the Hyatt with shuttles departing at 6:45 p.m. Walking maps are available in the ASHRAE App and at the Registration desk located in 104 at the Long Beach Convention Center.

### WOMEN IN ASHRAE HAPPY HOUR

BO-Beau Kitchen + Roof Tap  
144 Pine Ave.  
Monday, June 26  
4:30 – 6:30 p.m.  
Cost: \$20

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. This event requires pre-registration. Tickets includes food and two drink tickets.

## **PRESIDENT'S LUNCHEON**

Regency Ballroom, 4th Floor, Hyatt Regency

Monday, June 26

12:15 - 2:00 p.m.

Cost: \$50

2017–18 ASHRAE President Bjarne W. Olesen, Ph.D., Fellow ASHRAE, Life Member, presents his presidential theme, “Extend”, which is based upon the Society goal to “Extend Our Community” found in our Strategic Plan. Together, we can extend our global community, our technological horizons, and our value to Members.

Certificates of appreciation to retiring Board members are presented, and the 2017–18 officers and Board of Directors installed.

## **LIFE MEMBERS' LUNCHEON**

Seaview A, 1st Floor, Hyatt Regency

Tuesday, June 27

12:00 – 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**

Regency Ballroom ABC, 4th Floor, Hyatt Regency

Tuesday, June 27

Cost: \$60

### **Reception and Cash Bar**

6:15 p.m.–7:15 p.m.

Regency Foyer

### **Dinner and Entertainment**

7:15–10:00 p.m.

Join us for a beach party! Come dressed in your best beach attire and experience the next best thing to Jimmy Buffett and the Coral Reefer Band concert. Mark Wood and the Parrot Head Band perform songs from over 40 years of Jimmy Buffet's music. They will entertain you live and in person at Member's Night Out, so come join us!

# 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 technical paper sessions, conference paper sessions, seminars, workshops and forums. 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.

See page 46 for more information on the five types of sessions that are presented in the Technical Program.

PowerPoint presentations with audio descriptions are posted online in the Virtual Conference for all Technical Paper Sessions, Conference Paper Sessions, Seminars and Workshops. The Virtual Conference is included with full Conference registration.

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. Also, certain sessions may be acceptable for ASHRAE certification renewal. Send questions to [certification@ashrae.org](mailto:certification@ashrae.org). Your badge will be scanned as you enter the session and a summary of sessions attended will be emailed to you upon conclusion of the conference.

## **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 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](http://www.ashrae.org/bookstore).

The membership booth is located in the registration area. 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 conference registration form or within 60 days following the conference. 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.

## AWARDS PRESENTATION

Saturday, June 24, 3:15-5:30 p.m.

Plenary Session, Hyatt Regency

Regency Ballroom, 4th Floor

### LINCOLN BOUILLON AWARD

*“Given in recognition of outstanding work in increasing the membership of Society.”*

**Jason R. Urso, P.E.**, Westfield, MA

Connecticut Chapter

### CHAPTER PROGRAM STAR AWARD

*“Given in recognition of excellence in chapter program endeavors.”*

**Chun-Sing Wong, Ph.D., BEAP**, Hong Kong

Hong Kong Chapter

### WILLIAM J. COLLINS, JR. RP AWARD

*“Given in recognition of the chapter RP Chair who excels in raising funds for ASHRAE’s RP Campaign.”*

**Patrick Huang, C.Eng.**, Hong Kong

Hong Kong Chapter

### ENVIRONMENTAL HEALTH AWARD

*“Given in recognition of excellence in volunteer service focused on environmental health issues.”*

**W. Gene Tucker, Ph.D.**, Cary, NC

Triangle Chapter

### HOMER ADDAMS AWARD

*“Given in recognition of a graduate student who has been engaged in an ASHRAE research project.”*

**Parham Azimi**, Chicago, IL

Illinois Chapter

### GOVERNMENT ADVOCACY AWARD

*“Given in recognition to an individual for outstanding effort and achievement in state, provincial, and local government activities in connection with technical issues important to the Society.”*

**Sam C. M. Hui, Ph.D., C.Eng., BEAP, BEMP, HBDP**,

Hong Kong

Hong Kong Chapter

### LOU FLAGG HISTORICAL AWARD

*“Given in recognition of a Chapter Gold Ribbon Award winner for compiling information on outstanding historical projects or persons related to HVAC&R.”*

**Dusty Stoabs, P.E., CPMP**, Oklahoma City, OK

Central Oklahoma Chapter



## STANDARDS ACHIEVEMENT AWARD

*“Given in recognition for excellence in volunteer service for developing ASHRAE standards/guidelines.”*

**Steven T. Bushby, Fellow ASHRAE**, Gaithersburg, MD  
*National Capital Chapter*

## ASHRAE JOURNAL PAPER AWARD

*“Given in recognition of the best article published in the ASHRAE Journal in 2016.”*

**Hugh Crowther, P.Eng.**, Markham, ON, Canada, *Hamilton Chapter*, and **Yi Teng Ma**, Markham, ON, Canada, *Toronto Chapter*, authors of “Design Considerations for Dedicated OA Systems.”

## SCIENCE AND TECHNOLOGY FOR THE BUILT ENVIRONMENT BEST PAPER AWARD

*“Given in recognition of the best referred paper published in the volume year of the Science and Technology for the Built Environment, the ASHRAE Research Journal.”*

**Nesreen Ghaddar, Ph.D.**, Beirut, Lebanon, *Lebanese Chapter*, **Bachir El Fil**, Atlanta, GA, *Atlanta Chapter*, **Kamel Ghali, Ph.D.**, Beirut, Lebanon, authors of “Optimizing Performance of Ceiling Mounted Personalized Ventilation System Assisted by Chair Fans: Assessment of Thermal Comfort and Indoor Air Quality.”

## CROSBY FIELD AWARD

*“Given in recognition of the highest rated paper presented at a Technical Session or Symposium in 2016.”*

**Stephen Kujak**, La Crosse, WI and **Edward McCampbell Hamilton**, Pittsburg, CA for authoring “Examination of the Reactions of R-40 with R-134a and POE Refrigeration System Materials”

## ASHRAE TECHNICAL PAPER AWARD

*“Given in recognition of the best paper presented at a Technical Paper Session at a Society Conference in 2016.”*

**Dennis L. O’Neal, Ph.D., P.E., Fellow ASHRAE, Life Member**, Waco, TX; **Carl Lewis Reid**, Austin, TX; and **Peng Yin, Ph.D.**, Lafayette, LA for authoring “Characterizing the Performance of Fixed-Airflow Series Fan-Powered Terminal Units Using a Mass and Energy Balance Approach”

**James A. Milke, Ph.D., P.E.**, College Park, MD; **Christine Pongratz**, London, UK; and **Arnaud Trouvé, Ph.D.**, College Park, MD for authoring “A CFD Study to Identify Methods to Increase Maximum Velocity of Makeup Air for Atrium Smoke Control”

**Nicholas Gayeski, Ph.D.**, Maynard, MA; **Stephen Samouhos, Ph.D. P.E.**, West Orange, NJ; **Siân Kleindienst, Ph.D.**, Somerville, MA; **Ryan Cruz**, Somerville, MA; **Jaime**

**Gagne, Ph.D.**, Somerville, MA; and **Bradley Werntz**, Newton Center, MA for authoring “Data and Interfaces for Advanced Building Operations and Maintenance”

**Kathleen Sturtevant**, North Andover, MA; **Alexandra Brogan**, Columbus, OH; **Zachary Valigosky**, West Des Moines, IA; **Vijay Gopalakrishnan**, North Andover, MA and **John Kelly Kissock, Ph.D., P.E.**, Dayton, OH for authoring “Improving Variable-Speed Pumping Control to Maximize Savings”

### **WILLIS H. CARRIER AWARD**

*“Given in recognition of the best paper presented at a Society Conference in 2016 by a member thirty-two years of age or less.”*

**Carl Lewis Reid**, Austin, TX; and **Peng Yin, Ph.D.**, Lafayette, LA for authoring “Characterizing the Performance of Fixed-Airflow Series Fan-Powered Terminal Units Using a Mass and Energy Balance Approach”

### **DISTINGUISHED SERVICE AWARD**

*“Given in recognition of faithful and distinguished service on behalf of the Society.”*

**Eric W. Adams, Ph.D.**, Indianapolis, IN

**Nerses (Nick) Agopian**, Madison, WI

**Jason A. Atkisson, P.E.**, Madison, WI

**Vikrant C. Aute, Ph.D.**, College Park, MD

**Robert Bean**, Calgary, AB, Canada

**Barry B. Bridges, P.E., CPMP, Life Member**, St. Paul, MN

**Tina M. Brueckner**, Eagan, MN

**Oswaldo de Siqueira Bueno, P.Eng., BEAP, Life Member**, Sao Paulo, Brazil

**Douglas Cane**, Mississauga, ON, Canada

**James A. Carlson**, Omaha, NE

**Joseph A. Chin, P.E.**, Menlo Park, CA

**Leonard A. Damiano**, Loris, SC

**Abdel K. Darwich, P.E., HFDP**, Sacramento, CA

**Hywel Davies, Ph.D.**, London, UK

**Larry O. Degelman, P.E., Life Member**, College Station, TX

**John F. Dunlap, P.E., Fellow ASHRAE, Life Member**, Richmond, VA

**Annette Dwyer**, Fort Myers Beach, FL

**Jim Earley, P.E.**, Roswell, GA

**Blake E. Ellis, P.E.**, Overland Park, KS

**Christopher M. Gray, Ph.D., P.E.**, Columbus, GA

**Kamel Haddad, Ph.D.**, Ottawa, ON, Canada

**Paul M. Haydock, P.E.**, Indianapolis, IN

**Roger L. Hedrick**, Boulder, CO

**N. Eileen Jensen, P.E.**, Vancouver, WA

**Amir Jokar, Ph.D., P.E.**, Irvine, CA

Roger K. Jones, P.E., Crofton, MD  
Stephen Kujak, La Crosse, WI  
Jon Christopher Larry, P.E., Richmond, VA  
Jennifer E. Leach, P.E., East Stroudsburg, PA  
Thomas J. Leck, Ph.D., Hockessin, DE  
Michel Lecompte, Life Member, Saint-Hubert, QC, Canada  
Paul A. Lindahl, Jr., Overland Park, KS  
Wahid Maref, Ph.D., Montreal, QC, Canada  
Sarah E. Maston, P.E., CPMP, Hudson, MA  
Francis A. Mills, Life Member, Lancashire, UK  
Ronnie R. Moffitt, P.E., Lexington, KY  
Frank Thomas Morrison, Jessup, MD  
Robert Alan Neely, The Woodlands, TX  
Roger M. Pasch, P.E., Life Member, Eden Prairie, MN  
Michael P. Patton, Irvine, CA  
Michael A. Pouchak, P.E., Golden Valley, MN  
Irene Reichert, Stuttgart, Germany  
Lee Riback, Dallas, TX  
William A. Ryan, Ph.D., P.E., Chicago, IL  
Kenneth Schultz, Ph.D., La Crosse, WI  
Leon E. Shapiro, Oak Park, CA  
Thursten D. Simonsen, P.E., HBDP, San Antonio, TX  
Russell J. Stuber, Tonawanda, NY  
Zuraimi M. Sultan, Ph.D., Singapore  
Len Swatkowski, Morton Grove, IL  
Megan M. Tosh, P.E., BEMP, Portland, OR  
Pawel Wargocki, Ph.D., Kongens Lyngby, Denmark  
Bede W. Wellford, Warwick, RI  
Philip J. Winters, P.E., Chicago, IL  
Xiaohui Zhou, Ph.D., P.E., Ames, IA  
Wangda Zuo, Ph.D., Coral Gables, FL

### **EXCEPTIONAL SERVICE AWARD**

*“Given in recognition of faithful service with exemplary effort on behalf of the Society, in excess of that required for the Distinguished Service Award.”*

Erich Binder, Calgary, AB, Canada  
Steven T. Bushby, Fellow ASHRAE, Gaithersburg, MD  
Samuel D. Cummings, Jr., P.E., Fellow ASHRAE, Life Member, Little Rock, AR  
Patricia T. Graef, P.E., Fellow ASHRAE, Life Member, Ft. Myers, FL  
Essam E. Khalil, Ph.D., Fellow ASHRAE, Cairo, Egypt  
Kishor Khankari, Ph.D., Fellow ASHRAE, Ann Arbor, MI  
Bert Phillips, P.Eng., Life Member, Winnipeg, MB, Canada

## **DISTINGUISEHD 50-YEAR MEMBER AWARD**

*“Given in recognition of fifty years of membership and performing outstanding service for the Society.”*

**Luc Bertrand, ING., Fellow ASHRAE, Life Member,**  
Saint-Lambert, QC, Canada

**Raymond Cohen, Ph.D., P.E., Fellow ASHRAE, Life Member,**  
Valparaiso, IN

**Emil E. Friberg, P.E., Fellow ASHRAE, Life Member,**  
Arlington, TX

**Warren G. Hahn, P.E., Fellow ASHRAE, Life Member,**  
Tampa, FL

**Gordon V.R. Holness, P.E., Presidential Fellow ASHRAE,**  
**Life Member,** West Palm Beach, FL

**S. Louis Kelter, P.E., Fellow ASHRAE, Life Member,**  
Somerset, NJ

**Rodney H. Lewis, P.E., Fellow ASHRAE, Life Member,**  
Austin, TX

**Richard P. Lortie, Fellow ASHRAE, Life Member,**  
Winston Salem, NC

**George E. Menzies, P.Eng., Life Member,** Hamilton, ON,  
Canada

**Erling J. Olsen, P.E., Fellow ASHRAE, Life Member,**  
Bainbridge Island, WA

**Robert D. Pagliasotti, Life Member,** Lakewood, CO

**Richard J. Pearson, P.E., Fellow ASHRAE, Life Member,**  
Madison, WI

**Alberto J. Sanchez, P.E., Fellow ASHRAE, Life Member,**  
Blue Bell, PA

**Eugene Stamper, P.E., Fellow ASHRAE, Life Member,**  
Teaneck, NJ

**Laurance S. Staples, Jr., Life Member,** Prairie Village, KS

**Sunny C.L. Tan, Fellow ASHRAE, Life Member,** Singapore

## **ANDREW T. BOGGS SERVICE AWARD**

*“Given to a past Exceptional Service Award recipient in recognition of continuing, unselfish, dedicated and distinguished work on behalf of the Society.”*

**Steven T. Taylor, P.E., Fellow ASHRAE,** Alameda, CA

## **LOUISE & BILL HOLLADAY DISTINGUISHED FELLOW AWARD**

*“Given to a Fellow of the Society in recognition of continuing preeminence in engineering or research work.”*

**Zahid H. Ayub, Ph.D., P.E.,** Arlington, TX

## ROOMS/HOURS

### FINDING YOUR ASSIGNED MEETING ROOM

The ASHRAE Annual Conference and committee meetings are located in three different venues: Hyatt Regency (H), Renaissance (R) and the Long Beach Convention Center (LBCC). Please refer to pages 2–7 for floor plans and page 87 for descriptions on how to access meeting rooms in each venue. All venues are within easy walking distance of one another.

### CONFERENCE REGISTRATION, 104, Long Beach Convention Center (LBCC), 1st Floor

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, June 23	10:00 a.m.–5:00 p.m.
Saturday, June 24	7:15 a.m.–6:00 p.m.
Sunday, June 25	7:00 a.m.–5:00 p.m.
Monday, June 26	7:30 a.m.–5:00 p.m.
Tuesday, June 27	7:30 a.m.–4:30 p.m.
Wednesday, June 28	7:30 a.m.–10:15 a.m.

### ASHRAE BOOKSTORE, 104, Long Beach Convention Center (LBCC), 1st Floor

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, June 23	10:00 a.m.–5:00 p.m.
Saturday, June 24	7:15 a.m.–6:00 p.m.
Sunday, June 25	7:00 a.m.–5:00 p.m.
Monday, June 26	7:30 a.m.–5:00 p.m.
Tuesday, June 27	7:30 a.m.–4:30 p.m.
Wednesday, June 28	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, 104, Long Beach Convention Center (LBCC), 1st Floor

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

Saturday, June 24	1:00 p.m.–3:00 p.m.
Sunday, June 25	7:00 a.m.–5:00 p.m.
Monday, June 26	7:00 a.m.–12:15 p.m. and 1:30 p.m.–5:00 p.m.
Tuesday, June 27	7:00 a.m.–5:00 p.m.
Wednesday, June 28	7:00 a.m.–1:00 p.m.

**MEMBERSHIP DESK, 104, Long Beach Convention Center (LBCC), 1st Floor**

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, Seaview BC, Hyatt Regency (H), 1st Floor (Lower Level)**

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

Friday, June 23 . . . . .	12:00 p.m.–5:00 p.m.
Saturday, June 24 . . . . .	.8:00 a.m.–5:00 p.m.
Sunday, June 25 . . . . .	.8:00 a.m.–5:00 p.m.
Monday, June 26 . . . . .	.8:00 a.m.–5:00 p.m.
Tuesday, June 27 . . . . .	.8:00 a.m.–5:00 p.m.
Wednesday, June 28 . . . . .	.8:00 a.m.–1:00 p.m.

**YEA ACTIVITY**

**Young Engineers in ASHRAE (YEA) Hospitality Reception Regency DEF, Hyatt Regency (H), 4th Floor (Upper Level)**

Attention young professional members age 35 and younger! You are invited to visit the YEA Hospitality Suite on Sunday, June 25, 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](http://www.ashrae.org/yea).

The Leadership U participants for the 2017 ASHRAE Annual Conference are:

- Akshay Bhargava**, Spacecoast Chapter, Region, Region XII
- Tiffany Biagini**, Illinois Chapter, Region VI
- Joseph Chin**, San Jose Chapter, Region X
- James Gallick**, Columbus Chapter, Region V

**ASHRAE MEMBER LOUNGE, Beacon A, Hyatt Regency (H), 4th Floor (Upper Level)**

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

Saturday, June 24 .....	7:30 a.m.–3:00 p.m.
Sunday, June 25 .....	7:30 a.m.–4:00 p.m.
Monday, June 26 .....	7:30 a.m.–4:00 p.m.
Tuesday, June 27 .....	7:30 a.m.–4:00 p.m.
Wednesday, June 28 .....	7:30 a.m.–1:00 p.m.

More information about the ASHRAE Member Lounge can be found on page 18.

**ASHRAE SPOUSE LOUNGE, Seaview Rotunda, Hyatt Regency (H), 1st Floor (Lower Level)**

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

Saturday, June 24 .....	7:30 a.m.–3:00 p.m.
Sunday, June 25 .....	7:30 a.m.–4:00 p.m.
Monday, June 26 .....	7:30 a.m.–4:00 p.m.
Tuesday, June 27 .....	7:30 a.m.–4:00 p.m.
Wednesday, June 28 .....	7:30 a.m.–1:00 p.m.

More information about the ASHRAE Spouse Lounge can be found on page 18.

**LONG BEACH HOST COMMITTEE DESK, 104, Long Beach Convention Center (LBCC), 1st Floor**

Information about the city of Long Beach will be available.

**CHICAGO WINTER CONFERENCE INFORMATION, 104, Long Beach Convention Center (LBCC), 1st Floor**

Information on the upcoming Winter Conference scheduled for January 20–24, 2018 at the Palmer House Hilton will be available in the registration area.

**UPCOMING CONFERENCES**

**ASHRAE 2017 Building Performance Analysis Conference**

September 27–29, 2017 • Atlanta, GA

**Second ASHRAE Developing Economies Conference**

November 10–11, 2017 • Delhi, India

## LOCATION OF MEETINGS AND EVENTS

The ASHRAE Annual Conference and committee meetings are located in three different venues: Hyatt Regency (H), Renaissance (R) and the Long Beach Convention Center (LBCC). Please refer to pages 2–7 for floor plans and descriptions on how to access meeting rooms in each venue. All venues are within easy walking distance of one another.

## CONFERENCE AND MEETING SCHEDULE

### FRIDAY, JUNE 23

- 8:00 am–5:00 pm **Committee Meetings**  
Hyatt Regency, Long Beach Convention Center, and Renaissance.  
*See listing on pages 88–120*
- 10:00 am–5:00 pm **Registration and ASHRAE Bookstore**,  
104, LBCC, 1st floor

### SATURDAY, JUNE 24

- 7:30 am–3:00 pm **ASHRAE Member Lounge**, Beacon A, Hyatt Regency, 4th Floor (Upper Level) and **Spouse Lounge**, Seaview Rotunda, Hyatt Regency, 1st floor (Lower Level).  
*See description on page 18.*
- 7:15 am–6:00 pm **Registration and ASHRAE Bookstore**,  
104, LBCC, 1st floor
- 8:00 am–5:00 pm **Committee Meetings**  
Hyatt Regency, Long Beach Convention Center, and Renaissance.  
*See listing on pages 88–120*
- 1:00 pm–3:00 pm **Speakers' Lounge**, 104, LBCC, 1st floor

### Special Event

- 3:15 pm–5:00 pm **Meeting of the Members**,  
Plenary Session, Regency Ballroom, Hyatt Regency, 4th Floor (Upper 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 23.*  
**Keynote Address:** Derreck Kayongo  
*See description on page 19.*  
Plenary Session is open, no badge nor registration is required to attend.



## Special Event

7:00–9:00 p.m. **Welcome Party**, Aquarium of the Pacific  
*Ticket required.*  
*See description on page 19.*

## SUNDAY, JUNE 25

7:00 am–5:00 pm **Speakers' Lounge**, 104, LBCC, 1st floor

7:00 am–5:00 pm **Registration and ASHRAE Bookstore**,  
104, LBCC, 1st Floor

7:30 am–4:00 pm **ASHRAE Member Lounge**, Beacon A,  
Hyatt Regency, 4th Floor (Upper Level)  
and **Spouse Lounge**, Seaview Rotunda,  
Hyatt Regency, 1st floor (Lower Level).  
*See description on page 18.*

8:00 am–4:45 pm **Technical Sessions**, LBCC, 1st and  
2nd Floors,  
*See Technical Program on pages 48–59.*

8:00 am–5:00 pm **Committee Meetings**, Hyatt Regency,  
LBCC, Seaside rooms at the LBCC and  
Renaissance.  
*See listing on pages 88–120.*

9:00 am–9:30 am **Networking Coffee Break**, Outside of  
100 rooms at the LBCC, 1st Floor

2:00 pm–5:30 pm **General Tour: Whale Watching**  
*See description on page 35.*

4:00 pm–6:00 pm **Young Engineers in ASHRAE (YEA)**  
Hospitality Reception, Regency DEF,  
Hyatt Regency, 4th Floor

*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 29.*

## MONDAY, JUNE 26

7:00 am–12:15 pm **Speakers' Lounge**, 104, LBCC,  
1st Floor

7:30 am–5:00 pm **Registration and ASHRAE Bookstore**,  
104, LBCC, 1st Floor

7:30 am–4:00 pm **ASHRAE Member Lounge**, Beacon A,  
Hyatt Regency, 4th Floor (Upper Level)  
and **Spouse Lounge**, Seaview Rotunda,  
Hyatt Regency, 1st floor (Lower Level).  
*See description on page 18.*

8:00 am–12:00 pm **Technical Sessions**, LBCC, 1st and  
2nd Floors,  
*See Technical Program on pages 59–66.*

9:30 am–11:00 am **ASHRAE Meet and Greet**, Beacon  
Rotunda, Hyatt Regency, 4th Floor.  
*See description on page 18.*

8:00 am–5:00 pm **Committee Meetings**, Hyatt Regency, LBCC, Seaside rooms at the LBCC and Renaissance.

*See listing on pages 88–120.*

### **Special Event**

12:15 pm–2:00 pm **President's Luncheon**, Regency Ballroom, Hyatt Regency, 4th Floor  
Doors open at 12:00 p.m. *Ticket required.*  
*See description on page 20.*

1:30 pm–4:30 pm **Speakers' Lounge**, 104, LBCC, 1st Floor

2:15 pm–3:45 pm **Technical Sessions**, LBCC, 1st and 2nd Floors  
*See Technical Program on page 67.*

2:00 pm–4:30 pm **General Tour: Queen Mary and Ghost Stories Tour.** *Ticket Required.*

2:30 pm–4:30 pm **General Tour: Biking the Coast.** *Ticket Required.*

2:30 pm–4:30 pm **Technical Tour: Engineering Tour of the Queen Mary.** *Ticket Required.*  
*See tour descriptions on page 37.*

4:30 pm–6:30 pm **Women in ASHRAE Happy Hour**, BO-Beau's Kitchen + Roof Tap.  
*Pre-registration required.*  
*See description on page 19.*

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

## **TUESDAY, JUNE 27**

7:00 am–5:00 pm **Speakers' Lounge**, 104, LBCC, 1st Floor

7:30 am–4:00 pm **ASHRAE Member Lounge**, Beacon A, Hyatt Regency, 4th Floor (Upper Level) and Spouse Lounge, Seaview Rotunda, Hyatt Regency, 1st Floor (Lower Level).  
*See description on page 18.*

7:30 am–4:30 pm **Registration and ASHRAE Bookstore**, 104, LBCC, 1st Floor

8:00 am–4:45 pm **Technical Sessions**, LBCC, 1st and 2nd Floors  
*See Technical Program on pages 67–76.*

8:00 am–5:00 pm **Committee Meetings**, Hyatt Regency, LBCC, Seaside rooms at the LBCC and Renaissance.  
*See listing on pages 88–120.*

9:30 am–12:00 pm **General Tour: U.S.S. Iowa Tour.** *Ticket Required.*  
*See descriptions on page 36.*

- 12:00 pm–1:30 pm **Life Members' Lunch**, Seaview A, Hyatt Regency, 1st Floor  
*Ticket Required.*  
*See description on page 20.*
- 1:00 pm–3:00 pm **Technical Tour: Cal State Long Beach Central Plant.** *Ticket Required.*
- 2:00 pm–4:00 pm **Technical Tour: Cal State Long Beach Central Plant.** *Ticket Required.*
- 2:00 pm–5:00 pm **Certification Exams:** 203C, LBCC, 2nd Floor.  
*More information on page 45.*
- 2:30 pm–5:00 pm **General Tour: California Coastline Nature Walk.** *Ticket Required.*  
*See tour descriptions on page 36.*

### **Special Event**

- 6:15 pm–7:15 pm **Reception**, Regency Foyer, Hyatt Regency, 4th Floor
- 7:15 pm–10:30 pm **Members' Night Out**, Regency ABC, Hyatt Regency, 4th Floor. Beach attire.  
*Ticket Required.*  
*See description on page 20.*

## **WEDNESDAY, JUNE 28**

- 7:00 am–1:00 pm **Speakers' Lounge**, 104, LBCC, 1st Floor
- 7:30 am–10:15 am **Registration**, 104, LBCC, 1st Floor
- 7:30 am–1:00 pm **ASHRAE Bookstore**, 104, LBCC, 1st Floor
- 7:30 am–1:00 pm **ASHRAE Member Lounge**, Beacon A, Hyatt Regency, 4th Floor (Upper Level) and **Spouse Lounge**, Seaview Rotunda, Hyatt Regency, 1st Floor (Lower Level).  
*See description on page 18.*
- 8:00 am–12:30 pm **Technical Sessions**, LBCC, 1st and 2nd Floors  
*See Technical Program on pages 77–86.*
- 8:00 am–5:00 pm **Committee Meetings**, Hyatt Regency, LBCC, Seaside rooms at the LBCC and Renaissance.  
*See listing on pages 88–120.*

## 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 online and at the ASHRAE registration desk located in 104 and the Long Beach Convention Center on the 1st floor.

All tours depart from the main entrance of the Hyatt Regency. Please arrive at least 10 minutes before the tour is scheduled to depart.

### GENERAL TOURS

#### Whale Watching

Sunday, June 25

2:00 pm – 5:30 pm.

\$185.00

Experience the rush of the Pacific Ocean -- California sunshine above and the cool sea mist rising from the waves! Guests will have the opportunity to experience the open waters as they search for breathtaking marine mammals including whales and dolphins. Boat trip is approximately (2 – 2.5) hours. Guests are encouraged to dress in layers and to wear tennis shoes or deck shoes.

#### Biking The Coast

Monday, June 26

2:30 pm – 4:30 pm

\$170.00

On this scenic bike tour, enjoy views of the shoreline and ocean while our expert guides give insight into all the hidden gems the area has to offer. The ride is done at a rather easy pace and give guests the perfect opportunity to take in the fresh ocean air and see the local sights. Tour includes bicycle, helmet, safety vest and bottled water. Ride is approximately (2) hours long and is a relatively easy ride. Guests should be comfortable on a bike and are required to wear closed toe shoes, and athletic apparel and layers are suggested.

#### Queen Mary and Ghost Stories Tour

Monday, June 26

2:00 pm – 4:30 pm

\$85

The Queen Mary tour includes ghost stories of the dangerous past of the Queen Mary's long service in its thousand journeys across the ocean during WWII service as a troop carrier and cruise liner afterward. Explore the ship's foremost paranormal hot spots and discover the history behind her most notable

and intriguing apparitions. You will have time to explore and enjoy the ship on your own. Guests must be 13 years of age or older to attend the ghost stories tour.

### **U.S.S. Iowa Tour**

Tuesday, June 27

9:30 a.m. – 12:00 p.m.

\$100

Built in 1940, the U.S.S. Iowa was designated the “World’s Greatest Naval Ship” due to her big guns, heavy armor, fast speed, longevity and modernization. Having served her country for fifty years, the USS Iowa now calls the Port of Los Angeles in San Pedro her new home. Guests will enjoy a tour of the USS Iowa, from the boiler room to President Roosevelt’s private quarters, the past comes to life as guests explore this great battleship. Guests are encouraged to wear shoes comfortable to walk and stand in for long periods of time. Guests should be comfortable climbing stairs.

### **California Coastline Nature Walk**

Tuesday, June 27

2:30 pm – 5:00 pm

\$135

This educational walk leads you past several nature viewing points where guests get the chance to spot some rare birds and endemic butterflies. Get some breathtaking views of the dramatic coastline and learn about whale migration. Afterwards, head down along the coast to the water that leads to a secret cove with amazing coastal tide pools. As the water recedes, diverse marine life reveals themselves within the pools. From flowery anemones to elusive octopi and starfish, prepare to see the best the ocean has to offer.

## TECHNICAL TOURS

### Engineering Tour of the Queen Mary

Monday, June 26

2:30 pm – 4:30 pm

\$55

***Join us for a tour of the Queen Mary Engine Room with an HVAC spin.***

The Queen Mary's maiden voyage was made in 1936. Initial stint of cruise ship service was followed by North Atlantic transport duty during WWII. Following hostilities Queen Mary was used to transport troupes and families home. Queen Mary's final voyage brought her to Long Beach in 1967 where she was re-fitted for tourism duty.

The hotel aboard the Queen Mary opened in 1972; however Queen Mary was built for the North Atlantic. Spaces were conditioned by bringing in cold North Atlantic air.

To support the Queen Mary role as a hotel in Southern California, the ship was refitted with hydronic heating and cooling systems. The ship is now supplied with chilled water from a landside central chiller plant, located at the parking structure associated with Carnival Cruises. The current central plant began providing chilled water in February of 2003. A steam plant sits pier side.

Original HVAC designs utilized vent trunks where incoming air is cooled by chilled water coils and delivered to air handling rooms from where the cooled air is distributed throughout the ship.

The ship/hotel currently does not recycle conditioned air, the spaces are served by "100 % outside air". Likewise, integrated control of heating and cooling coils (many of which utilize 3-way valves), of air side equipment does not yet exist.

### Cal State Long Beach Central Plant

Tuesday, June 27

1:00 pm – 3:00 pm AND

2:00 pm – 4:00 pm

\$40

The Central Plant serves as the vast majority of the campus's heating and cooling needs through heating hot water and chilled water distribution networks. Currently the Central Plant provides services to approximately 2.7 million square feet of building space on campus. Come see a behind-the-scenes tour of the campus's heating and cooling systems. More information about the tour can be found on the ASHRAE App.

## FUTURE ASHRAE CONFERENCES

<b>Winter</b>	<b>Date</b>	<b>Annual</b>
Chicago, IL January 20–24	2018	Houston, TX June 23–27
Atlanta, GA January 12–16	2019	Kansas City, MO June 22–26
Orlando, FL February 1–5	2020	Austin, TX June 27–July 1

## 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	2017	Long Beach

# Long Beach *Sustainability Project*

With the 2017 ASHRAE Annual Conference being held in Long Beach, the ASHRAE SoCal and Orange Empire Chapters were given the opportunity to identify a local sustainability project to represent ASHRAE's commitment to sustainability and to help offset the environmental impact from holding the Annual Conference here. We decided to partner with Rebuilding Together Long Beach, an organization that serves to transform and revitalize the low-income communities in Long Beach, to help a local family in need to retrofit their home and provide educational materials on energy efficiency in Southern California.

The family in need consists of a father, mother, and son who need assistance addressing health and safety issues in their home. The father is disabled with congestive heart disease and is unable to work, and the son is autistic and suffers from cerebral palsy. The list of tasks needed to retrofit their home includes installing AC equipment and ductwork, new windows, and an attic fan and insulation.

This sustainability project was designed to have a holistic approach – helping this family but also having an impact on the Long Beach community – and is comprised of three parts:

1. Helping conduct an audit of the home, and specify and procure equipment with the assistance of local companies.
2. A Volunteer Day (June 3, 2017) where our chapter members donated their time and physical labor.
3. A presentation on energy efficiency and incentives at a Rebuilding Together Long Beach General Volunteer Meeting and a guide on energy efficiency and incentives in Southern California for the organization to distribute and have on hand in the future.

We are excited for our sustainability project that will directly improve the lives of this local family and to provide resources that Rebuilding Together Long Beach can use well after this project ends.



## 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](http://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](http://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](mailto: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](http://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 (ASHRAE Member \$415)**

**SATURDAY, JUNE 24, 2017**



### **Effective Energy Management in New & Existing Buildings**

8:00 a.m. – 3:00 p.m., Long Beach Convention Center, Room: 102C

This course weaves together energy management principles of the ASHRAE Handbook-HVAC Applications; Energy Star Guidelines; and new ASHRAE Standard 100-2015 “Energy Efficiency in Existing Buildings.” Practical experience of successful energy managers is presented. Numerous case studies are discussed, including a hospital, high-rise building, bank, and convention center.

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

### **Commissioning Process in New & Existing Buildings**

8:00 a.m. – 3:00 p.m., Long Beach Convention Center, Room: 103C

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

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

## HALF-DAY SHORT COURSES

**Registration fees: \$184 (ASHRAE Member \$139)**

**SATURDAY, JUNE 24, 2017**

### **Designing High-Performance Healthcare HVAC Systems**

12:00 p.m. – 3:00 p.m., Long Beach Convention Center, Room: 204

This course details the relationship of infection control and HVAC design including application of ANSI/ASHRAE/ASHE Standard 170-2013, Ventilation of Health Care Facilities. 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

## SUNDAY, JUNE 25, 2017

### **Air-to-Air Energy Recovery Applications: Best Practices**

3:30 p.m. – 6:30 p.m., Long Beach Convention Center, Room: 102C

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. Particular configurations that are most commonly used in high-performance buildings and how they can best be used to meet stretch goals for IEQ and energy efficiency and thermal comfort will be examined with respect to established performance metrics, peak performance results and annual energy savings. Best practices for mechanical design, exchanger selection and control strategies are discussed.

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

### **Laboratory Design: The Basic and Beyond**

3:30 p.m. – 6:30 p.m., Long Beach Convention Center, Room: 103C

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. Example problems and case studies are presented.

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

## MONDAY, JUNE 26, 2017



### **Complying with Standard 90.1-2016 Appendix G**

2:30 p.m. – 5:30 p.m., Long Beach Convention Center, Room: 102C

Based on ASHRAE Standard 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings, learn the addendum bm, which allows Appendix G to be used as a compliance path within 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

## Understanding & Designing Dedicated Outdoor Air Systems (DOAS)

2:30 p.m. – 5:30 p.m., Long Beach Convention Center,  
Room: 103C

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. The course addresses over 30 frequently asked questions and draws conclusions.

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

**TUESDAY, JUNE 27, 2017**

## Complying with Standard 90.1-2016: HVAC/Mechanical



8:00 a.m. – 11:00 a.m., Long Beach Convention Center,  
Room: 102C

In 2007, ASHRAE determined that the 2010 version of Standard 90.1 would show a 30% reduction in energy use when compared to the 2004 edition. The 2016 edition added an 8.5% source energy savings and 7.6% site energy savings, for a total of nearly 40% below that required for a 2004-compliant building. The new and updated Mandatory and Prescriptive requirements for HVAC and Service Water Heating systems, along with insights on how to comply during building design and construction.

**Instructor:** McHenry Wallace, P.E., Member ASHRAE, LEED® AP

## High-Performance Building Design: Applications & Future Trends

12:00 p.m. – 3:00 p.m., Long Beach Convention Center,  
Room: 102C

High performance is more than just energy efficiency, and this course addresses issues and methods for providing high performance in areas beyond energy efficiency, such as indoor environmental quality. 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 summarizes how ASHRAE Standards address them.

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

## Variable Refrigerant Flow System: Design & Application



12:00 p.m. – 3:00 p.m., Long Beach Convention Center,  
Room: 103C

Variable Refrigerant Flow (VRF) systems are now becoming increasingly utilized across North America. 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 using building-specific scenarios.

**Instructors:** Paul Doppel, Member ASHRAE; and Jocelyn Leger, P.Eng., Member ASHRAE

## ASHRAE CERTIFICATION EXAMS

**Tuesday, June 27**

2:00 p.m. – 5:30 p.m.

203C, Long Beach Convention Center, 2nd  
Floor

Recognized by over 30 national, state and local government bodies – and with over 2,500 certifications earned – ASHRAE certifications increasingly have become the must-have credential for built-environment professionals.

ASHRAE certification exams will be administered to candidates in these key, built-environment fields: Commissioning, Energy Assessment, Energy Modeling, Healthcare Facility Design, High-Performance Building Design and Building Operations.

*Pre-application required.*

# ASHRAE ANNUAL CONFERENCE TECHNICAL PROGRAM

Long Beach – June 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.

**Debates.** Debates highlight hot-button issues. Experts, either on teams or as individuals, present different sides of an issue in debate format. Each participant presents evidence for or against a specific statement or question such as ‘Is Sustainability Really Sustainable?’.

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

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

**Seminars.** Seminars feature presentations on subjects of current interest. Papers are not available from the Society; however, seminar PowerPoint presentations with audio descriptions of the presentations are posted online in the Virtual Conference. Access is free for attendees who purchase a conference registration, and access will also be available for purchase. Orders can be taken in the ASHRAE Bookstore.

**Technical Paper Sessions.** These sessions present papers on current applications or procedures, as well as papers resulting from research on fundamental concepts and basic theory. Papers presented in these sessions have successfully completed a rigorous peer review. You are invited to comment

on these papers. Forms for written comment are available at each session. Power point presentations with audio descriptions of the presentations are posted online in the Virtual Conference. Preprints of papers and an online papers collection are available for purchase in the ASHRAE bookstore.

**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.



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



2017 ASHRAE Annual Conference Seminars  
(online) – \$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)



Approved for GBCI LEED AP CE Credits

**Packages:** *Purchase in the Conference Bookstore*

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

*All prices are special conference-only prices.*



## Sunday, June 25

8:00 AM – 9:00 AM

### Forum 1 (Advanced)

#### Commissioning Experience with California Title 24 VAV Lab Exhaust

Room: 101A

**Sponsor:** 9.10 Laboratory Systems

**Moderator:** Victor Neuman, P.E., Member, Laboratory Exhaust Certification LLC, San Diego, CA

8:00 AM – 9:00 AM

### Workshop 1 (Basic)



#### Are We Afraid of What We'll Find? Using Real Buildings to Improve ASHRAE Standards and Publications

Room: 201A

**Sponsor:** 2.8 Building Environmental Impacts and Sustainability

**Chair:** Joy Altwies, Ph.D., P.E., Member, University of Wisconsin-Madison, Madison, WI

**1. Highlights of 1627-RP: Actual Energy Performance of Small Office and K-12 School Buildings Designed to Meet the 30% ASHRAE Advanced Energy Design Guides**

**Dennis Jones, P.E., Member, Group14 Engineering Inc., Denver, CO**

**2. Potential New Research on the Actual Energy Performance of Buildings Designed to Comply with ASHRAE Standard 90.1-2010**

**J. Kevin Cross, P.E., Member, Honeywell, Fort Collins, CO**

8:00 AM – 9:00 AM

### Workshop 2 (Intermediate)



#### Are You Ready For 21st Century Building Automation?

Room: 101B

**Sponsor:** 1.4 Control Theory and Application, 7.5 Smart Building Systems

**Chair:** Marcelo Acosta, P.Eng., Member, Armstrong Fluid Technologies, Toronto, ON, Canada

**1. Potentials and Disappointments: The Slow Adoption of Advanced Building Automation**

**Marcelo Acosta, P.Eng., Member, Armstrong Fluid Technologies, Toronto, ON, Canada**

**2. Are Millennials Ready for Advanced Building Automation?**

**Michelle Shadpour, Student Member, SC Engineers, Inc., San Diego, CA**

8:00 AM – 9:00 AM

### Workshop 3 (Intermediate)



#### Bringing Standard 90.1 to the World: The Addition of Climate Zone 0

Room: 103AB

**Sponsor:** Chapter Technology Transfer Committee

**Chair:** Andy Cochrane, Member, Industrial Air Inc., Greensboro, NC

**1. Bringing ASHRAE 90.1 to the World: The Addition of Climate Zone 0**

**Chris Mathis, Member, Mathis Consulting, Montreal, AL**

8:00 AM – 9:00 AM

**Workshop 4 (Basic)**

G

**Common Commissioning Terminology for the Building Industry: An International Overview***Room: 203AB***Sponsor: AiCARR, CIBSE, SSPC 202***Chair: Livio de Santoli, P.Eng., Member, AiCARR, Milano, Italy***1. ASHRAE Overview***Walter Grondzik, P.E., Fellow Life Member, ASHRAE, Atlanta, GA***2. CIBSE Overview***Hywel Davies, CIBSE, London, United Kingdom*

8:00 AM – 9:00 AM

**Workshop 5 (Advanced)**NY  
PDH

G

**Engineers of Trial: You Decide Guilt or Innocence***Room: 102AB***Sponsor: 7.2 HVAC&R Construction & Design Build Technologies, 1.7 Business, Management & General Legal Education***Chair: Michael Cooper, P.E., Member, MCC, Metairie, LA***1. The Case for the Plaintiff***E. Mitchell Swann, P.E., Member, Virtual Construction/BIM Manager, Paoli, PA***2. The Case for the Defense***Michael Connor, P.E., Member, WSP, Atlanta, GA*

8:00 AM – 9:00 AM

**Workshop 6 (Intermediate)**

G

**Science and Technology for the Built Environment Writer's Workshop: Authoring Research Papers with Impact***Room: 202AB***Sponsor: Publishing and Education Council***Chair: Reinhard Radermacher, Ph.D., Fellow ASHRAE, University of Maryland, College Park, MD***1. Writing for Maximum Impact***Alexa Flood, Taylor and Francis, Philadelphia, PA***2. Writing Research Papers that Get Published***Alexa Flood<sup>1</sup> and Mary Baugher<sup>2</sup>, (1)Taylor and Francis, Philadelphia, PA, (2)University of Maryland, College Park, MD*

8:00 AM – 9:00 AM

**Workshop 7 (Intermediate)****Status of Standards and Codes in the USA, In View of the Application of Low GWP Refrigerants***Room: 201B***Sponsor: Refrigeration Committee***Chair: Steven Eckels, Ph.D., Member, Kansas State University Institute for Environmental Research, Manhattan, KS***1. Status of ASHRAE 15, Related Codes and SNAP***Phillip Johnson, P.E., Member, Daikin Applied, Staunton, VA***2. Status of UL Standards and Related Codes***Bill Hansen, P.E., Member, Ingersoll Rand, La Crosse, WI*

9:45 AM – 10:45 AM

**Panel 1 (Intermediate)**

**The US Department of Energy's Recent Regulatory Activity on Water Heaters**

Room: 202AB

**Sponsor: 6.6 Service Water Heating Systems**

Moderator: James D. Lutz, P.E., Member, Hot Water Research, Oakland, CA

1. **Harvey Sachs**, Member, ACEEE, Washington, DC
2. **Frank Stanonik**, Life Member, Air Conditioning, Heating and Refrigeration Institute, Washington, DC
3. **Ashley Armstrong**, US Department of Energy, Washington, DC
4. **James Lutz**, Member, Lawrence Berkeley National Laboratory, Berkeley, CA

9:45 AM – 10:45 AM

**Debate 1 (Intermediate)**

**Cumbersome and Correct vs. Half-Baked and High-Speed**

Room: 203AB

**Sponsor: 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment, 4.10 Indoor Environmental Modeling**

Moderator: Nick Gangemi, Life Member, James W. VanGilder, P.E., Member

1. **Mark Seymour**, CEng, Member, Future Facilities Ltd, London, United Kingdom
2. **James W. VanGilder**, P.E., Member, Schneider Electric, Andover, MA
3. **Nick Gangemi**, Life Member, Northern Air Systems, Rochester, NY

9:45 AM – 10:45 AM

**Conference Paper Session 1 (Intermediate)**

**Weather Modeling Applications**



Room: 103AB

Chair: Stephen W. Duda, P.E., Fellow ASHRAE, Ross & Baruzzini, Inc., St. Louis, MO

**1. Typical and Design Weather Year for Building Energy Simulation (LB-17-C001)**

**Yusuke Arima**, BEAP<sup>1</sup>, Ooka Ryoza, Ph.D., OPMP, HBDP and BEAP<sup>1</sup> and **Hideki Kikumoto**, Ph.D., BEAP<sup>1</sup>, (1) The University of Tokyo, Tokyo, Japan

**2. An Analytical Approach to the Impact of Heat Waves on Buildings and Their Occupants (LB-17-C002)**

**David Coley**<sup>1</sup>, **Alfonso Ramallo-González**<sup>1</sup>, **Manuel Herrera**<sup>1</sup> and **Matthew E. Eames**, Ph.D.<sup>2</sup>, (1)University of Bath, Bath, United Kingdom, (2)University of Exeter, Exeter, United Kingdom

**3. CFD and Wind Tunnel Study of the Performance of Outdoor Commercial Plaza Air-Conditioning System (LB-17-C003)**

**E. M. ElBialy**, Ph.D.<sup>1</sup> and **SA Ghani**, Ph.D.<sup>1</sup>, (1) Qatar University, Doha, Qatar

9:45 AM – 10:45 AM

**Conference Paper Session 2 (Intermediate)**

**How Healthcare Facilities and Infection Control Are Affected by HVAC Systems**

Room: 101B



Chair: Sonya Pouncy, Member, Walker-Miller Energy Services, Detroit, MI

**1. Analysis of HVAC Configurations for a Hospital Operating Room (LB-17-C004)**

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

**2. An Efficient Ventilation Configuration for Preventing Bioaerosol Exposures to Health Care Workers in Airborne Infection Isolation Rooms (LB-17-C005)**

Deepthi Sharan Thatiparti, Student Member<sup>1</sup>, Urmila Ghia, Ph.D.<sup>1</sup> and Kenneth R. Mead, Ph.D., P.E., Member<sup>2</sup>, (1)University of Cincinnati, Cincinnati, OH, (2)CDC- National Institute for Occupational Safety and Health (NIOSH), Cincinnati, OH

**3. Cross Infection Due to Pathogen Transport in Indoor Environments: Investigative Study Assessing Impact of Ventilation Type, Air Changes and Furniture Layout (LB-17-C006)**

Shamia Hoque, Ph.D., Associate Member, University of South Carolina, Columbia, SC

9:45 AM – 10:45 AM

**Seminar 1 (Intermediate)**

**Psychrometrics of Chilled Beam Systems**

Room: 201B



**Sponsor: 5.3 Room Air Distribution**

Chair: Donald E Larsson, Member, United States Green Building Council, Washington, DC

**1. Psychrometrics of Chilled Beam Systems**

Donald Larsson, Member, United States Green Building Council, Washington, DC

**2. Application of Chilled Beam Systems**

Thomas Rice, Member, Semco LLC, Columbia, MO

**3. Successful Chilled Beam System Installations**

Paul Christy, Clark County Public Schools, Winchester, KY

9:45 AM – 10:45 AM

**Seminar 2 (Intermediate)**



**Commissioning Complex Labs: Stories from the Field**

Room: 102AB

**Sponsor: 9.10 Laboratory Systems, 7.7 Testing and Balancing**

Chair: Wade H. Conlan, P.E., Member, Hanson Professional Services, Orlando, FL

**1. Lab Building Case Study: Safety vs. Energy Conservation**

Justin Garner, P.E., Member, Engineered Air Balance Company, Inc., Houston, TX

**2. Continuous Improvement of Commissioning / Certification of Bsl-3 Laboratories**

Carol Donovan, Member, Alares LLC, Quincy, MA

9:45 AM – 10:45 AM

**Seminar 3 (Intermediate)**

**Smart Buildings, Smart Cities**

Room: 201A

**Sponsor: I.4 Control Theory and Application**

Chair: Joseph Kilcoyne, P.E., Member, SC Engineers, Inc., San Diego, CA

**1. What Is Smart? The Architecture of a Smart City**

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

**2. Turning Modern Cities into SMART Cities**

Parita Ammerlahn, City of San Diego – Environmental Services Department, San Diego, CA



11:00 AM – 12:30 PM

**Conference Paper Session 3 (Intermediate)**

**Air Conditioning Large Spaces: Air Flow, Energy Efficiency and Tower Water Treatment**

Room: 201A

Chair: Yu Joe Huang, Member, White Box Technologies, Moraga, CA

**1. Air Flow Regimes in an Air Conditioned Playground Zone of Open-Roof Football Stadium (LB-17-C007)**

Essam E. Khalil, Fellow ASHRAE<sup>1</sup>, Esmail ElBialy, Dr.Ing.<sup>1</sup>, Waleed AbdelMaksoud, Ph.D., P.E.<sup>1</sup> and Mohamed E. Ashmawy, P.E.<sup>1</sup>, (1)Cairo University Faculty of Engineering, Cairo, Egypt

**2. Legionella Bacteria Control in Cooling Tower Water Systems- An Independent Study Indicates Current Acceptable Microbiological Control Methods are Ineffective Industry Standard Levels of Acceptable Bacteria Need to Change (LB-17-C008)**

Paul Puckorius<sup>1</sup> and John Dresty<sup>2</sup>, (1)Puckorius & Associates, Inc. Water & Wastewater Consultants, Westminster, CO, (2)Griswold Water Systems, Irvine, CA

**3. Case Study of Chiller Selection for the Retrofit of a Large Building Cooling System (LB-17-C009)**

James Turcato, Student Member<sup>1</sup> and Kevin Anderson, Ph.D., P.E., Member<sup>1</sup>, (1) California State Polytechnic University at Pomona, Pomona, CA



Tech Program

11:00 AM – 12:30 PM

**Conference Paper Session 4 (Intermediate)**

**HVAC Equipment Components**

Room: 101A

Chair: Daniel Pettway, Life Member, Hobbs & Associates, Norfolk, VA

**1. Rapid Modelling of Air Flow through Louvers (LB-17-C011)**

Vaibhav Arghode, Ph.D.<sup>1</sup> and Taareesh Taneja<sup>1</sup>, (1) Indian Institute of Technology - Kanpur, Kanpur, India

**2. Efficiency Enhancement of a V-Shaped Evaporator (LB-17-C012)**

Zongqin Zhang, Ph.D., Member<sup>1</sup>, Haijin Xu, P.E.<sup>1</sup>, Xinyu Zhang, P.E.<sup>2</sup>, Weixin Zhang, P.E.<sup>1</sup> and Donna M. L. Meyer, Ph.D.<sup>2</sup>, (1)Nanjing Canatal A/C Co., Ltd, Nanjing, China, (2)University of Rhode Island, Kingston, RI

**3. Flow and Heat Transfer in Vortex-Enhanced Offset Strip-Fin Array, Numerical Study (LB-17-C013)**

Arindom Joardar, Ph.D., Associate Member<sup>1</sup> and Anthony Jacobi<sup>2</sup>, (1) Carrier Corporation, Syracuse, NY, (2)University of Illinois at Urbana Champaign, Urbana, IL



#### 4. A Systematic Classification for HVAC Systems and Components (LB-17-C014)

*Han Li, Student Member<sup>1</sup>, Yan Chen<sup>2</sup>, Jian Zhang, Ph.D., Member<sup>2</sup>, Rahul Athalye, Associate Member<sup>2</sup>, Vrushali Mendon, Member<sup>2</sup> and Yulong Xie, Ph.D.<sup>2</sup>, (1)Carnegie Mellon University, Pittsburgh, PA, (2) Pacific Northwest National Laboratory, Richland, WA*

11:00 AM – 12:30 PM

#### Seminar 4 (Basic)

#### Designing, Operating and Living at a Net Zero Energy and Net Zero Water Building

Room: 103AB

**Sponsor: 7.6 Building Energy Performance**



*Chair: Hyojin Kim, Ph.D., Member, The Catholic University of America, Washington, DC*

##### 1. Owner's Perspective

*Mary Tod Winchester, Chesapeake Bay Foundation, Annapolis, MD*

##### 2. Engineer's Perspective

*Brian Coffield, P.E., Associate Member, SmithGroupJJR, Washington, DC*

##### 3. Occupants' Perspectives

*Hyojin Kim, Ph.D., Member, The Catholic University of America, Washington, DC*

11:00 AM – 12:30 PM

#### Seminar 5 (Basic)

#### (WITHDRAWN) Drones Have Arrived: Unmanned Aerial Systems (UAS) in the Built Environment

Room: 102AB

**Sponsor: 1.5 Computer Applications**

11:00 AM – 12:30 PM

#### Seminar 6 (Intermediate)



#### Going Small in Exhaust Air Energy Recovery, for Multi-Family Buildings Size Doesn't Matter

Room: 203AB

**Sponsor: 5.5 Air-to-Air Energy Recovery**

*Chair: Marc Tardif, Innergytech Inc., Drumminville, QC, Canada*

##### 1. Introduction to the Residential Air-to-Air Energy Recovery Ventilator

*Adam Fecteau, Member, Aldes, Saint-Léonard-d'Aston, QC, Canada*

##### 2. Energy Recovery Ventilation Applications for Multifamily High Rise Dwelling Units in Northeastern Climate

*Manalee Nabar, Bright Power Inc., New York, NY*

##### 3. Single Residential and MURB Energy Modeling Programs and Air-to-Air Energy Recovery

*Peter Grinbergs, Associate Member, Airia Residential Systems Inc., London, ON, Canada*

##### 4. Energy Recovery Ventilators for High Rise Residential Buildings

*James Dean, dpoint Technologies, Inc., Vancouver, BC, Canada*

11:00 AM – 12:30 PM

**Seminar 7 (Intermediate)**



**NZEB from Foundation to Financing:  
Nonresidential Buildings**

*Room: 201B*

**Sponsor: 6.7 Solar Energy Utilization, 6.8 Geothermal Heat Pump and Energy Recovery Applications, TC 2.8**

*Chair: Janice Means, P.E., Life Member, Lawrence Technological University, Southfield, MI*

**1. Introduction to Solar Electric Design and Installation**

*Khalid Nagidi, BEAP, Member, Energy Management Consulting Group, Wantagh, NY*

**2. Photovoltaic (PV) Systems Impact on Electric Demand**

*Svein Olav Morner, Ph.D., P.E., CPMP, Member, Sustainable Engineering Group, Madison, WI*

**3. Financing and Ownership Alternatives for Large Scale Solar PV Projects**

*James Leidel, Member, Oakland University, Rochester, MI*

**4. Deep Energy Refurbishment of Historic and Heritage Buildings to Reach NZEB Status**

*Marija Todorovic, Ph.D., P.E., Fellow ASHRAE, University of Belgrade, VEA-INVI.Ltd Director, Belgrade, Serbia*

11:00 AM – 12:30 PM

**Seminar 8 (Intermediate)**



**Occupant Behavior Based Modeling Predictive Control**

*Room: 202AB*

**Sponsor: MTG.OBB Occupant Behavior in Buildings**

*Chair: Da Yan, Tsinghua University, Beijing, China*

**1. Occupant-Integrated Model Predictive Control of Building HVAC Systems: Benefits, Drawbacks and Challenges**

*David Blum, Ph.D., Associate Member, Lawrence Berkeley National Laboratory, Berkeley, CA*

**2. Behavior Driven Model Predictive Controls for Future Smart Buildings**

*Bing Dong, Associate Member, University of Texas at San Antonio, San Antonio, TX*

**3. Fault and Occupant Tolerant Model Predictive Control of Building HVAC System**

*Pengfei Li, Ph.D., United Technologies Research Center, East Hartford, CT*

**4. The Combination and Application of Model Predictive Control and Occupant Behavior**

*Da Yan, Tsinghua University, Beijing, China*

11:00 AM – 12:30 PM

**Seminar 9 (Intermediate)****Using Optimization to Squeeze More Performance Out of Existing Systems***Room: 101B***Sponsor: 1.13 Optimization***Chair: Christopher R. Laughman, Ph.D., Member, Mitsubishi Electric Research Laboratories, Waltham, MA***1. Optimization of Small Diameter Tube-Fin Heat Exchangers to Enable Performance Improvements, Charge Reduction and Cost Savings***Daniel Bacellar, University of Maryland, College Park, MD***2. Improving Heat Exchanger Circuitry by Using Derivative-Free Optimization***Christopher R. Laughman, Ph.D., Member, Mitsubishi Electric Research Laboratories, Waltham, MA***3. Optimizing Mini-Split Air Conditioning Units Using Alternative Refrigerants***Bo Shen, Ph.D., Member, Oak Ridge National Laboratory, Oak Ridge, TN***4. Operation Optimization of Buildings as Virtual Batteries for the Grid with High Penetrations of Renewables***Zheng O'Neill, Ph.D., P.E., Member, University of Alabama, Tuscaloosa, AL*

1:30 PM – 3:00 PM

**Conference Paper Session 5 (Intermediate)****Thermal Comfort in Modern Transportation***Room: 101A**Chair: Edward A. Vineyard, Fellow ASHRAE, Texas A&M University, College Station, TX***1. Ventilation Efficiency and Thermal Passenger Comfort of Novel Car Ventilation Concepts (LB-17-C015)***Tobias Dehne, CPMP<sup>1</sup>, Johannes Bosbach<sup>1</sup>, Daniel Schmelting<sup>1</sup>, Pascal Lange<sup>1</sup> and Andre Volkman<sup>1</sup>, (1) German Aerospace Center (DLR) Institute of Aerodynamic and Flow Technology, Göttingen, Germany***2. Numerical Simulations of Air Flow Movement and Thermal Comfort in Commercial Aircraft Cabins (LB-17-C016)***Essam E. Khalil, Fellow ASHRAE<sup>1</sup>, Esmail ElBialy, Dr.Eng.<sup>1</sup>, Moustafa Salah, P.Eng.<sup>1</sup> and Ahmed Fahim, Ph.D., P.E.<sup>2</sup>, (1)Cairo University Faculty of Engineering, Cairo, Egypt, (2)HBRC, Cairo, Egypt***3. Effects of Diffuser Arrangements for Mixing and Displacement Ventilations on Indoor Environmental Qualities in Two Adjacent Spaces (LB-17-C017)***Hyeunguk Ahn, Student Member<sup>1</sup> and Donghyun Rim, Ph.D., Associate Member<sup>2</sup>, (1)Pennsylvania State University, State College, PA, (2) Pennsylvania State University, University Park, PA***4. Analysis of Heat Transfer inside Vehicle Cabin by Means of Contribution Ratio of Indoor Climate (LB-17-C018)***Yasuhiro Tanoue<sup>1</sup>, Hideaki Nagano, Ph.D.<sup>1</sup>, Shinsuke Kato, Dr.Eng., Fellow ASHRAE<sup>2</sup> and Itsuhei Khori<sup>1</sup>, (1)Tokyo City University, Tokyo, Japan, (2)University of Tokyo Institute of Industrial Science, Tokyo, Japan*



1:30 PM – 3:00 PM

**Seminar 10 (Intermediate)**



**Research Methods to Achieve Superior Comfort, Health and Well-Being in Buildings**

Room: 203AB

**Sponsor: SGPC 10**

Chair: Eric Adams, Ph.D., Member, Indiana University Purdue University Indianapolis, Indianapolis, IN

**1. Health and Wellness in the Built Environment**

Eric Saunders, Ph.D., International WELL Building Institute, Brooklyn, NY

**2. Humidity Interaction Effect on the Building and Occupants**

Eric Brodsky, P.E., Member, Research Products Corporation, Madison, WI

**3. Implications of Modern Indoor Lighting on Circadian Health**

Frederick Marks, AIA, Visiting Scholar, Salk Institute for Biological Studies, La Jolla, CA

**4. The Well Living Laboratory: A Facility for Investigating the Impact of the Indoor Environment on Human Comfort, Health and Productivity**

Nicholas Clements, Ph.D., Well Living Lab, Rochester, MN

1:30 PM – 3:00 PM

**Seminar 11 (Intermediate)**



**Absorption Heat Pump Applications: Industrial, Space Heating and Water Heating**

Room: 102AB

**Sponsor: 8.3 Absorption and Heat Operated Machines, 9.2 Industrial Air Conditioning**

Chair: Patrick Geoghegan, Ph.D., Member, Oak Ridge National Laboratory, Oak Ridge, TN

**1. Real World Examples of Industrial Absorption Heat Pumps: Exotic Applications, Working Fluids and Cycles (multi-effect)**

Jürgen Scharfe, P.E., Member, JS Energie & Beratung GmbH, Erding, Germany

**2. Case Studies from Around the World that Are Using Modern Absorption Heat Pumps to Save Energy and Water Resources on Planet Earth**

Douglas A. Davis, Associate Member, Broad USA, Hackensack, NJ

**3. Mass Markets in the US for Sorption Heating Appliances**

Kyle Gluesenkamp, Ph.D., Associate Member, Oak Ridge National Laboratory, Oak Ridge, TN

1:30 PM – 3:00 PM

**Seminar 12 (Intermediate)**



**An Interdisciplinary Framework and Survey for Investigating Cross-Country Occupant Behavior in Buildings**

Room: 201A

**Sponsor: MTG.OBB Occupant Behavior in Buildings**

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

**1. An Interdisciplinary Research Approach to Energy-Related Behavior in Buildings**

Simona D'Oca, Ph.D., LBNL, Berkeley, CA

Tech Program

**2. Performance Analysis of Occupant Behavior Questionnaire Survey Data in China's Residential Buildings**

*Da Yan, Tsinghua University, Beijing, China*

**3. Insights on Social Psychological and Contextual Factors Affecting Energy Behaviors and Conservation Intentions in Residential and Commercial Buildings**

*Chien-fei Chen, Ph.D., University of Tennessee, Knoxville, TN*

**4. Lightweight and Adaptive Building Simulation (LABS) Framework for Integrated Building Energy and Occupant Behavior Analysis**

*Carol Menassa, Ph.D., University of Michigan, Ann Arbor, MI*

1:30 PM – 3:00 PM

**Seminar 13 (Basic)**



**Building EQ: ASHRAE and APPA Adapting to Energy Challenges Today**

*Room: 101B*

**Sponsor: Building EQ Committee**

*Chair: Hoy Bohanon, P.E., Member, Hoy Bohanon Engineering, PLLC, Clemmons, NC*

**1. The New Building EQ**

*Hugh Crowther, Member, Swegon North America, Inc., Markham, ON, Canada*

**2. Adapt Building EQ**

*Michael Brandemuehl, Fellow Member, University of Colorado, Boulder, CO*

**3. ASHRAE's Partnership with APPA**

*Daniel Redmond, Carleton University, Ottawa, ON, Canada*

**4. APPA's Opportunity and Expectations of Building EQ**

*Charles Scott, Illinois State University, Normal, IL*

1:30 PM – 3:00 PM

**Seminar 14 (Intermediate)**



**Commissioning of Commercial Kitchen Ventilation Systems, Including Examples of Real World Successes and Failures**

*Room: 201B*

**Sponsor: 5.10 Kitchen Ventilation, 7.9 Building Commissioning**

*Chair: Francis Kohout, P.E., Member, Cyclone Energy Group, Chicago, IL*

**1. What Is Commercial Kitchen Ventilation Commissioning?**

*Donald Fisher, P.Eng. Life Member, Fisher Consultants, Danville, CA*

**2. Overall CKV Commissioning and the Critical Role of Testing and Balancing**

*Jason Brown, Associate Member, Melink Corp., Milford, OH*

**3. Commercial Kitchen Ventilation Operation and Performance: Reality Check from the Field**

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

1:30 PM – 3:00 PM

**Seminar 15 (Intermediate)**



**The IoT for Better Building Operation and Control**

Room: 202AB

**Sponsor: 7.5 Smart Building Systems, 1.4 Control Theory and Application**

Chair: Michael Brambley, Ph.D., Fellow ASHRAE, Pacific Northwest National Laboratory, Richland, WA

**1. Smart Plug Enabled Intelligent Commercial Building Operations**  
Gang Wang, P.E., Member, University of Miami, Coral Gables, FL

**2. Iot Technologies Make Buildings More Energy Efficient and Way Smarter**

Xin (Sherry) Hu, Ph.D., P.E., Member, BriteThings, San Francisco, CA

**3. An Energy Balance Model for Detecting Anomalies in Residential Buildings**

Brent Huchuk, ecobee, Toronto, ON, Canada

**4. Connected Appliances for the Win-Win!**

Dane Christensen, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

1:30 PM – 3:00 PM

**Seminar 16 (Intermediate)**



**Use of Geothermal Heat Pumps to Achieve Net Zero**

Room: 103AB

**Sponsor: 6.8 Geothermal Heat Pump and Energy Recovery Applications**

Chair: William Murphy, Ph.D., P.E., Fellow ASHRAE, University of Kentucky, Paducah, KY

**3. Big Data on a Net Zero Energy Building**

Benjamin Skelton, P.E., CPMP and BEMP, Member, Cyclone Energy Group, Chicago, IL

**1. Evolution of Zero Energy Geothermal Schools from 2010 to 2016**  
Ken Seibert, P.E., Member, CMTA Inc., Louisville, KY

**2. Use of Geothermal and Biofuels to Reach Net Zero in a Northern Public Transit Center**

Erin McConahey, P.E., HBDP, Fellow ASHRAE, Arup, Los Angeles, CA

**4. Geothermal Design for a 24/7/365 Net Zero Police Station**

Spivey Lipsey, P.E., Member, CMTA Engineers, Lexington, KY

3:15 PM – 4:45 PM

**Seminar 17 (Basic)**



**Those Who Cannot Remember the Past are Condemned to Repeat It: Modeling, Performance and Lessons Learned from Installation of Solar Energy Systems**

Room: 103AB

**Sponsor: 6.7 Solar Energy Utilization, 2.8 Building Environmental Impacts and Sustainability, 6.8 Geothermal Heat Pump and Energy Recovery Applications**

Chair: Michael Case, Ph.D., Associate Member, US Army Corps of Engineers, Champaign, IL

**1. Learning from History: Lesson Learned over 35 Years of Solar Energy at Fort Huachuca, AZ**

William Stein, US Army Corps of Engineers, Champaign, IL

## 2. Solar Thermal Sizing, Modeling and Verification for an Army Barracks

*Jay Tulley, U.S. Army Garrison, Monterey, CA*

## 3. Solar Community Heating and Cooling System with Central Heat Pump and Geo-Exchange System for Cold Climates

*Farzin Masoumi, Member, Union Gas Limited, Toronto, ON, Canada*

# Monday, June 26

8:00 AM – 9:30 AM

## Panel 2 (Intermediate)

### How Not to Design a Radiant Heating and Cooling System: Lessons Learned and Strategies for Success

*Room: 202AB*

#### **Sponsor: 6.5 Radiant Heating and Cooling**

*Moderator: Devin Abellon, P.E., Member, Uponor,*

*Apple Valley, MN*

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

**2. Dan Nall, AIA, Fellow ASHRAE,** Syska Hennessy, New York, NY

**3. Peter Rumsey,** Point Energy Innovations, Oakland, CA

**4. Robert Bean,** Healthy Heating, Calgary, AB, Canada

**5. Devin Abellon, P.E., Member,** Uponor, Apple Valley, MN

8:00 AM – 9:30 AM

## Conference Paper Session 6 (Advanced)

### Utilizing Predictive Occupant Behavior and Counting to Better Determine Hot Water and Heating Demand Loads and IAQ

*Room: 101A*



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

#### **1. Sizing Methodology for Domestic Hot Water Systems Based on Accurate Occupant Behavior (LB-17-C019)**

*Jean Rouleau, Student Member<sup>1</sup>, Louis Gosselin, Ph.D., P.E., Member<sup>1</sup> and Alfonso Ramallo-Gonzalez<sup>2</sup>, (1) Université Laval, Québec, QC, Canada, (2) University of Bath, Bath, United Kingdom*

#### **2. Modelling Residential Building Stock Heating Load Demand, Integration of Occupancy Models (LB-17-C020)**

*Giuseppina Buttitta, Student Member<sup>1</sup>, William Turner<sup>1</sup>, Donal Finn<sup>1</sup> and Oliver Neu<sup>1</sup>, (1) University College of Dublin (UCD), Dublin, Ireland*

#### **3. Development and Comparison of Four Different Occupancy Counting and Estimation Solutions (LB-17-C021)**

*Junjing Yang, Ph.D., Associate Member<sup>1</sup>, Alexandros Pantazaras<sup>1</sup>, Arun Kumar Chandran, Ph.D.<sup>1</sup>, Siew Eang Lee, Ph.D.<sup>1</sup>, Mat Santamouris, Ph.D.<sup>2</sup>, Kwok Wai Tham, Ph.D.<sup>1</sup> and Lawrence Wong<sup>1</sup>, (1) National University of Singapore, Singapore, Singapore, (2) UNSW, Sydney, Australia*

#### **4. A Low-Cost Bi-Directional People Counter for Building Control (LB-17-C022)**

*Peng Yin, Ph.D., Associate Member<sup>1</sup> and Xiaoguang Xiao, Student Member<sup>1</sup>, (1) University of Louisiana at Lafayette, Lafayette, LA*

8:00 AM – 9:30 AM

**Seminar 18 (Intermediate)**



**Bridging the Information Gaps to Operation Management**

Room: 102AB

**Sponsor: 7.3 Operation and Maintenance Management, 7.9 Building Commissioning, 7.8 Owning and Operating Costs**

**Chair: Robyn Ellis, Associate Member, City of Hamilton - Public Works, Hamilton, ON, Canada**

**1. Bridging the Information Gap during Commissioning and Project Turnover to Operations**

**Chuck Dale-Derks, P.E., Member, McClure Engineering, St. Louis, MO**

**2. Commissioning Documentation for Operations Management**

**John Gibbemeyer, P.E., Member, George Mason University, Fairfax, VA**

**3. Building Re-Tuning with Automated Data-Logger Networks**

**Paul Reale, Building Performance Lab, City University of New York, New York, NY**

**4. Commissioning in the Cloud**

**Kris Kinney, Member, Highwoods Properties, Raleigh, NC**

8:00 AM – 9:30 AM

**Seminar 19 (Intermediate)**



**Changes to Heat Gain Tables in the Handbook Commercial Load Calculations Chapter 18**

Room: 201A

**Sponsor: 4.1 Load Calculation Data and Procedures, 5.10 Kitchen Ventilation**

**Chair: Jeff Stein, P.E., Member, Taylor Engineering, LLC, Alameda, CA**

**1. RP-1742 Update to Measurements of Office Equipment Heat Gain Data: Experimental Approach and Results Overview**

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

**2. RP-1742 Update to Measurements of Office Equipment Heat Gain Data: Data Analysis and Parametric Studies**

**Omer Sarfraz, Student Member, Oklahoma State University, Stillwater, OK**

**3. RP-1631 Update to Kitchen Appliance Heat Gain Data**

**Rich Swierczynna, Associate Member, Fisher-Nickel, San Ramon, CA**

8:00 AM – 9:30 AM

**Seminar 20 (Basic)**



**Preventing Headlines: Securing Building Automation Systems**

Room: 103AB

**Sponsor: 1.4 Control Theory and Application, 1.5 Computer Applications, 7.5 Smart Building Systems**

**Chair: Michael Pouchak, P.E., Member, Honeywell International, Golden Valley, MN**

**1. Specifying Cyber Security Requirements for Building Automation Systems: An Introduction to Industry Challenges, Opportunities and Best Practices**

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

**2. The 20 Minute Risk Assessment**

**Bruce Billedeaux, P.E., Member, Maverick Technologies, Portage, MI**

**3. Using a Systems Approach to Secure Networks***Mike Pouchak, P.E., Member, Honeywell, Golden Valley, CA***4. Cybersecurity Compliance Testing***Paul Forney, Schneider Electric, Lake Forest, CA*

8:00 AM – 9:30 AM

**Seminar 21 (Intermediate)****Passive and Net Zero: An Envelope Perspective***Room: 201B***Sponsor: 4.4 Building Materials and Building Envelope Performance***Chair: Achilles Karagiozis, Ph.D., Member, Owens Corning, Granville, OH***1. Climate Specific Passive Building Challenges***Katrin Klingenberg, Passive House Institute US | PHIUS, Urbana, IL***2. Building Energy and Envelope Performance of a Near Net Zero Energy Building***Stanley Gatland II, Member, Saint Gobain Corp., Philadelphia, PA***3. Hygrothermal Considerations for Building Envelopes in Passive Buildings***Florian Antretter, Member, Fraunhofer-Institut für Bauphysik, Munich, Germany*

8:00 AM – 9:30 AM

**Seminar 22 (Intermediate)****What Is the Prospect for Low-Cost Chemical and Biological Threat Detection and Response in Commercial Buildings?***Room: 101B***Sponsor: 2.3 Gaseous Air Contaminants and Gas Contaminant Removal Equipment, 2.4 Particulate Air Contaminants and Particulate Contaminant Removal Equipment***Chair: Russell Taylor, Ph.D., Member, United Technologies Research Center, East Hartford, CT***1. Biological and Chemical Threat Detection in Commercial Buildings: A DHS Perspective***Matthew Davenport, Department of Homeland Security, Washington, DC***2. The Need for Low Cost Biological Agent Detection in Buildings: A DOD Perspective***Patricia Buckley, US Army ECBC (Edgewood Chemical Biological Center), Parkville, MD***3. A Decision Support Framework for Automated Building Systems Response to Mitigate Occupant and Facility Impacts from Chemical and Biological Agents***Angela Waterworth, Pacific Northwest National Labs, Richland, WA***4. A Study of Hazardous Agent Propagation in an Office Building to Evaluate HVAC Threat Mitigation Strategies***Russell Taylor, Ph.D., BEMP, Member, United Technologies Research Center, East Hartford, CT*

8:00 AM – 9:30 AM

**Seminar 23 (Intermediate)**



**Contamination Control and Lubricant Considerations during Retrofits to Low GWP Refrigerants**

Room: 203AB

**Sponsor:** 3.3 Refrigerant Contaminant Control, 3.2 Refrigerant System Chemistry, 3.4, MTG Low GWP  
**Chair:** Ed Hessel, Ph.D., Associate Member, Chemtura Corp., Fords, NJ

**1. Lubricant Considerations during Retrofits to Low GWP Refrigerants**

Joe Karnaz, DSc, Member, Shrieve Chemical, Houston, TX

**2. Impact of Contamination on the Stability of Low GWP Refrigerants**

Sarah Kim, Ph.D., Associate Member, Arkema, Inc., King of Prussia, PA

**3. Key Learnings from Conversions of Commercial Refrigeration Systems to Low GWP Alternatives**

Andrew Pansulla, Chemours, Wilmington, DE

9:45 AM – 10:45 AM

**Debate 2 (Intermediate)**

**Commissioning Agents For Smart Buildings: Whose Side Am I On?**

Room: 203AB

**Sponsor:** 1.4 Control Theory and Application, 7.5 Smart Building Systems, HVAC Security TG2

**Moderator:** Frank Shadpour, P.E., Fellow ASHRAE, SC Engineers, Inc., San Diego, CA

1. George Rogers, RQ Construction, Carlsbad, CA

2. Daniel Farrow, Palomar Health, San Diego, CA

3. Frank Shadpour, P.E., HFDP, Fellow ASHRAE, SC Engineers, Inc., San Diego, CA

9:45 AM – 10:45 AM

**Technical Paper Session 1 (Intermediate)**

**How Will Technology Lead Us to a More Efficient Built Environment?**

Room: 102AB



**Chair:** Rachel Romero, P.E., Member, National Renewable Energy Laboratory, Golden, CO

**1. Autonomous Robotic Building Energy Audits: Demonstrated Technology and Open Challenges (LB-17-001)**

Christopher Bay, Student Member<sup>1</sup>, Trevor Terrill<sup>1</sup> and Bryan Rasmussen, Ph.D., P.E., Member<sup>1</sup>, (1)Texas A&M University, College Station, TX

**2. First-Year Calibration of a Design Energy Model at a Medical Office Building (LB-17-002)**

Thomas Langran, P.E.<sup>1</sup> and Michael Weller<sup>2</sup>, (1)Kaiser Permanente, Anaheim, CA, (2)Glumac, Irvine, CA

**3. Development of Maximum Technically Achievable Energy Targets for Commercial Buildings (RP-1651) (LB-17-003)**

Jason Glazer, P.E., Member, GARD Analytics, Inc., Arlington Heights, IL

Tech Program

9:45 AM – 10:45 AM

**Conference Paper Session 7 (Basic)****Improving Refrigeration in the Retail Food Establishments***Room: 101B**Chair: Xiwang Li, Student Member, Drexel University, Philadelphia, PA***1. Defining Room Area for Connected Spaces for Flammable Refrigerants (LB-17-C023)***William Hansen, P.E., Member<sup>1</sup> and Stephen Kujak, Member<sup>1</sup>, (1) Trane, Ingersoll Rand, La Crosse, WI***2. Long-Term Thermal Performance of Polyurethane Insulation within Cold Storage Panel Systems Used in U.S. Retail Grocery Environments (LB-17-C024)***James M Costanza, Member, KPS Global LLC, Fort Worth, TX***3. Analysis of Water-Cooled Refrigeration Systems for the Food Retail Industry (LB-17-C025)***Maria-Aliki Efstratiadi, M.D.<sup>1</sup>, Salvador Acha, Ph.D., Associate Member<sup>1</sup>, Nilah Shah, Ph.D.<sup>1</sup> and Christos N. Markides, Ph.D.<sup>1</sup>, (1) Imperial College London, London, United Kingdom*

9:45 AM – 10:45 AM

**Conference Paper Session 8 (Intermediate)****Considerations in Stairway Pressurization and Underground Structure's Life Safety***Room: 101A**Chair: Peter McDonnell, McClure Engineering, Inc., Twin Falls, ID***1. Pressurized Stairwells with Open Doors and the IBC (LB-17-C026)***John Klote, P.E., Fellow Life Member<sup>1</sup>, Paul Turnbull, Member<sup>2</sup> and Douglas H. Evans<sup>3</sup>, (1)John Klote Fire and Smoke Consulting, Leesburg, VA, (2)Siemens Building Technologies, Inc., Buffalo Grove, IL, (3)Clark County Building Division, Las Vegas, NV***2. Fire and Life Safety Systems at Delhi Metro Underground Stations (LB-17-C027)***Anoop Kumar Gupta, Member<sup>1</sup>, Abdhesh Kumar Singh, Member<sup>1</sup> and Rajesh Kumar Jain<sup>1</sup>, (1)Delhi Metro Rail Corp. Limited, New Delhi, India***3. Life Safety Considerations in Tunnel Smoke Control (LB-17-C028)***Yoon Ko, Ph.D., Member<sup>1</sup> and Ahmed Kashef, P.E., Member<sup>1</sup>, (1)National Research Council Canada, Ottawa, ON, Canada*

9:45 AM – 10:45 AM

**Seminar 24 (Intermediate)****As Cool as it Sounds: Strategies to Mitigate the Acoustic Challenges of Radiantly-Cooled Environments***Room: 103AB***Sponsor: 6.5 Radiant Heating and Cooling***Chair: Devin Abellon, P.E., Member, Uponor, Apple Valley, MN***1. Effect of Acoustical Coverage and Air Movement on the Cooling Capacity of a Radiant Chilled Ceiling***Caroline Karmann, Student Member, UC Berkeley, Berkeley, CA***2. Effects of Horizontal and Vertical Sound Absorbers on the Cooling Capacity of Thermally Activated Building Systems (TABS)***Marcos Dominguez, Student Member, Technical University of Denmark, Lyngby, Denmark*



9:45 AM – 10:45 AM

**Seminar 25 (Intermediate)**



**ASHRAE’s Residential Energy Performance Standards for New and Existing Buildings**

Room: 202AB

**Sponsor: 7.6 Building Energy Performance, SSPC 100, SSPC 90.2, Residential Building Committee**

*Chair: Michael Deru, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO*

**1. Standard 90.2: The Path to Performance**

*Theresa A. Weston, Ph.D., Member, DuPont Building Innovations, Richmond, VA*

**2. Standard 100 Residential Applications and Options**

*Neil P. Leslie, P.E., Member, Gas Technology Institute, Des Plaines, IL*

9:45 AM – 10:45 AM

**Seminar 26 (Advanced)**



**Evolution of Underfloor Design and its Application for Millennial Office Spaces**

Room: 201A

**Sponsor: 5.3 Room Air Distribution**

*Chair: Matt Bhumbla, Member, Price Industries, Suwanee, GA*

**1. Underfloor System Design Evolution**

*Dan Nall, AIA, Fellow ASHRAE, Syska Hennessy, New York, NY*

**2. Top Five Application Considerations for Successful UFAD Systems**

*Jim Megerson, P.E., Member, Design Mechanical Inc., Kansas City, KS*

9:45 AM – 10:45 AM

**Forum 2 (Basic)**

**Great Minds Don’t Always Think Alike: What Is Needed for a “Good” Project Specification?**

Room: 201B

**Sponsor: 9.8 Large Building Air-Conditioning Systems**

*Moderator: Heather Schopplein, Member, P.E., Haldeman Inc., San Diego, CA*

11:00 AM – 12:00 PM

**Technical Paper Session 2 (Intermediate)**

**Cooling Systems Design, Operation and Commissioning**

Room: 102AB



*Chair: Sonya Pouncy, Member, Walker-Miller Energy Services, Detroit, MI*

**1. Performance Monitoring of a Chilled Water Distribution System HVAC-Cx (LB-17-004)**

*Natascha Milesi Ferretti, P.E., Member<sup>1</sup>, Mike Galler, Member<sup>1</sup> and Steven Bushby<sup>1</sup>, (1) National Institute of Standards and Technology, Gaithersburg, MD*

**2. Optimizing the Design of Chilled Water Plants for Commercial Building Energy Systems (LB-17-005)**

*Nabil Nassif<sup>1</sup>, Nihal AlRae<sup>1</sup> and Fouad AlRifaie<sup>1</sup>, (1) North Carolina A&T University, Greensboro, NC*

### 3. Low-Cost Control System Built Upon Consumer-Based Electronics for Supervisory Control of a Gas-Operated Heat Pump (LB-17-006)

*Ahmad Abu-Heiba<sup>1</sup>, Randall Wetherington<sup>1</sup>, Isaac Mahderekal, Ph.D., Member<sup>2</sup> and Edward A. Vineyard, Fellow ASHRAE<sup>3</sup>, (1)Oak Ridge National Laboratory, Oak Ridge, TN, (2)Energy Studies and Services Group, Henderson, NV, (3)Texas A&M University, College Station, TX*

11:00 AM – 12:00 PM

#### Conference Paper Session 9 (Intermediate)

##### Residential High Efficiency



*Room: 203AB*

*Chair: Mini Malhotra, Member, Oak Ridge National Laboratory, Oak Ridge, TN*

##### 1. Residential Hybrid-Ground Source Heat Pump – Phase I (LB-17-C029)

*Nelson Fumo, Ph.D., Associate Member<sup>1</sup> and Vicente Bortone, P.E.<sup>2</sup>, (1)University of Texas at Tyler, Tyler, TX, (2)Johnson Controls, Inc., Lenexa, KS*

##### 2. Thermoeconomic Comparison of Residential Solar-Powered Heat Pump Systems (LB-17-C030)

*Yeshpal Gupta, Ph.D.<sup>1</sup> and Patrick Phelan<sup>1</sup>, (1) Lincus, Inc., Tempe, AZ*

##### 3. Design and Pilot Testing of a Residential Chilled Water Thermal Storage System as Part of a Net Zero Energy and Water House (LB-17-C031)

*Charles R Upshaw, Ph.D., Associate Member<sup>1</sup>, Joshua Rhodes, Ph.D., Student Member and Michael Webber, Ph.D., Member, University of Texas, Austin, TX*

11:00 AM – 12:00 PM

#### Seminar 27 (Intermediate)



##### Best Practices for Employing VRF Systems

*Room: 201A*

*Sponsor: 8.7 Variable Refrigerant Flow, 7.9 Building Commissioning*

*Chair: Lee Riback, Member, McKinstry, Dallas, TX*

##### 1. Best Practices and Quality Control Considerations for VRF Projects

*Bill Artis, Member, Daikin, New York, NY*

##### 2. Lessons Learned through Commissioning

*Thomas Conn, Horizon Engineering Associates, New York, NY*

11:00 AM – 12:00 PM

#### Seminar 28 (Advanced)



##### Commercial Kitchen Ventilation: Insights into Energy and Water Efficiency!

*Room: 101B*

*Sponsor: 5.10 Kitchen Ventilation*

*Chair: Donald Fisher, P.Eng., Life Member, Fisher Consultants, Danville, CA*

##### 1. The Potential for Exhaust Air Heat Recovery in Commercial Kitchen Ventilation

*Rich Swierczyna, Associate Member, Fisher-Nickel, San Ramon, CA*

##### 2. Field Test Results of an Air-to-Water Heat Exchanger in a Commercial Kitchen

*Michael Watz Jr., P.E., Member, Accurex a Greenheck Company, Schofield, WI*

**3. Clean in Place Hoods, the Labor and Water Resource Trade Off**  
*Russell Robinson, Member, Gaylord Industries, Tualatin, OR*

**4. Modeling Demand Controlled Kitchen Ventilation Systems**  
*Vernon Smith, P.E., Life Member, Smith Energy Engineers, LLC, Niwot, CO*

11:00 AM – 12:00 PM

**Seminar 29 (Basic)**



**Urban-Scale Building Energy Modeling, Part 5**

*Room: 101A*

**Sponsor: 1.5 Computer Applications, 4.7 Energy Calculations**  
*Chair: Bass Abushakra, Ph.D., Member, United States Military Academy, West Point, NY*

**1. Automatic Building Energy Model Creation (AutoBEM)**

*Joshua New, Ph.D., Member, Oak Ridge National Laboratory, Oak Ridge, TN*

**2. Simplified Estimation of Energy Use Intensity Based on Building Façade Features**

*Joon-Ho Choi, Ph.D., Associate Member, University of Southern California, Los Angeles, CA*

**3. Retrofitting District-Scale Buildings to Cut Energy Use By 50%: A Case Study**

*Yixing Chen, Ph.D., Associate Member<sup>1</sup> and Tianzhen Hong, Ph.D., Member<sup>1</sup>, (1) Lawrence Berkeley National Laboratory, Berkeley, CA*

11:00 AM – 12:00 PM

**Forum 3 (Basic)**

**Accreditation of HVAC&R Engineering Programs:**

**Who Cares?**

*Room: 202AB*

**Sponsor: Student Activities Committee**

*Moderator: Michael Brandemuehl, Fellow Member, University of Colorado, Boulder, CO*

11:00 AM – 12:00 PM

**Forum 4 (Intermediate)**

**What the FPT Is Commissioning for Design Build Projects?**

*Room: 103AB*

**Sponsor: 7.9 Building Commissioning, 7.2 HVAC&R Construction & Design Build Technologies**

*Moderator: Will Mak, P.E., Member, Cyclone Energy Group, Chicago, IL*

11:00 AM – 12:00 PM

**Workshop 8 (Basic)**



**Opaque OPRs Produce Obscure Objectives**

*Room: 201B*

**Sponsor: 7.3 Operation and Maintenance Management, 1.7 Business, Management & General Legal Education**

*Chair: E. Mitchell Swann, P.E., Member, Virtual Construction/BIM Manager, Paoli, PA*

**1. Owner's Perspective of an OPR**

*Wayne Webster, Member, Princess Towers, Inc., Kingston, ON, Canada*

**2. Cx Provider's Perspective of an OPR**

*Mina Agarabi, P.E., CPMP, Member, Agarabi Engineering PLLC, New York, NY*

2:15 PM – 3:45 PM

**Seminar 30 (Basic)**
**Your Ethics Tool Box: Building a Framework for Ethical Decision-Making With Case Studies**
*Room: 103AB*
**Sponsor: 1.7 Business, Management & General Legal Education**
*Chair: James Arnold, P.E., Member, Haslett Heating and Cooling, Columbus, OH*
**1. Your Ethics Tool Box: Building a Framework for Ethical Decision-Making**
*Kathleen Lacey, J.D., Ukleja Center for Ethical Leadership at California State University, Long Beach, Long Beach, CA*
**2. Case Studies in Engineering Ethics Part 1**
*Kristin Schaefer, P.E., Member, Schaefer Engineering, Katy, TX*
**3. Case Studies in Engineering Ethics Part 2**
*Mike Bilderbeck, P.E., Fellow ASHRAE, Pickering, Inc., Memphis, TN*
**Tuesday, June 27**

8:00 AM – 9:30 AM


**Conference Paper Session 10 (Intermediate)**
**Using Occupancy and Actual Short-Term/Long-Term Energy Data to Develop More Accurate Modeling Tools**
*Room: 101A*
*Chair: Alamelu Brooks, Member, ICF International, Columbia, MD*
**1. Case Study on the Validity of Energy Simulation and Energy Measuring in the Office ZEB in California, U.S. (LB-17-C032)**
*Hidemitsu Koyanagi, Ph.D.<sup>1</sup> and Alan Meier, Ph.D.<sup>2</sup>, (1) TAISEI Corporation, Yokohama, Japan, (2) Lawrence Berkeley National Lab, Berkeley, CA*
**2. Improving the Accuracy of Building Energy Simulation Using Real-Time Occupancy Schedule and Metered Electricity Consumption Data (LB-17-C033)**
*Chandra Sekhar, Ph.D., Fellow ASHRAE<sup>1</sup>, Junjing Yang, Ph.D., Associate Member<sup>1</sup>, Prashant Anand, Student Member<sup>1</sup>, David Cheong, Ph.D., Member<sup>1</sup> and, (1) National University of Singapore, Singapore, Singapore*
**3. Half-Hourly Regional Electricity Price Modelling for Commercial End Users in the UK (LB-17-C034)**
*Salvador Acha, Ph.D., Aitor Soler, Gonzalo Bustos, P.Eng. and Nilah Shah, Ph.D., Imperial College London, London, United Kingdom*
**4. A Systematic Feature Selection Procedure for Data-driven Building Energy Forecasting Model Development (LB-17-C035)**
*Liang Zhang, Student Member<sup>1</sup> and Jin Wen, Ph.D., Member<sup>1</sup>, (1) Drexel University, Philadelphia, PA*

8:00 AM – 9:30 AM

**Seminar 31 (Intermediate)**



**Feedback: The Essential Ingredient for High Performance Green Homes**

Room: 201A

**Sponsor: 2.8 Building Environmental Impacts and Sustainability, 4.4 Building Materials and Building Envelope Performance, Residential Building Committee**

**Chair: Audrey Dupuis, Member, Pageau Morel, Montreal, QC, Canada**

**1. Feedback Tools for Designing and Implementing Comfortable Efficient Homes**

**Dan Perunko, Balance Point Home Performance, Nevada City, CA**

**2. Which Should Come First in Housing, Energy Efficiency or Thermal Comfort?**

**Robert Bean, Member, Indoor Climate Consultants Inc., Calgary, AB, Canada**

**3. The Energy and Environmental Benefits of Design Choices that Provide Excellent Comfort**

**Jim Larsen, Cardinal Glass Industries, Eden Prairie, MN**

8:00 AM – 9:30 AM

**Seminar 32 (Intermediate)**



**Ejector Systems in Transport Refrigeration**

Room: 201B

**Sponsor: 10.6 Transport Refrigeration**

**Chair: Robert Chopko, Member, Carrier Transicold, Syracuse, NY**

**1. Modeling, Design and Efficiency of Two-Phase Ejectors to Increase Cop of Transport Refrigeration Systems**

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

**2. Application of Natural Refrigerant CO2 in Container Transport Refrigeration Systems and Potential Benefits and Impacts with CO2 Ejector Cycle**

**Keonwoo Lee, Member, Carrier Transicold, Syracuse, NY**

**3. Manufacturing Considerations for Ejector Systems**

**David Lee, Member, Mueller Refrigeration, Hartsville, TN**

8:00 AM – 9:30 AM

**Seminar 33 (Basic)**



**Flooding, Superstorm Sandy: Lessons Learned and Strategies Implemented**

Room: 202AB

**Sponsor: 2.5 Global Climate Change, 2.8 Building Environmental Impacts and Sustainability, 4.2 Climatic Information**

**Chair: Scott Sherwood, Member, Eco Care Corporation, Bronx, NY**

**1. Superstorm Sandy: Lessons Learned**

**Chris Colasanti, P.E., Member, Jaros Baum & Bolles, New York, NY**

**2. Superstorm Sandy: New Codes and Design Considerations**

**Illya Azaroff, AIA, +LAB Architect PLLC, New York, NY**

**3. Life Safety Issues That Occurred at NYU Medical during and in the Aftermath of Superstorm Sandy**

**Richard Cohen, NYU Langone Medical Center, New York, NY**

**4. Climatic Information: History and Current Data & Trending**

**Scott Sherwood, Member, Eco Care Corporation, Bronx, NY**

8:00 AM – 9:30 AM

**Seminar 34 (Intermediate)****Not-in-Kind HVAC Technologies, Part 1***Room: 101B***Sponsor: Publication and Education Council***Chair: Pradeep Bansal, Ph.D., Fellow ASHRAE, ASHRAE STBE Editorial Board, Atlanta, GA***1. Compressor Driven Metal Hydride Heat Pumps Using Adsorptive Slurry and Isothermal Compression***Nelson James, Student Member<sup>1</sup>, James Braun, Ph.D., Fellow ASHRAE<sup>1</sup>, Eckhard Groll, Dr.Ing., Fellow ASHRAE<sup>1</sup> and Travis Horton, Ph.D., Member<sup>1</sup>, (1)Purdue University, West Lafayette, IN***2. Design of a Hydraulically Driven Compressive Elastocaloric Cooling System***Yunho Hwang, Ph.D., Member<sup>1</sup>, Suxin Qian, Ph.D., Member<sup>2</sup>, Yunlong Geng, Ph.D., Member<sup>1</sup>, Yi Wang, Ph.D., Member<sup>1</sup>, Jan Muehlbauer, Member<sup>1</sup>, Jiazhen Ling, Ph.D., Member<sup>1</sup>, Reinhard Radermacher, Ph.D., Fellow ASHRAE<sup>1</sup> and Ichiro Takeuchi, Ph.D.<sup>1</sup>, (1)University of Maryland, College Park, MD, (2)Xi'an Jiaotong University, Xi'an, China***3. Design and Performance of a Novel Magnetocaloric Heat Pump***Michael Benedict, Ph.D., Member<sup>1</sup>, S.a. Sherif, Ph.D., Member<sup>2</sup>, Michael Schroeder, Member<sup>1</sup> and David Beers, Member<sup>1</sup>, (1)General Electric, Louisville, KY, (2)University of Florida, Gainesville, FL*

8:00 AM – 9:30 AM

**Seminar 35 (Intermediate)****Advancing Standard 90.1 to Net Zero Energy Buildings***Room: 103AB***Sponsor: 7.6 Building Energy Performance, SSPC 90.1***Chair: Bing Liu, P.E., Member, Pacific Northwest National Laboratory, Portland, OR***1. Advancing Standard 90.1 Envelope Requirements***Leonard Sciarra, AIA, Member, Gentler, Chicago, IL***2. Advancing Standard 90.1 Lighting and Power Requirements***Eric Richman, Member, Pacific Northwest National Laboratory, Richland, WA***3. Advancing Standard 90.1 Mechanical Requirements***Richard Lord, Fellow ASHRAE, United Technologies Carrier Corp, Murfreesboro, TN***4. Advancing Standard 90.1 Performance-Based Path to Achieving Net Zero Energy Buildings***Michael Rosenberg, Fellow ASHRAE, Pacific Northwest National Laboratory, Richland, WA*

8:00 AM – 9:30 AM

**Seminar 36 (Basic)****Using Nature, Keeping Control***Room: 102AB***Sponsor: 1.4 Control Theory and Application, 4.5 Fenestration, MTG OBB***Chair: James Coogan, P.E., Associate Member, Siemens Industry, Inc., Buffalo Grove, IL***1. Engaging Users in Natural Ventilation in Mixed Mode Buildings***Glenn Friedman, P.E., Fellow ASHRAE, Taylor Engineering, Alameda, CA*

**2. Reducing Uncertainty When Controlling Natural Ventilation**  
*Stephen Ray, Ph.D., P.E., Associate Member, North Park University, Chicago, IL*

**3. Integrated Room Control for HVAC, Lighting and Daylighting**  
*Klaus Jank, Siemens BT, Buffalo Grove, IL*

8:00 AM – 9:30 AM

**Seminar 37 (Basic)**



**Water Treatment: The Overlooked Aspect of Commissioning Hydronic Systems**

*Room: 203AB*

**Sponsor: 3.6 Water Treatment, 8.6 Cooling Towers and Evaporative Condensers**

*Chair: Helen Cerra, Member, ChemTreat, Inc., Glen Allen, VA*

**1. Commissioning of Your Steam System's Water Treatment Program**  
*Todd Cornwell, Member, AFCO, Raleigh, NC*

**2. Proper Commissioning of Your Cooling System's Water Treatment Program**

*Dan Weimar, Member, Chem-Aqua, Inc., Irving, TX*

**3. Potable Water and Other Indoor Aerosolizing Systems**

*Tim Keane, Member, Legionella Risk Management Inc., Chalfont, PA*

9:45 AM – 10:45 AM

**Technical Paper Session 3 (Intermediate)**

**Research in HVAC Fundamentals**



*Room: 102AB*

*Chair: Daniel Pettway, Member, Hobbs & Associates, Norfolk, VA*

**1. Updating the ASHRAE Climate Design Data for 2017 (RP-1699) (LB-17-007)**

*Michael Roth, Ph.D., Klimaat, Guelph, ON, Canada*

**2. Effects of Air Leakage on Buildings' Overall Thermal Resistances Based on U.S. Climate Zones (LB-17-008)**

*Simon Pallin, Ph.D., Associate Member<sup>1</sup>, Michaela Stockdale<sup>2</sup>, Phillip Boudreaux, Ph.D.<sup>1</sup> and Elizabeth Buechler<sup>3</sup>, (1)ORNL, Oak Ridge, TN, (2)Tennessee Technological University, Cookeville, TN, (3)Tufts University, Medford, MA*

**3. Automatic Fault Detection and Diagnostics and Hierarchical Fault Suppression in ASHRAE (RP-1455) (LB-17-009)**

*Reece Kiri, P.E., Member<sup>1</sup> and Steven Taylor, P.E., Fellow ASHRAE<sup>1</sup>, (1) Taylor Engineering LLC, Alameda, CA*

9:45 AM – 10:45 AM

**Conference Paper Session 11 (Intermediate)**

**CFD for Smoke Management**



*Room: 101B*

**Sponsor: 5.6 Control of Fire and Smoke**

*Chair: Paul Turnbull, Member, Siemens Building Technologies, Inc., Buffalo Grove, IL*

**1. Tenability Analysis and Atrium Smoke Control (LB-17-C036)**

*John Klote, P.E., Fellow Life Member, John Klote Fire and Smoke Consulting, Leesburg, VA*

**2. CFD Modeling of Full-Size Highrise Fire Smoke Spread and Control (LB-17-C037)**

*Liangzhu Wang, Ph.D., P.E., Member<sup>1</sup>, Dahai Qi, Student Member<sup>1</sup>, Shamim Mashayekh<sup>1</sup> and Malek Soubra<sup>1</sup>, (1) Concordia University, Montreal, QC, Canada*

**3. CFD Analysis of Smoke Protected Seating (LB-17-C038)**

**Jennifer L. Wiley, P.E.<sup>1</sup> and Michael J. Ferreira, P.E.<sup>1</sup>, (1) Jensen Hughes Inc., Baltimore, MD**

9:45 AM – 10:45 AM

**Conference Paper Session 12 (Intermediate)****Highly Efficient HVAC System Components**

Room: 101A

Chair: Stephanie Kunkel, Member, JMT, Sparks, MD

**1. Application of TPRTs (Thermal Performance/Response Tests) in a Saturated Porous Formation (LB-17-C039)**

**Wonjun Choi, Ph.D., Member<sup>1</sup> and Ryoza Ooka, Ph.D., Member<sup>1</sup>, (1) University of Tokyo, Tokyo, Japan**

**2. Investigation of a Design and Operation Method for a Heat Recovery Ground Source Heat Pump System (LB-17-C040)**

**Takao Katsura, Ph.D.<sup>1</sup>, Katsunori Nagano, Ph.D.<sup>1</sup> and Yasushi Nakamura, Ph.D.<sup>2</sup>, (1)Hokkaido University, Sapporo, Japan, (2)Nippon Steel & Sumikin Engineering, Tokyo, Japan**

**3. Retrofit of Commercial Buildings Using a Gas Heat Pump System (LB-17-C041)**

**Leticia De Oliveira Neves, Ph.D., Member<sup>1</sup>, Bruno Scalet, P.E.<sup>2</sup>, Fernando Alves<sup>2</sup>, Tássia Marques<sup>2</sup> and Edson Kurotsu<sup>2</sup>, (1)University of Campinas, Campinas, Brazil, (2)CTE, São Paulo, Brazil**

9:45 AM – 10:45 AM

**Seminar 38 (Intermediate)****Not-in-Kind HVAC Technologies, Part 2**

Room: 103AB

**Sponsor: Publication and Education Council**

Chair: Pradeep Bansal, Ph.D., ASHRAE STBE Editorial Board, Atlanta, GA

**1. Elastocaloric Cooling: From Fundamental Thermodynamics to Solid State Air Conditioning**

**Marvin Schmidt, Member<sup>1</sup>, Susanne-Marie Kirsch, Member<sup>1</sup>, Stefan Seelecke, Dr.Ing., Member<sup>1</sup> and Andreas Schütze, Dr.Ing., Member<sup>1</sup>, (1)Saarland University, Saarbrücken, Germany**

**2. Magnetic Heat Pumps: An Overview of Design Principles and Challenges**

**Paulo Trevizoli, Ph.D., Member<sup>1</sup>, Theodor Christiaanse, Student Member<sup>1</sup>, Premakumara Govindappa, Student Member<sup>1</sup>, Iman Niknia, Student Member<sup>1</sup>, Reed Teyber, Student Member<sup>1</sup>, Jader Barbosa<sup>1</sup> and Andrew Rowe, Ph.D., Member<sup>1</sup>, (1)University of Victoria, Victoria, BC, Canada**

9:45 AM – 10:45 AM

**Seminar 39 (Basic)****Chiller Retrofit Case Study: From Evaluating Options to Optimizing Operation**

Room: 203AB

**Sponsor: 7.6 Building Energy Performance**

Chair: Annie Smith, Member, Ross & Baruzzini, St. Louis, MO

**1. Case Study: Critically Evaluating Replacement Chiller Options beyond Lifecycle Cost Analysis**

**Edmund Wong, P.E., Associate Member, Arup, Los Angeles, CA**

**2. Post Chiller Retrofit: Ongoing Optimization Strategies for Continuous Improvement**

**Jeff Landreth, P.E., BEAP and CPMP, Associate Member, tk1sc, Los Angeles, CA**



9:45 AM – 10:45 AM

**Seminar 40 (Advanced)**



**Delivering a Successful Critical Facility/Data Center Project by Fostering a Healthy Relationship between the Owner, Engineer and Commissioning Agent**

Room: 201A

**Sponsor: 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment, 7.9 Building Commissioning**

*Chair: Nick Gangemi, Life Member, Northern Air Systems, Rochester, NY*

**1. The EOR’s Perspective on Delivering a Successful Critical Facility/Data Center Project By Fostering a Healthy Relationship with the Owner and Commissioning Agent**

*Vali Sorell, P.E., Member, Sorell Engineering, Charlotte, NC*

**2. The CxA’s Perspective on Delivering a Successful Critical Facility/Data Center Project by Fostering a Healthy Relationship with the Owner and Engineer**

*Terry Rodgers, Member, Primary Integration Solutions Inc., Charlotte, NC*

9:45 AM – 10:45 AM

**Forum 5 (Basic)**

**Future Smart Buildings: What Data Do We Need to Collect and How?**

Room: 202AB

**Sponsor: 7.5 Smart Building Systems**

*Moderator: Kristen Cetin, Ph.D., P.E., Member, Iowa State University, Ames, IA*

9:45 AM – 10:45 AM

**Forum 6 (Basic)**

**Best Practices for Low Energy Residential Buildings Across the Globe**

Room: 201B

**Sponsor: 2.8 Building Environmental Impacts and Sustainability, AASA, MTG.HCDG Hot Climate Design Guide**

*Moderator: Ashish Rakheja, P.E., Member, AEON Integrated Building Design Consultants LLP, Noida, India*

11:00 AM – 12:30 PM

**Conference Paper Session 13 (Intermediate)**

**Design, Commissioning and Fault Detection Considerations for New and Existing Buildings**

Room: 101B



*Chair: Xiufeng Pang, Lawrence Berkeley National Laboratory, Berkeley, CA*

**1. Design-Build Commissioning: How to Enforce When the Contractor Is the Designer (LB-17-C042)**

*Michael Flemming, P.E., Associate Member<sup>1</sup> and Bishara Mogannam<sup>2</sup>, (1) Interface Engineering, San Francisco, CA, (2) CTC Design, Santa Clara, CA*

**2. IED and LCA in Design Processes for Refurbishment (LB-17-C043)**

*Mathilde Landgren, Ph.D.<sup>1</sup> and Lotte M.B. Jensen, Ph.D.<sup>1</sup>,  
(1) Technical University of Denmark, Kgs. Lyngby, Denmark*

**3. Using Pattern Matching and Principal Component Analysis Method for Whole Building Fault Detection (LB-17-C044)**

*Yimin Chen, Student Member<sup>1</sup>, Adam Reigner<sup>1</sup> and Jin Wen, Ph.D., Member<sup>1</sup>, (1) Drexel University, Philadelphia, PA*

**4. Codes and Standards Options for Existing Buildings in BC (LB-17-C045)**

*James Montgomery, Ph.D., Member<sup>1</sup>, Andrew Pape-Salmon, P.Eng., Member<sup>2</sup> and Toby Lau, P.E., Member<sup>3</sup>, (1)RDH Building Science Inc., Vancouver, BC, Canada, (2)BC Government, Building and Safety Standards Branch, Victoria, BC, Canada, (3)BC Hydro, Vancouver, BC, Canada*

11:00 AM – 12:30 PM

**Conference Paper Session 14 (Intermediate)****Low GWP Refrigerants: Is There a Tradeoff in Performance and Safety?**

Room: 101A



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

**1. Application of Safety Factors When Setting Charge Limits for A2L Flammable Refrigerants (LB-17-C046)**

*William Hansen, P.E., Member<sup>1</sup> and Stephen Kujak, Member<sup>1</sup>, (1) Trane, Ingersoll Rand, La Crosse, WI*

**2. Impact of Next Generation Low GWP Refrigerants on Building Sustainability (LB-17-C047)**

*Stephen Kujak, Member<sup>1</sup>, Tina Li Juan Hong, Ph.D.<sup>1</sup>, Xiuwei Yin<sup>2</sup> and Ted Xueyuan Yang<sup>3</sup>, (1) Trane, Ingersoll Rand, La Crosse, WI, (2)Ingersoll Rand, Tyler, TX, (3)Ingersoll Rand, Shanghai, China*

**3. Predicted Heat Transfer and Pressure Drop Performance of Low Global Warming Potential R410A Alternatives (LB-17-C048)**

*Jordan Morrow, Student Member<sup>1</sup>, Melanie Derby, Ph.D., Member<sup>1</sup> and Xi Chen<sup>1</sup>, (1) Kansas State University, Manhattan, KS*

**4. Performance of an Air-Cooled Chiller with R410A Alternatives R452B and R32 (LB-17-C049)**

*Kenneth Schultz, Ph.D., Member<sup>1</sup> and Gurudath Nayak, Ph.D.<sup>2</sup>, (1) Ingersoll Rand, La Crosse, WI, (2) Ingersoll Rand, Bangalore, India*

11:00 AM – 12:30 PM

**Seminar 41 (Intermediate)****Designs and Policies for Affordable Zero Net Energy Homes and Sustainable Communities**

Room: 201B

**Sponsor: 2.8 Building Environmental Impacts and Sustainability, Residential Building Committee**

Chair: *Larry Brand, Member, Gas Technology Institute, Davis, CA*

**1. Affordable Zero Net Energy Home Design Strategies**

*George Koertzen, Habitat for Humanity of San Joaquin County, Inc., Stockton, CA*

**2. Challenges and Opportunities in the Design of Sustainable Communities**

*Judi Schweitzer, Schweitzer and Associates, Lake Forest, CA*

**3. Zero Net Energy Policies: Opportunities and Challenges in California**

*Sue Kristjansson, Southern California Gas Co., Los Angeles, CA*

11:00 AM – 12:30 PM

**Seminar 42 (Intermediate)**



**Integrate Your Body: Human Physiological Response as a Potential Driving Factor in IEQ Controls**

Room: 102AB

**Sponsor: 2.1 Physiology and Human Environment, 1.5 Computer Applications**

*Chair: Mark Jackson, Ph.D., McCree Consulting, Grand Prairie, TX*

**1. Thermal Comfort in Health Care: The Need for Physiological Feedback**

*Rodrigo Mora, Ph.D., Associate Member, British Columbia Institute of Technology, Burnaby, BC, Canada*

**2. Using Occupants' Control Behavior with Internet-Connected Personal Comfort System to Predict Individuals' Thermal Preference**

*Joyce Kim, Student Member, University of California, Berkeley, Berkeley, CA*

**3. Bio-Sensing Environmental Control: Data-Driven Thermal Sensation Prediction as a Function of Local Body Skin Temperature**

*Joon-Ho Choi, Ph.D., Associate Member, University of Southern California, Los Angeles, CA*

11:00 AM – 12:30 PM

**Seminar 43 (Intermediate)**



**Making Displacement and Natural Ventilation Work in High Heat Gain Applications**

Room: 103AB

**Sponsor: 4.10 Indoor Environmental Modeling**

*Chair: Wangda Zuo, Ph.D., Member, University of Miami, Coral Gables, FL*

**1. CFD Ventilation Study of an Aluminum Foundry**

*Duncan Phyfe, Associate Member<sup>1</sup> and Marty Kozlak<sup>1</sup>, (1) ARL, Alden, MA*

**2. Natural Ventilation Modeling of High Heat Gain Auditoria**

*Malcolm Cook, Member<sup>1</sup>, Faisal Durrani, Ph.D.<sup>1</sup> and James J. McGuiirk, Ph.D.<sup>1</sup>, (1) Loughborough University, Loughborough, United Kingdom*

**3. Push It to the Limit: Using Displacement Ventilation for High Heat Gain Applications**

*Mike Koupriyanov, P.E., Associate Member, Price Industries Limited, Winnipeg, MB, Canada*

**4. Natural Ventilation Potential Maps of North America for Removing High Heat Gains**

*Leon Wang, Ph.D., P.E., Member<sup>1</sup>, Jun Cheng, Student Member<sup>1</sup> and Ali Katal<sup>1</sup>, (1) Concordia University, Montréal, QC, Canada*

11:00 AM – 12:30 PM

**Seminar 44 (Intermediate)**



**Optimization of Existing Buildings Is Much More than Retro Commissioning**

Room: 202AB

**Sponsor: 7.9 Building Commissioning, 7.6 Building Energy Performance**

*Chair: Wade H. Conlan, P.E., Member, Hanson Professional Services, Orlando, FL*

**1. Campus Energy Management: You Need a Plan**

*Nathaniel Boyd, P.E., CPMP, Member, Hanson Professional Services, Orlando, FL*

**2. How to RetroCommission a 30,000 Ton Chiller Plant**

*Joshua Harwood, P.E., McKinstry, Denver, CO*

**3. Taking the “Retro” out of Retro-Commissioning**

*Benjamin Skelton, P.E., CPMP and BEMP, Member, Cyclone Energy Group, Chicago, IL*

11:00 AM – 12:30 PM

**Seminar 45 (Intermediate)**



**The Use of Pollution Control Units and Technologies to Control Grease, Smoke and Odor from Commercial Kitchens**

*Room: 201A*

**Sponsor: 5.10 Kitchen Ventilation, 5.4 Industrial Process Air Cleaning (Air Pollution Control)**

*Chair: Derek Schrock, Member, Halton Company, Scottsville, KY*

**1. Safety Requirements of Pollution Control Units: The Timely Release of New UL8782**

*Dwayne Sloan, UL LLC, Research Triangle Park, NC*

**2. Pollution Control Technologies: Rising to the Challenge**

*Chris Lowell, Member, Air Scrubbers, Sanford, NC*

**3. Electrostatic Pollution Controls: Performance and Maintenance Considerations**

*Russ Robison, Member, Gaylord Industries, Tualatin, OR*

**4. The Use of Ozone Generators in CKV Exhaust**

*Mark Tilles, Associate Member, AirMaid/Interzon, Stockholm, Sweden*

11:00 AM – 12:30 PM

**Seminar 46 (Intermediate)**



**Updates in the Air Distribution Systems Design Procedure: Expansion of Air Diffusion Performance Index Method**

*Room: 203AB*

**Sponsor: 5.3 Room Air Distribution**

*Chair: David John, P.E., Member, Stan Weaver & Co., Tampa, FL*

**1. Updates in Air Diffusion Performance Index Diffuser for Cooling Operation**

*Atila Novoselac, Ph.D., Member, University of Texas at Austin, Austin, TX*

**2. A New Air Diffusion Performance Index for Heating Operation**

*Shichao Liu, Ph.D., Associate Member, Center for Built Environment at UC Berkeley, Berkeley, CA*

**3. Connection between Air Diffusion Performance Index and Ventilation Effectiveness (EV): Effects of Diffuser Adjustment and Return Air Placement**

*Hideyuki Amai, University of Texas at Austin, Austin, TX*

**4. The History of Air Diffusion Performance Index and the Results of Research Project RP 1546 Expansion and Updating of the ADPI Method**

*David John, P.E., Member, Stan Weaver & Co., Tampa, FL*

1:30 PM – 3:00 PM

**Debate 3 (Intermediate)**

**Fellow's Debate: There is No Purpose in a Code of Ethics**

*Room: 203AB*

**Sponsor: College of Fellows, 1.7 Business, Management & General Legal Education**

*Moderator: Larry Spielvogel, P.E., Fellow Life Member, Consulting Engineer, Bala Cynwyd, PA*

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

**2. Kathleen Lacey, J.D., Ukleja Center for Ethical Leadership at California State University, Long Beach, Long Beach, CA**

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

**4. E. Mitchell Swann, P.E., Member, Virtual Construction/BIM Manager, Paoli, PA**

**5. Samir Traboulsi, Dr.Ing., P.Eng., Fellow Life Member, Thermotrade/Ranec, Beirut, Lebanon**

**6. Victor Goldschmidt, Ph.D., Fellow Life Member, Purdue University, Northport, MI**

**7. Larry Spielvogel, P.E., Fellow Life Member, Consulting Engineer, Bala Cynwyd, PA**

3:15 PM – 4:45 PM

**Seminar 47 (Intermediate)**



**Zero Energy Healthcare Buildings: Current Status and Future Efforts**

*Room: 203AB*

**Sponsor: 9.6 Healthcare Facilities, 2.8 Building Environmental Impacts and Sustainability, TC 7.6**

*Chair: David Eldridge Jr., P.E., Member, Grumman/Butkus Associates, Evanston, IL*

**1. Toward NZE Hospitals in North America**

*Heather Burpee, University of Washington Integrated Design Lab, Seattle, WA*

**2. Owner Perspective on Potential for NZE Healthcare Facilities**

*Travis English, P.E., Member, Kaiser Permanente, Anaheim, CA*

**3. European Research Study into NZE Hospitals**

*Wim Maassen, Royal Haskoning DHV, Rotterdam, Netherlands*

**4. Strategies for NZE Hospitals in the UK**

*Francis Mills, CEng, Life Member, Frank Mills Consulting, Leyland, United Kingdom*

5:00 PM – 6:00 PM

**Seminar TC (Basic)**

**Seminar Ductless Car Park Ventilation: Global Trends and Design Practices**

*Room: Renaissance, Bixby 3*

**Sponsor: 5.9 Enclosed Vehicular Facilities**

*Chair: Yoon Ko, Ph.D., Member, National Research Council Canada, Ottawa, ON, Canada*

**1. Ductless Car Park Ventilation: Global Trends and Design Practices**

*Troy Goldschmidt, Member, Greenheck, Schofield, WI*

**Wednesday, June 28**

8:00 AM – 9:30 AM

**Technical Paper Session 4 (Basic)****Advances in Domestic Water Heating**

Room: 103AB

Chair: Ratnesh Tiwari, Ph.D., University of Maryland,  
College Park, MD

**1. The Dependence of Water Heater Energy Factor on Deviations from Nominal Test Conditions (LB-17-010)**

*William Healy, Member, National Institute of Standards and Technology, Gaithersburg, MD*

**2. Tankless Electric Water Heater Diversified Electrical Demand in Residential Applications (LB-17-011)**

*Carl C. Hiller, Ph.D., P.E., Fellow ASHRAE, Applied Energy Technology, Davis, CA*

**3. Hot Water Use in Hotels, Results of ASHRAE Research Project 1544, Part 4 of 6: Comparison of Travel and Business Hotel Hot Water System Monitoring Results (RP-1544) (LB-17-012)**

*Russell Johnson, Member<sup>1</sup> and Carl C. Hiller, Ph.D., P.E., Fellow ASHRAE<sup>2</sup>, (1) Johnson Research LLC, Pueblo West, CO, (2) Applied Energy Technology, Davis, CA*

**4. Hot Water Use in Hotels, Results of ASHRAE Research Project 1544, Part 5 of 6: Updated Hotel Hot Water System Design Techniques (RP-1544) (LB-17-013)**

*Carl C. Hiller, Ph.D., P.E., Fellow ASHRAE<sup>1</sup> and Russell Johnson, Member<sup>2</sup>, (1) Applied Energy Technology, Davis, CA, (2) Johnson Research LLC, Pueblo West, CO*

8:00 AM – 9:30 AM

**Conference Paper Session 15 (Intermediate)****Building Energy and Consumption**

Room: 101A

Chair: Rachel Romero, P.E., Member, National Renewable Energy Laboratory, Golden, CO

**1. Quantification of the Potential for Advanced Thermal Control Strategy over a Range of Buildings Characteristics (LB-17-C050)**

*Solène Goy, Student Member<sup>1</sup>, François Maréchal<sup>2</sup> and Donal Finn<sup>1</sup>, (1) University College Dublin, Energy Institute, Dublin, Ireland, (2) Ecole Polytechnique Fédérale de Lausanne, Industrial Process and Energy Systems Engineering (IPESE), Lausanne, Switzerland*

**2. The Impact of Chiller Plant Retrofit on Energy Consumption for Commercial Buildings in Singapore (LB-17-C051)**

*Siew Eang Lee, Ph.D.<sup>1</sup>, Chirag Deb<sup>1</sup> and Junjing Yang, Ph.D., Associate Member<sup>1</sup>, (1) National University of Singapore, Singapore, Singapore*

**3. Unsupervised Non-Intrusive Building Energy Disaggregation (LB-17-C052)**

*Mohammad A. Hossain, Student Member<sup>1</sup>, Ethan M. Pickering<sup>1</sup>, Jack Mousseau<sup>1</sup>, Arash Khalilnejad<sup>1</sup>, Rachel A. Swanson<sup>1</sup>, Roger H. French<sup>1</sup> and Alexis R. Abramson<sup>1</sup>, (1) Case Western Reserve University, Cleveland, OH*

**4. Analysis of Energy Consumption in Office Buildings Based on the National Building Energy Database in Korea (LB-17-C053)**

*Haeng Pil Jo<sup>1</sup>, Hye Gi Kim<sup>1</sup> and Sun Sook Kim, Ph.D., Member<sup>1</sup>, (1) Ajou University, Suwon, Korea, Republic of (South)*

8:00 AM – 9:30 AM

**Conference Paper Session 16 (Intermediate)**

**Dynamic HVAC Controls**



*Room: 101B*

*Chair: Geoff Bares, P.E., Member, CB&I, Plainfield, IL*

**1. An Implementation Framework of Model Predictive Control for HVAC Systems: A Case Study of EnergyPlus Model-Based Predictive Control (LB-17-C054)**

*Zhiang Zhang, Student Member<sup>1</sup> and Khee Poh Lam, Ph.D.<sup>1</sup>, (1) Carnegie Mellon University, Pittsburgh, PA*

**2. Dynamic Scheduling of HVAC Systems' Occupied Period using Access Control Data (LB-17-C055)**

*Bianca Howard, Ph.D.<sup>1</sup>, Salvador Acha, Ph.D.<sup>1</sup>, Nilay Shah, Ph.D.<sup>1</sup> and John Polak, Ph.D.<sup>1</sup>, (1) Imperial College London, London, United Kingdom*

**3. Comparing Guideline 36 Single Duct VAV Terminal Reheat Strategy with a Similar, Homegrown Approach (LB-17-C056)**

*Andrew Windham, Ph.D., Associate Member, Appalachian State University, Boone, NC*

**4. Field Performance of a MPC Coordinating Multiple Rooftop Units (LB-17-C057)**

*Donghun Kim, Ph.D.<sup>1</sup> and James E. Braun<sup>1</sup>, (1) Purdue University, West Lafayette, IN*

8:00 AM – 9:30 AM

**Seminar 48 (Intermediate)**

**Achieving Net Zero: Design Strategies and Modeling Techniques**

*Room: 102AB*

**Sponsor: 7.1 Integrated Building Design, 1.5 Computer Applications**

*Chair: Krishnan Gowri, Ph.D., Fellow ASHRAE, Autodesk, Bothell, WA*

**1. Trending Towards Net Zero: Codes, Standards and Voluntary Programs**

*Krishnan Gowri, Ph.D., Fellow ASHRAE, Autodesk, Bothell, WA*

**2. Scenario Analysis for ZNE Modeling**

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

**3. The Technical Feasibility of Zero Net Energy Buildings in California**

*Wyatt Kennedy, P.E., Arup, San Francisco, CA*

**4. Aiming for Zero-Net-Energy at an Existing Supermarket**

*Elizabeth Joyce, P.E., BEAP, Associate Member, Arup, San Francisco, CA*

8:00 AM – 9:30 AM

**Seminar 49 (Intermediate)**



**Direct Expansion Ground Source Heat Pump: Reviewing Issues, Advancements and Advantages**

*Room: 203AB*

**Sponsor: 6.8 Geothermal Heat Pump and Energy Recovery Applications**

*Chair: Xiaobing Liu, Ph.D., Member, Oak Ridge National Laboratory, Oak Ridge, TN*

- 1. Natural Refrigerant, Geothermal DX Heat Pump System**  
*Marc Portnoff, Oak Ridge National Laboratory, Oak Ridge, TN*
- 2. Performance and Reliability of Direct-Expansion Ground-Coupled Heat Pumps**  
*Demba Ndiaye, Ph.D., P.E., BEMP, Member, University of North Carolina at Charlotte, Charlotte, NC*
- 3. Status and Trends in DX Bore Field Dimensioning**  
*Louis Lamarche, Ph.D., Ecole de Technologie Superieure, Montreal, QC, Canada*
- 4. Debunking the Myths Surrounding Direct Geexchange Heat Pumps**  
*Joe Parsons Jr., Member, EarthLinked Technologies, Inc., Lakeland, FL*
- 5. Direct Expansion Ground Source Heat Pump Using Carbon Dioxide as Refrigerant**  
*Parham Eslami Nejad, Ph.D., Natural Resources Canada, Varennes, QC, Canada*

8:00 AM – 9:30 AM

**Seminar 50 (Intermediate)**

**High Efficiency Commercial Refrigeration Systems with Natural Refrigerants**

*Room: 201A*

**Sponsor: 10.7 Commercial Food and Beverage Refrigeration Equipment, Refrigeration Committee, TC8:1 Positive Displacement Compressors; TC3.1 Refrigerants and Secondary Coolants**

*Chair: Georgi Kazachki, Ph.D., Member, Dayton Phoenix Group, Inc., Dayton, OH*

**1. Doing It All Efficiently with CO2 Refrigeration Anywhere in the World**

*Klaas Visser, P.E., Affiliate, KAV Consultants Pty Ltd, Kangaroo Flat, Australia*

**2. Design and Performance Validation of Ultralow Charge Ammonia Cascade System for Retail Food Environment**

*Masood Ali, Kysor/Warren, Columbus, GA*

**3. Opportunities for Utilizing Two-Phase Ejectors to Increase Efficiency of Commercial Refrigeration Systems Using Natural Refrigerants**

*Stefan Elbel, Ph.D., Member, Creative Thermal Solutions and University of Illinois at Urbana-Champaign, Urbana, IL*

**4. Packaged Ammonia/CO2 Systems for Refrigeration**

*Scott Mitchell, Associate Member, Southern California Edison, Irwindale, CA*

Tech Program

8:00 AM – 9:30 AM

**Seminar 51 (Intermediate)**



**It's a Breeze! Understanding the Fundamentals of Air Flow around Buildings and Its Effect on Ventilation and Air Quality**

*Room: 202AB*

**Sponsor: 4.3 Ventilation Requirements and Infiltration**

*Chair: Martin Stangl, P.Eng., Member, RWDI Consulting Engineers, Guelph, ON, Canada*

**1. Air Flow around Buildings and Its Effect on Ventilation and Air Quality**

*Michael Ratcliff, Ph.D., P.E., Member, RWDI, Redlands, CA*



**2. Dispersion Modeling Techniques for Exhaust Stack Design**

*Brad Cochran, P.E., Member, CPP Wind Engineering & Air Quality Consultants, Fort Collins, CO*

**3. Engineered Lab Exhaust Design Application**

*Nathan Ho, P.E., Associate Member, P2S Engineering, Inc., Long Beach, CA*

8:00 AM – 9:30 AM

**Seminar 52 (Basic)**



**The New 90.2**

*Room: 201B*

**Sponsor: 7.6 Building Energy Performance, SSPC 90.2; Residential Building Committee**

*Chair: Theresa A. Weston, Ph.D., Member, DuPont Building Innovations, Richmond, VA*

**1. Standard 90.2 in a Diverse Residential Marketplace**  
*Chris Mathis, Member, Mathis Consulting, Montreal, AL*

**2. Standard 90.2 Performance and Flexibility**  
*Philip Fairey, Member, Florida Solar Energy Center, Cocoa, FL*

**3. Illuminating the ASHRAE 90.2 Lighting Requirements**  
*Michael Jouaneh, Member, Lutron Electronics Co., Inc., Coopersburg, PA*

9:45 AM – 10:45 AM

**Technical Paper Session 5 (Intermediate)**

**Building System Analysis**



*Room: 103AB*

*Chair: Jaya Mukhopadhyay, Ph.D., Member, Montana State University, Bozeman, MT*

**1. Interpreting Occupant-Building Interactions for Improved Office Building Design and Operation (LB-17-014)**

*Sara Gilani, Student Member<sup>1</sup> and William O'Brien, Ph.D., Member<sup>1</sup>, (1) Carleton University, Ottawa, ON, Canada*

**2. Performance Evaluation of an Incorporation of a Compact Liquid Desiccant System into an Evaporative Cooling-Assisted 100% Outdoor Air System (LB-17-015)**

*Ahmed Mohamed, Sohag University - Department of Mechanical Engineering, Sohag Governorate, Egypt*

9:45 AM – 10:45 AM

**Conference Paper Session 17 (Intermediate)**

**Analyzing, Improving and Innovating Thermal Comfort**

*Room: 101B*

*Chair: Peng Yin, Ph.D., Associate Member, University of Louisiana at Lafayette, Lafayette, LA*



**1. Experimental Study of Energy Savings Using a Household Humidifier (LB-17-C058)**

*Kevin Anderson, Ph.D., P.E., Member<sup>1</sup> and Patricia Wassem<sup>1</sup>, (1) California State Polytechnic University at Pomona, Pomona, CA*

**2. Improving Thermal Comfort via Spatially Adaptive HVAC (LB-17-C059)**

*Robert Bailey, Ph.D., P.E., Member<sup>1</sup>, Matthew Kalensky<sup>1</sup> and Charles Wilson<sup>1</sup>, (1) Loyola University Maryland, Baltimore, MD*

**3. Cooling Performance Analysis and Optimization of a Room with Radiant Panel Using CFD (LB-17-C060)**

*Abdullah Karimi, Affiliate<sup>1</sup> and Reza Ghias, Ph.D., Member<sup>1</sup>, (1) Southland Industries, Dulles, VA*

9:45 AM – 10:45 AM

**Conference Paper Session 18 (Intermediate)****Thermal Storage***Room: 101A**Chair: Marija Todorovic, P.Eng., Fellow ASHRAE, University of Belgrade, Belgrade, Serbia***1. Experimental Performance Study on a CO<sub>2</sub> Heat Pump System with Thermal Storage (LB-17-C061)***Fang LIU, Ph.D., P.E., Member<sup>1</sup>, Weiquan Zhu<sup>1</sup> and Yang Cai<sup>1</sup>, (1) Shanghai University of Electric Power, Shanghai, China***2. Integrated Optimization of PV and Storage Systems for UK Non-Domestic Buildings (LB-17-C062)***Salvador Acha, Ph.D., Member<sup>1</sup>, Arthur Mariaud<sup>1</sup>, Ned Ekins-Daukes, Ph.D.<sup>1</sup> and Nilay Shah, Ph.D.<sup>1</sup>, (1) Imperial College London, London, United Kingdom***3. Efficient Interaction between Energy Demand, Surplus HEAT/Cool and Thermal Storage (LB-17-C063)***Trond Thorgeir Harsem, P.Eng.<sup>1</sup> and Janne Grindheim, M.D., BEAP and HFDP<sup>1</sup>, (1) Norconsult AS, Sandvika, Norway*

9:45 AM – 10:45 AM

**Seminar 53 (Intermediate)****Control System Best Practices: How to Make Your Control System Project a Success, Part 1***Room: 201A***Sponsor: 1.4 Control Theory and Application***Chair: Kris Kinney, Member, Highwoods Properties, Raleigh, NC***1. Effective Design of Building Control Systems***Frank Shadpour, P.E., HFDP, Fellow ASHRAE, SC Engineers, Inc., San Diego, CA***2. What Owners and Engineers Should Know about Control Systems for Successful Implementation***Larry Fisher, Life Member, ECT Services (Retired), Louisville, KY*

9:45 AM – 10:45 AM

**Seminar 54 (Advanced)****Hot Water Distribution Systems in Residential Buildings***Room: 201B***Sponsor: 6.6 Service Water Heating Systems***Chair: James D. Lutz, P.E., Member, Hot Water Research, Oakland, CA***1. Energy and Water Losses in a Residential PEX Home-Run System***Tania Ullah, Associate Member, National Institute of Standards and Technology, Gaithersburg, MD***2. Pressure Drop and Flow Rates in Residential Water Piping***Gary Klein, Associate Member, Gary Klein and Associates, Inc., Rancho Cordova, CA*

9:45 AM – 10:45 AM

**Seminar 55 (Intermediate)**



**Research Updates on Radiant Cooling and Heating Systems**

Room: 202AB

**Sponsor: 6.5 Radiant Heating and Cooling**

Chair: Paul Raftery, Ph.D., Center for the Built Environment, Berkeley, CA

**1. New Method for the Design of Radiant Floor Cooling Systems with Direct Solar Radiation**

Jingjuan Feng, Ph.D., Associate Member, Taylor Engineering, Alameda, CA

**2. Design Cooling Load Calculations Comparison between TABS and Air Systems**

Eleftherios Bourdakis, Student Member, Technical University of Denmark, Kongens Lyngby, Denmark

9:45 AM – 10:45 AM

**Seminar 56 (Basic)**



**Urban-Scale Building Energy Modeling, Part 6**

Room: 102AB

**Sponsor: 1.5 Computer Applications, 4.7 Energy Calculations**

Chair: Joshua New, Ph.D., Member, Oak Ridge National Laboratory, Oak Ridge, TN

**1. Agent Based Modeling to Estimate the Adoption of Energy Efficient Building Technologies**

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

**2. Virtual Reality UBEM**

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

9:45 AM – 10:45 AM

**Workshop 9 (Advanced)**

**How to Design, Construct and Operate Net Zero Hospitals and Save Money**

Room: 203AB

**Sponsor: 9.6 Healthcare Facilities, 2.8 Building Environmental Impacts and Sustainability, SSPC 170**

Chair: Francis Mills, CEng, Member, Frank Mills Consulting, Leyland, United Kingdom

**1. How to Achieve Net Zero Energy Hospitals**

Hans Besselink, Member, HaskoningDHV Nederland B.V., Rotterdam, Netherlands

**2. Strategies to Net Zero Hospitals**

Frank Mills, CEng, Member, Frank Mills Consulting, Leyland, United Kingdom

11:00 AM – 12:30 PM

**Technical Paper Session 6 (Intermediate)****Airside HVAC Advances***Room: 103AB**Chair: Ratnesh Tiwari, Ph.D., University of Maryland, College Park, MD***1. Differential Pressure Rise Measurements and Impact in EnergyPlus Modeling for Series VAV Fan Powered Terminal Units (RP-1292) (LB-17-016)***John Bryant, Ph.D., P.E., Member, Texas A&M University, College Station, TX***2. ASHRAE SSPC 170 Natural Ventilation Task Group: Position Paper on Natural Ventilation in Health Care Facilities (LB-17-017)***Travis English, P.E., Member<sup>1</sup>, Paul Ninomura<sup>2</sup>, Heather Burpee<sup>3</sup>, Jeremy Fauber, P.E., Member<sup>4</sup> and Arash Guilty<sup>5</sup>, (1)Kaiser Permanente, Anaheim, CA, (2)Indian Health Service, Seattle, WA, (3)University of Washington Integrated Design Lab, Seattle, WA, (4) Heapy Engineering, Dayton, OH, (5)Mazzetti, Denver, CO***3. Redesigning the HVAC System of a University Laboratory Building (LB-17-018)***James Mathias, Member<sup>1</sup>, Navya Madineedi<sup>1</sup> and Justin Harrell<sup>1</sup>, (1) Southern Illinois University Carbondale, Carbondale, IL***4. Energy and Control Performance Investigation of Air Handling Units with Return Air Bypass (LB-17-019)***Gang Wang, Ph.D., P.E., Member<sup>1</sup>, Xuejing Zheng<sup>2</sup>, Esber Andiroglu<sup>1</sup> and Li Song, Ph.D., P.E., Member<sup>3</sup>, (1)University of Miami, Coral Gables, FL, (2)Tianjin University, Tianjin, China, (3)University of Oklahoma, Norman, OK*

11:00 AM – 12:30 PM

**Conference Paper Session 19 (Intermediate)****Ventilation: A Critical Element from Design through Operation***Room: 101B**Chair: Anil Parekh, Member, HBC – CanmetENERGY, Ottawa, ON, Canada***1. Motorized Windows: A New Approach to Saving Energy in Office Buildings (LB-17-C064)***Niraj Chandra, P.Eng., Member<sup>1</sup> and Udit Sapre<sup>2</sup>, (1)Government of Canada, Gatineau, QC, Canada, (2)Carleton University, Ottawa, ON, Canada***2. Experimental Study on Influence of Overhang of Exhaust Hood on Ventilation Requirements (LB-17-C065)***Toshiya Iwamatsu, Ph.D., Associate Member<sup>1</sup> and Wataru Urabe<sup>2</sup>, (1) Central Research Institute of Electric Power Industry, Komae, Japan, (2)Central Research Institute of Electric Power Industry, Tokyo, Japan***3. Ventilation and Corresponding CO<sub>2</sub> Levels in High School Classrooms (LB-17-C066)***Leigh Lesnick, Student Member<sup>1</sup>, Atila Novoselac, Ph.D., Member<sup>1</sup> and Richard Corsi, Ph.D., P.E.<sup>1</sup>, (1) University of Texas at Austin, Austin, TX***4. The Effects of Temperature and Humidity on the Permeation Properties of Membrane Transport Media Used in Energy Recovery Ventilators (LB-17-C067)***Steven Rogak, Ph.D., P.E.<sup>1</sup>, Amin Engarnevis, Student Member<sup>1</sup>, Sarah Romani<sup>1</sup>, Alexander Sylvester, Student Member<sup>1</sup>, Ryan Huizing, P.Eng.<sup>2</sup>, and Sheldon Green, Ph.D., P.E.<sup>1</sup>, (1)University of British Columbia, Vancouver, BC, Canada, (2)dPoint Technologies, Vancouver, BC, Canada*

11:00 AM – 12:30 PM

**Conference Paper Session 20 (Intermediate)**

**District and Central Plant Efficiency**



Room: 101A

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

**1. Comparison of the Energy Saving Potential between Centralized and Decentralized Pumping Systems under Various Flow Conditions (LB-17-C068)**

Mingzhe Liu<sup>1</sup>, Ryoza Ooka, Ph.D., Member<sup>1</sup>, Wonjun Choi, Ph.D., Member<sup>1</sup> and Shintaro Ikeda<sup>1</sup>, (1) University of Tokyo, Tokyo, Japan

**2. CFD Investigation on Parameters Affecting the Thermal Performance of Mechanical Draft Cooling Towers in District Cooling Plants (LB-17-C069)**

E. M. ElBialy, Ph.D.<sup>1</sup> and Essam E. Khalil, Fellow ASHRAE<sup>1</sup>, (1) Cairo University, Cairo, Egypt

**3. Large Campus Loop Performance Improvement, Negative Pressure Issue (LB-17-C070)**

Robert Henry, P.E.<sup>1</sup>, Hui Chen, P.E., BEAP, BEMP, CPMP, HBDP and OPMP, Member<sup>1</sup>, Homer Bruner, Member<sup>1</sup>, Klayton Wittler<sup>1</sup>, Elijah Crosby<sup>1</sup> and James Riley<sup>1</sup>, (1) Texas A&M University, College Station, TX

**4. Evaluating and Improving the Chilled Water System of a Data Center Using Flow Network Modeling (LB-17-C071)**

Amir Radmehr, Ph.D.<sup>1</sup>, John Fitzpatrick<sup>2</sup> and Kanchan Kelkar, Ph.D.<sup>3</sup>, (1) Innovative Research, Inc., Plymouth, MN, (2) University of Rochester, Rochester, NY, (3) Innovative Research, LLC, Plymouth, MN

11:00 AM – 12:30 PM

**Seminar 57 (Intermediate)**



**Dampness and Mold in Homes: Update on Health Effects and Environmental Assessments that Are Useful for Physicians**

Room: 203AB

Sponsor: 1.12 Moisture Management in Buildings, Environ Health, SSPC 62.1, SSPC 62.2

Chair: Elliott Horner, Ph.D., Member, UL Environment, Marietta, GA

**1. Key Elements of Relevant and Useful Home Assessments**

Kevin Kennedy, MPH, CIEC, MS, Associate Member, Children's Mercy Hospitals and Clinics, Kansas City, MO

**2. Finally Getting to the Cause: What Is Damp and Mold Doing to Residents?**

Jay Portnoy, M.D., Children's Mercy Hospital, Kansas City, MO

**3. Residential Dampness Assessment: Elements of a Useful Report**

Elliott Horner, Ph.D., Member, UL Environment, Marietta, GA

11:00 AM – 12:30 PM

**Seminar 58 (Intermediate)**



**Acoustic Performance Standards for Residential Buildings and When They Fall Short**

*Room: 201B*

**Sponsor: 2.6 Sound and Vibration**

*Chair: Erik Miller-Klein, P.E., Member, A3 Acoustics, LLP, Seattle, WA*

**1. Status of Acoustical Standards and Codes in the USA for Residential Buildings**

*Cathleen Novak, Associate Member, Veneklasen Associates, Santa Monica, CA*

**2. Where Current Standards and Codes Fall Short: Tones and Unsteady Noise from MEP Systems**

*Roman Wowk, Associate Member, Papadimos Group, San Francisco, CA*

**3. ISO 19488: Acoustic Classification for Residential Buildings**

*Jason Swan, Member, Sandy Brown Associates, LLP, London, United Kingdom*

11:00 AM – 12:30 PM

**Seminar 59 (Intermediate)**



**Don't Be Scared: CFD for Everyday Design**

*Room: 202AB*

**Sponsor: 4.10 Indoor Environmental Modeling**

*Chair: James W. VanGilder, P.E., Member, Schneider Electric, Andover, MA*

**1. Using CFD Modeling for HVAC System Design**

*Mike Koupriyanov, P.E., Associate Member, Price Industries Limited, Winnipeg, MB, Canada*

**2. Practical Applications of CFD for Optimizing Chilled Beam Performance**

*Ramin Rezaei, Associate Member, Southland Industries, Dulles, VA*

**3. Garbage In, Garbage Out: Is Conceptual Data Center CFD Design Any Use?**

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

11:00 AM – 12:30 PM

**Seminar 60 (Intermediate)**



**Power Trends Update: Aligning Future Facility Capability and ITE Power**

*Room: 102AB*

**Sponsor: 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment**

*Chair: Nick Gangemi, Life Member, Northern Air Systems, Rochester, NY*

**1. Datacom Equipment Workloads, Configurations and Applications**

*Matt Archibald, Associate Member, Lenovo, NY, NY*

**2. Datacom Equipment Power Trends**

*Susan Smith, Member, Intel Corp, Hillsboro, OR*

**3. Data Center Solutions and Examples**

*Jerrod Buterbaugh, Lenovo, New York, NY*

11:00 AM – 12:30 PM

**Seminar 61 (Intermediate)**



**Do You Know What You Are Breathing?**

**Indoor Air Contaminants**

*Room: 201A*

*Sponsor: 2.3 Gaseous Air Contaminants and Gas Contaminant Removal Equipment, 2.4 Particulate Air Contaminants and Particulate Contaminant Removal Equipment*

*Chair: Kyung-Ju Choi, Ph.D., Member, Clean & Science, Louisville, KY*

**1. Fate and Transport of Phthalates in Indoor Environments and the Influence of Temperature: A Case Study**

*Chenyang Bi, Associate Member, The University of Texas at Austin, Austin, TX*

**2. Impact of Residential HVAC Filters on Indoor Air Quality**

*John Zhang, Ph.D., Member, 3M Personal Care Division, St. Paul, MN*

**3. Effectiveness of Residential Air Cleaning Devices in Removal of Particulate and Gaseous Pollutants: A Review**

*Thad Ptak, Ph.D., Member, A. O. Smith Corporation, Milwaukee, WI*

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## FINDING YOUR MEETING LOCATION

Society and Technical committee meetings are located in three different venues: Hyatt Regency (H), Renaissance (R) and the Long Beach Convention Center (LBCC). Please see page 2–7 for maps of each venue. All venues are in easy walking distance to one another.

### Hyatt Regency (H)

Meeting rooms at the Hyatt will be marked “H” with a “-“ indicating the floor number. Meeting rooms are on the 1<sup>st</sup> (Lower Level) and 4<sup>th</sup> (Upper Level) floors. From the lobby, take the escalator near The Cove Coffee Bar down to the 1<sup>st</sup> floor and turn right to access the meeting space on the 1<sup>st</sup> floor. From the main entrance of the hotel, enter the lobby and take the escalator or stairs on your right to access the 4th floor. The first set of escalators stop on the Mezzanine level which will take you to Convention Center.

### Renaissance (R)

Meeting rooms at the Renaissance will be marked “R” with a “-“ indicating the floor number. Meeting rooms are on the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> floors. From the main entrance, go through the lobby and past the Promenade Café and turn left to access the meeting rooms on the 1<sup>st</sup> floor. From the main entrance, take the elevators or stairs on your right to the meeting space on the 2<sup>nd</sup> and 3<sup>rd</sup> floor.

### Long Beach Convention Center (LBCC)

Meeting rooms at the Long Beach Convention Center will be marked “LBCC” with a “-“ indicating the floor number. Meeting rooms are on the 1<sup>st</sup> and 2<sup>nd</sup> floor. From the first floor take the elevators or stairs located outside of 103 to the 2<sup>nd</sup> level. See page 6 for information regarding access to seaside meeting rooms.

**From the Hyatt’s** main entrance, take the escalators to the Mezzanine level to access the Convention Center South Entrance. You will enter near room 104 (Registration, Bookstore and Speakers Lounge).

**From the Renaissance, Westin and Courtyard,** enter the Convention Center through the North Entrance. You will enter near room 100.

**From the Hyatt Centric,** enter the Convention Center through the Main Entrance. You will enter in the main lobby.



**Seaside rooms (SS) at the Convention Center require a separate entrance** and will be marked “SS.” From the North Entrance of the Convention Center (outside room 100), walk outside and take the stairs on your left down to Seaside Way. Turn right on Seaside way and walk past the loading dock to the Seaside Entrance. Follow the ASHRAE signs to the entrance.

*See page 7 for a campus map of the LBCC.*

## **SOCIETY COMMITTEE MEETINGS**

The venue and floor numbers are indicated in parenthesis in the listing below. Subcommittees are indented. Rooms will be set as indicated 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.

### **Venue Key:**

**(H)** = Hyatt with a “-” indicating the floor number.

**(R)** = Renaissance with a “-” indicating the floor number.

**(LBCC)** = Long Beach Convention Center with a “-” indicating the floor number.

**(LBCC-SS)** = Seaside rooms (SS) at LBCC require a separate entrance and will be marked “SS.” See page 6 for more details.

### **AEDG Steering Committee (15/10) Electric**

Monday (6/26) 2:15 pm – 5:00 pm Shoreline A (H-1)

### **Appointments Roadmap (32/0)**

Sunday (6/25) 7:00 am – 8:00 am Seaview A (H-1)

### **ASHRAE Foundation (30/15) Electric**

Monday (6/26) 7:30 am – 9:45 am Shoreline B (H-1)

ASHRAE Foundation Executive Subcommittee (10/5) Electric

Saturday (6/24) 1:30 pm – 3:00 pm Harbor C (H-1)

### **Associate Society Alliance (35/35) Screen**

Monday (6/26) 4:15 pm – 6:15 pm Beacon B (H-4)

### **Audit Committee (5/3)**

Friday (6/23) 3:30 pm – 5:00 pm Harbor C (H-1)

### **Broadcasting ASHRAE Impact and Key Constituency**

#### **Leadership Outreach Ad Hoc (30/6) Screen**

Saturday (6/24) 8:00 am – 10:00 am 201B (LBCC-2)

### **Board of Directors (41/100) Screen/Electric**

Sunday (6/25) 1:30 pm – 5:30 pm Regency ABC (H-4)

Wednesday (6/28) 2:00 pm – 6:00 pm Regency ABC (H-4)

### **Building EQ Committee (15/40) Screen/Electric**

Sunday (6/25) 8:30 am – 11:30 am Seaview A (H-1)

Building EQ Methodology (8/8) Screen/Electric

Saturday (6/24) 11:00 am – 1:00 pm Harbor B (H-1)

Building EQ Marketing (8/8) Screen/Electric

Saturday (6/24) 1:00 pm – 3:00 pm Harbor B (H-1)

**Building Envelope Committee (30/0)**

Monday (6/26) 9:00 am – 12:00 pm 203C (LBCC-2)

**Certification (12/12) Screen/Electric**

Saturday (6/24) 8:00 am – 12:00 pm Nieto (R-2)

**Chapter Technology Transfer Committee (30/15)****Screen/Electric**

Friday (6/23) 8:00 am – 12:00 pm 203B (LBCC-2)

Saturday (6/24) 8:00 am – 12:00 pm 202C (LBCC-2)

Chapter Technology Transfer Member Services (11/15) Screen

Friday (6/23) 1:30 pm – 5:00 pm 203A (LBCC-2)

Chapter Technology Transfer Operations (10/5) Screen

Friday (6/23) 1:30 pm – 5:00 pm 203B (LBCC-2)

Chapter Technology Transfer Executive (7/0)

Friday (6/23) 5:00 pm – 6:00 pm 203B (LBCC-2)

Chapter Technology Transfer Committee New Member Orientation (10/5) Screen/Electric

Saturday (6/24) 1:15 pm – 2:30 pm 202C (LBCC-2)

**CLIMA 2019 (12/0)**

Saturday (6/24) 12:30 pm – 1:30 pm Harbor C (H-1)

**Climate Change Position Document Committee (15/0)**

Tuesday (6/27) 8:00 am – 11:00 am Shoreline A (H-1)

**College of Fellows (25/10)**

Sunday (6/25) 10:00 am – 12:00 pm Shoreline B (H-1)

College of Fellows: Advisory Committee (15/10)

Sunday (6/25) 9:00 am – 10:00 am Shoreline B (H-1)

**Conferences and Expositions Committee (30/10)****Screen/Electric**

Saturday (6/24) 8:00 am – 3:00 pm 203C (LBCC-2)

Conferences and Expositions Executive (30/5)

Friday (6/23) 1:00 pm – 3:30 pm 203C (LBCC-2)

Conferences and Expositions Annual and Winter Meetings (30/5)

Friday (6/23) 3:30 pm – 6:00 pm 203C (LBCC-2)

**Development Committee (25/15) Screen/Electric**

Monday (6/26) 10:00 am – 12:00 pm Shoreline A (H-1)

**Director and Regional Chairs and Regional Members****Council Representatives (15/20)**

Friday (6/23) 11:00 am – 1:00 pm Shoreline B (H-1)

Wednesday (6/28) 12:00 pm – 2:00 pm Shoreline B (H-1)

**Directors-At-Large (15/20)**

Wednesday (6/28) 12:00 pm – 2:00 pm Shoreline A (H-1)

**Electronic Communications Committee (13/10) Screen**

Saturday (6/24) 11:00 am – 3:00 pm 101A (LBCC-1)

Electronic Communications Subcommittees (13/10) Screen

Saturday (6/24) 8:00 am – 11:00 am 101A (LBCC-1)

**Energy Efficiency in Buildings Position Document****Committee (10/0) Screen/Electric**

Tuesday (6/27) 3:00 pm – 4:00 pm Harbor A (H-1)

**Environmental Health (20/20) Screen/Electric**

Monday (6/26) 2:15 pm – 6:15 pm Seaview A (H-1)

Environmental Health Executive (20/20) Screen/Electric

Monday (6/26) 7:00 am – 8:00 am Seaview A (H-1)

Environmental Health Handbook/Policy (20/20) Screen/Electric

Monday (6/26) 8:00 am – 10:00 am Seaview A (H-1)

Environmental Health Program/Research (20/20) Screen/Electric

Monday (6/26) 10:00 am – 12:00 pm Seaview A (H-1)

### **Executive Committee (12/20) Screen/Electric**

Saturday (6/24) 8:30 am – 1:00 pm Seaview A (H-1)

Wednesday (6/28) 7:30 am – 9:00 am Seaview A (H-1)

Thursday (6/29) 7:30 am – 12:00 pm Seaview A (H-1)

### **Finance Committee (13/10) Electric**

Friday (6/23) 8:00 am – 12:00 pm Pacific (H-1)

[Finance Investment Subcommittee \(4/0\)](#)

Thursday (6/22) 5:00 pm – 7:00 pm Harbor B (H-1)

[Finance Planning Subcommittee \(8/8\) /Electric](#)

Thursday (6/22) 5:00 pm – 7:00 pm Pacific (H-1)

### **Grassroots Government Advocacy Committee (30/15) Screen/Electric**

Saturday (6/24) 8:00 am – 12:30 pm 202AB (LBCC-2)

[GGAC: Member Training \(30/15\) Screen/Electric](#)

Friday (6/23) 8:00 am – 10:00 am 202AB (LBCC-2)

[Grassroots Government Advocacy Executive \(15/10\) Screen/Electric](#)

Friday (6/23) 10:15 am - 12:00 pm 202AB (LBCC-2)

[GGAC: Active Outreach Subcommittee \(15/10\) Screen/Electric](#)

Friday (6/23) 1:00 pm – 2:30 pm 202AB (LBCC-2)

[GGAC: Responsive Engagement Subcommittee \(15/10\)](#)

[Screen/Electric](#)

Friday (6/23) 2:45 pm – 4:15 pm 202AB (LBCC-2)

[GGAC: Ad Hoc Committee on GGAC Structure \(15/10\)](#)

[Screen/Electric](#)

Friday (6/23) 4:30 pm – 6:00 pm 202AB (LBCC-2)

### **Handbook Committee (30/15) Screen**

Sunday (6/25) 10:30 am – 1:00 pm Bixby 1 (R-2)

[Handbook Excom \(5/5\)](#)

Saturday (6/24) 1:00 pm – 2:00 pm Harbor A (H-1)

[Handbook Strategic Planning \(5/5\)](#)

Saturday (6/24) 2:00 pm – 3:00 pm Harbor A (H-1)

[Handbook Electronic Media \(5/0\)](#)

Sunday (6/25) 8:00 am – 9:00 am Bixby 1 (R-2)

[Handbook Functional \(5/0\)](#)

Sunday (6/25) 8:00 am – 9:00 am Bixby 3 (R-2)

[Handbook International \(5/5\)](#)

Sunday (6/25) 8:00 am – 9:00 am Bixby 2 (R-2)

[Handbook Training Workshop \(50/0\) Screen](#)

Sunday (6/25) 8:00 am – 9:00 am Wilmore (R-2)

[Handbook 2018 Refrigeration TCs/Volume Subcommittee \(25/0\)](#)

Sunday (6/25) 9:00 am – 10:00 am Bixby 3 (R-2)

[Handbook 2019 HVAC Applications TCs/Volume Subcommittee \(25/0\)](#)

Sunday (6/25) 9:00 am – 10:00 am Bixby 1 (R-2)

[Handbook 2020 HVAC Systems and Equipment TCs/Volume Subcommittee \(25/0\)](#)

Sunday (6/25) 9:00 am – 10:00 am Bixby 2 (R-2)

[Handbook Volume Subcommittees \(25/0\)](#)

Sunday (6/25) 10:00 am – 10:30 am Bixby 1 (R-2)

### **Historical Committee (20/5) Screen**

Sunday (6/25) 8:30 am – 12:00 pm 203C (LBCC-2)

### **Honors & Awards (20/0) Screen/Electric**

Sunday (6/25) 1:30 pm – 5:00 pm 203C (LBCC-2)

Monday (6/26) 2:15 pm – 5:30 pm 203C (LBCC-2)

[Honors & Awards New Member Orientation \(5/5\) Screen/Electric](#)

Sunday (6/25) 12:30 pm – 1:30 pm 203C (LBCC-2)

### **IEQ-GA (20/0) Screen/Electric**

Tuesday (6/27) 4:00 pm – 5:30 pm Shoreline B (H-1)

### **Indoor Air Quality Position Document (10/0) Screen/Electric**

Tuesday (6/27) 9:00 am – 10:30 am Harbor A (H-1)

**Life Member Executive Board Meeting (10/0)**

Tuesday (6/27) 9:00 am – 11:00 am Pacific (H-1)

**Members Council (37/40) Screen/Electric**

Tuesday (6/27) 8:15 am – 2:00 pm Beacon B (H-1)

Members Council Planning Subcommittee (12/10) Electric

Saturday (6/24) 8:00 am – 12:00 pm Harbor C (H-1)

Members Council Region Operations Subcommittee (12/10) Electric

Sunday (6/25) 8:00 am – 12:00 pm Pacific (H-1)

**Membership Promotion (24/15) Screen/Electric**

Saturday (6/24) 8:00 am – 3:00 pm Shoreline B (H-1)

Membership Promotion Subcommittees (20/10) Screen/Electric

Friday (6/23) 8:00 am – 2:00 pm Seaview A (H-1)

**Nominating (48/0) Screen/Electric**

Sunday (6/25) 7:30 am – 12:00 pm Beacon B (H-4)

**PEAC (20/20) Screen/Electric**

Tuesday (6/27) 12:00 pm – 2:00 pm Shoreline A (H-1)

**Planning (25/25) Screen/Electric**

Friday (6/23) 1:00 pm – 6:00 pm Beacon B (H-4)

**Professional Development (15/15)**

Monday (6/26) 8:00 am – 12:00 pm Pacific (H-1)

**Publications Committee (15/10) Screen**

Sunday (6/25) 8:00 am – 12:00 pm Broadlind 1 (R-2)

Publications Planning Subcommittee (5/5)

Saturday (6/24) 10:00 am – 12:00 pm Harbor A (H-1)

**Publishing and Education Council (35/30) Screen/Electric**

Tuesday (6/27) 8:00 am – 12:00 pm Regency EF (H-4)

Publishing and Education Council E-Learning (12/0) Screen

Saturday (6/24) 1:30 pm – 3:00 pm Seaview A (H-1)

Publishing and Education Council Research Journal Associate Editor Meeting (12/4) Screen

Sunday (6/25) 10:00 am – 12:00 pm Harbor A (H-1)

Publishing and Education Council Fiscal (25/10) Screen

Monday (6/26) 2:00 pm – 3:30 pm Shoreline B (H-1)

Publishing and Education Council Functional (25/10) Screen

Monday (6/26) 3:30 pm – 5:00 pm Shoreline B (H-1)

Publishing and Education Council Orientation (35/30) Screen/Electric

Tuesday (6/27) 2:00 pm – 4:00 pm Regency EF (H-4)

**Refrigeration Committee (20/20) Screen/Electric**

Sunday (6/25) 8:00 am – 12:00 pm Shoreline A (H-1)

Refrigeration Excom (20/20) Screen

Sunday (6/25) 7:00 am – 8:00 am Shoreline A (H-1)

Refrigeration PMS for RP-1634 (15/0) Screen

Monday (6/26) 4:30 pm – 6:30 pm Harbor C (H-1)

**Region-at-Large (40/0) Screen**

Monday (6/26) 2:15 pm – 4:15 pm 101A (LBCC-1)

**Research Administration Committee (25/20) Screen/Electric**

Friday (6/23) 3:00 pm – 7:00 pm 202C (LBCC-2)

Saturday (6/24) 8:00 am – 3:00 pm 102AB (LBCC-1)

Wednesday (6/28) 7:00 am – 11:00 am 203C (LBCC-2)

RAC Excom (6/0) Screen

Friday (6/23) 1:00 pm – 2:30 pm 202C (LBCC-2)

**Research Promotion (25/5)**

Saturday (6/24) 7:30 am – 1:00 pm 103AB (LBCC-1)

Research Promotion Executive (10/0)

Friday (6/23) 9:30 am – 11:30 am Beacon A (H-4)

Research Promotion RVC Training (25/5) Screen

Friday (6/23) 1:30 pm – 5:00 pm Beacon A (H-4)

Research Promotion Subcommittee (10/0)

Saturday (6/24) 2:00 pm – 3:00 pm 103AB (LBCC-1)

### **Residential Building Committee (20/15) Screen/Electric**

Monday (6/26) 8:00 am – 12:00 pm Beacon B (H-4)

Residential Building Committee: Conferences Subcommittee (8/10)

Sunday (6/25) 8:30 am – 9:30 am Harbor B (H-1)

Residential Building Committee: Programs Subcommittee (8/10)

Sunday (6/25) 9:30 am – 10:30 am Harbor B (H-1)

Residential Building Committee: Technical Subcommittee (8/10)

Sunday (6/25) 10:30 am – 11:30 am Harbor B (H-1)

Residential Building Committee: Publications Subcommittee (8/10)

Sunday (6/25) 1:00 pm – 2:00 pm Harbor B (H-1)

Residential Building Committee: Stakeholders Subcommittee (8/10)

Sunday (6/25) 2:00 pm – 3:00 pm Harbor B (H-1)

Residential Building Committee: New Member Orientation (8/10)

Sunday (6/25) 3:00 pm – 4:00 pm Harbor B (H-1)

### **Scholarship Trustees (10/5) Screen/Electric**

Tuesday (6/27) 8:00 am – 12:00 pm Harbor B (H-1)

### **Society Rules (12/6) Screen/Electric**

Tuesday (6/27) 2:00 pm – 6:00 pm Harbor B (H-1)

### **Standards Committee (30/20) Screen/Electric**

Saturday (6/24) 8:00 am – 12:00 pm Beacon B (H-4)

Wednesday (6/28) 8:00 am – 10:00 am Regency ABC (H-4)

Standards: Executive Committee (10/10) Screen/Electric

Friday (6/23) 8:00 am – 12:00 pm Regency E (H-4)

StdC Training Adhoc (10/10) Screen/Electric

Friday (6/23) 12:00 pm – 1:00 pm Regency E (H-4)

Standards: ILS/ISAS (10/3) Screen/Electric

Friday (6/23) 1:00 pm – 4:00 pm Pacific (H-1)

Standards: PPIS (6/10) Screen/Electric

Friday (6/23) 2:00 pm – 6:00 pm Regency E (H-4)

Tuesday (6/27) 11:00 am – 2:00 pm Pacific (H-1)

Standards: SPLS (20/20) Screen/Electric

Friday (6/23) 2:00 pm – 6:00 pm Regency D (H-4)

Tuesday (6/27) 2:00 pm – 4:00 pm Pacific (H-1)

Standards: Code Interaction Subcommittee (CIS) (15/10)

Screen/Electric

Sunday (6/25) 6:00 pm – 9:30 pm Pacific (H-1)

Standards SRS (8/4) Screen/Electric

Tuesday (6/27) 5:00 pm – 6:00 pm Pacific (H-1)

### **Student Activities Committee (22/10) Screen/Electric**

Saturday (6/24) 8:00 am – 3:00 pm Shoreline A (H-1)

Student Activities RVC Training (15/5) Screen/Electric

Friday (6/23) 8:30 am – 9:30 am Shoreline A (H-1)

Student Activities Executive (25/5) Screen/Electric

Friday (6/23) 9:30 am – 11:30 am Shoreline A (H-1)

Student Activities K-12/STEM (20/5) Screen/Electric

Friday (6/23) 12:00 pm – 2:00 pm Shoreline A (H-1)

Student Activities ABET (15/5) Screen/Electric

Friday (6/23) 2:00 pm – 4:00 pm Shoreline B (H-1)

Student Activities Post High (15/5) Screen/Electric

Friday (6/23) 2:00 pm – 4:00 pm Shoreline A (H-1)

Student Activities Design Competition (15/5) Screen/Electric

Friday (6/23) 4:00 pm – 6:00 pm Shoreline A (H-1)

Student Activities Grants (15/5) Screen/Electric

Friday (6/23) 4:00 pm – 6:00 pm Shoreline B (H-1)

### **TC/TG Chair's Training Workshop (50/20)**

Sunday (6/25) 9:45 am – 10:45 am 101A (LBCC-1)

### **Technical Activities Committee (25/20) Screen/Electric**

Saturday (6/24) 8:00 am – 3:00 pm 101B (LBCC-1)

Wednesday (6/28) 7:00 am – 10:00 am 204 (LBCC-2)

**TAC/Standing Committee Executive Interface (25/20) Screen/Electric**

Saturday (6/24) 7:00 am – 8:00 am 101B (LBCC-1)

**TAC/TC/SSPC 90.1 Interface/Liaison Session (50/0) Screen/Electric**

Monday (6/26) 2:15 pm – 4:15 pm 202AB (LBCC-2)

### **Technology Council (37/20) Screen/Electric**

Wednesday (6/28) 9:00 am – 12:00 pm Beacon B (H-4)

**Technology Council: Operations Subcommittee (20/10)**

Screen/Electric

Tuesday (6/27) 7:30 am – 9:00 am Shoreline B (H-1)

**Technology Council: Special Projects Subcommittee (8/5)**

Screen/Electric

Tuesday (6/27) 9:00 am – 10:30 am Shoreline B (H-1)

**Technology Council: Document Review Subcommittee (10/10)**

Screen/Electric

Tuesday (6/27) 10:30 am – 12:00 pm Shoreline B (H-1)

**Technology Council Planning (25/10) Screen/Electric**

Tuesday (6/27) 2:00 pm – 4:00 pm Shoreline B (H-1)

### **Young Engineers in ASHRAE Committee (20/15) Electric**

Saturday (6/24) 8:00 am – 3:00 pm Pacific (H-1)

### **YEA Hospitality (125/0)**

Sunday (6/25) 4:00 pm – 6:00 pm Regency DEF (H-4)

## **TC/TG/MTG/GPC/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

The venue and floor numbers are indicated in parenthesis in the listing below. Subcommittees are indented. Rooms will be set as indicated 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.

## Venue Key:

See page 87–88 for more information on how to find your meeting location.

**(H)** = Hyatt with a “-” indicating the floor number.

**(R)** = Renaissance with a “-” indicating the floor number.

**(LBCC)** = Long Beach Convention Center with a “-” indicating the floor number.

**(LBCC-SS)** = Seaside rooms (SS) at LBCC require a separate entrance and will be marked “SS.” See page 6 for more details.

**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 (32/4)

Sunday (6/25) 6:30 am – 8:00 am Bixby 1 (R-2)

### TC/TG Chair’s Breakfast Section 2 (26/4)

Sunday (6/25) 6:30 am – 8:00 am Bixby 2 (R-2)

### TC/TG Chair’s Breakfast Section 3 (17/4)

Sunday (6/25) 6:30 am – 8:00 am Dawson (R-3)

### TC/TG Chair’s Breakfast Section 4 (19/4)

Sunday (6/25) 6:30 am – 8:00 am Broadlind 1 (R-2)

### TC/TG Chair’s Breakfast Section 5 (31/4)

Sunday (6/25) 6:30 am – 8:00 am Pike 3 (R-1)

### TC/TG Chair’s Breakfast Section 6 (23/4)

Sunday (6/25) 6:30 am – 8:00 am Bixby 3 (R-2)

### TC/TG Chair’s Breakfast Section 7 (23/4)

Sunday (6/25) 6:30 am – 8:00 am Broadlind 2 (R-2)

### TC/TG Chair’s Breakfast Section 8 (34/4)

Sunday (6/25) 6:30 am – 8:00 am Pike 2 (R-1)

### TC/TG Chair’s Breakfast Section 9 (24/4)

Sunday (6/25) 6:30 am – 8:00 am Pike 1 (R-1)

### TC/TG Chair’s Breakfast Section 10 (18/4)

Sunday (6/25) 6:30 am – 8:00 am Nieto (R-2)

### MTG Chairs’ Section Breakfast (11/4)

Sunday (6/25) 6:30 am – 8:00 am Tichenor (R-2)

### TC/TG Chair’s Training Workshop (50/20)

Sunday (6/25) 9:45 am – 10:45 am 101A (LBCC-1)

### TC Program Subcommittee Training (30/0) Screen

Tuesday (6/27) 11:15 am – 12:00 pm 202C (LBCC-2)

## Research Subcommittee Chairs (137/0) Screen

Monday (6/26) 6:30 am – 9:30 am Regency (H-4)

## TC 1.1 Thermodynamics and Psychrometrics (10/15)

Monday (6/26) 2:15 pm – 4:15 pm 204 (LBCC-2)

## TC 1.2 Instruments and Measurements (15/0)

Tuesday (6/27) 1:00 pm – 3:30 pm Seaside 6 (LBCC-SS)

TC 1.2 Research, Program, Handbook (8/2)

Sunday (6/25) 5:00 pm – 7:00 pm Seaside 2 (LBCC-SS)

## TC 1.3 Heat Transfer and Fluid Flow (25/25)

Tuesday (6/27) 1:00 pm – 3:30 pm Bixby 2 (R-2)

TC 1.3/8.5 Research Subcommittee Meeting and Project Review (20/30) Screen/Electric

Sunday (6/25) 3:00 pm – 7:00 pm 102AB (LBCC-1)

## TC 1.4 Control Theory and Application (20/80) Screen

Tuesday (6/27) 1:00 pm – 3:30 pm 102AB (LBCC-1)

TC 1.4 YEA/Education (20/10) Screen/Electric

Sunday (6/25) 2:00 pm – 3:00 pm Nieto (R-2)

TC 1.4 Control Components and Applications (20/10) Screen/Electric

Sunday (6/25) 3:00 pm – 4:00 pm Nieto (R-2)

TC 1.4 Programs (20/10) Screen/Electric

Sunday (6/25) 4:00 pm – 5:30 pm Nieto (R-2)

TC 1.4 Research (20/10) Screen/Electric

Monday (6/26) 2:30 pm – 4:30 pm Seaside 4B (LBCC-SS)

TC 1.4 Handbook (10/5) Screen/Electric

Monday (6/26) 4:30 pm – 6:30 pm Seaside 4B (LBCC-SS)

TC 1.4 RP-1746 PMS (7/5) Screen/Electric

Monday (6/26) 6:30 pm – 8:00 pm Seaside 4B (LBCC-SS)

TC 1.4 Executive (10/3) Screen/Electric

Tuesday (6/27) 7:00 am – 8:00 am Seaside 3B (LBCC-SS)

## TC 1.5 Computer Applications (25/25) Screen/Electric

Monday (6/26) 6:30 pm – 9:00 pm Pike 1 (R-1)

TC 1.5 DBOSS (20/10)

Sunday (6/25) 3:00 pm – 4:00 pm Pike 2 (R-1)

TC 1.5 Cyber Security (20/10)

Sunday (6/25) 4:00 pm – 5:00 pm Pike 2 (R-1)

TC 1.5 Emerging Applications (20/15)

Sunday (6/25) 5:00 pm – 6:00 pm Pike 2 (R-1)

TC 1.5 Research (20/15)

Sunday (6/25) 6:00 pm – 7:00 pm Pike 2 (R-1)

TC 1.5 Program (20/15)

Sunday (6/25) 7:00 pm – 8:00 pm Pike 2 (R-1)

TC 1.5 Handbook (20/10)

Monday (6/26) 6:00 pm – 6:30 pm Pike 1 (R-1)

## TC 1.6 Terminology (10/5) Screen/Electric

Monday (6/26) 4:30 pm – 6:00 pm Seaside 6 (LBCC-SS)

TC 1.6 Working Group Subcommittee (10/3) Screen/Electric

Monday (6/26) 8:00 am – 11:30 am Seaside 6 (LBCC-SS)

## TC 1.7 Business, Management and General Legal Education (20/5)

Monday (6/26) 10:15 am – 12:00 pm Nieto (R-2)



## **TC 1.8 Mechanical Systems Insulation (6/6) Screen**

- Monday (6/26) 4:15 pm – 6:30 pm Seaside 2 (LBCC-SS)**  
TC 1.8 Handbook (15/3)  
Sunday (6/25) 8:00 am – 10:30 am Tichenor (R-2)  
TC 1.8 Program (15/3)  
Sunday (6/25) 10:30 am – 11:00 am Tichenor (R-2)  
TC 1.8 Research (15/3)  
Sunday (6/25) 11:00 am – 12:00 pm Tichenor (R-2)

## **TC 1.9 Electrical Systems (8/4)**

- Tuesday (6/27) 3:30 pm – 6:00 pm Seaside 3B (LBCC-SS)**

## **TC 1.10 Cogeneration Systems (20/8) Electric**

- Tuesday (6/27) 2:30 pm – 4:00 pm Seaside 5A (LBCC-SS)**  
TC1.10 Handbook, Program, Research, CTIC, Membership  
Subcommittee (15/10) Electric  
Tuesday (6/27) 1:00 pm – 2:30 pm Seaside 5A (LBCC-SS)

## **TC 1.11 Electric Motors and Motor Control (13/7) Screen**

- Tuesday (6/27) 1:00 pm – 3:30 pm Seaside 3B (LBCC-SS)**

## **TC 1.12 Moisture Management in Buildings (20/20) Screen/Electric**

- Saturday (6/24) 1:00 pm – 3:00 pm Bixby 1 (R-2)**  
TC 1.12 Research, Program, Handbook, Standards (20/20)  
Screen/Electric  
Saturday (6/24) 8:00 am – 12:00 pm Bixby 1 (R-2)

## **TC 1.13 Optimization (20/5)**

- Sunday (6/25) 1:00 pm – 3:00 pm 202C (LBCC-2)**

## **TC 2.1 Physiology and Human Environment (25/30) Electric**

- Tuesday (6/27) 1:00 pm – 5:00 pm Seaside 1 (LBCC-SS)**  
TC 2.1 Research/Programs/Handbook Follow-Up Meeting  
(10/5) Electric  
Sunday (6/25) 1:30 pm – 3:30 pm Seaside 3B (LBCC-SS)

## **TC 2.2 Plant and Animal Environment (10/5) Screen/ Electric**

- Monday (6/26) 4:15 pm – 6:30 pm Harbor B (H-1)**

## **TC 2.3 Gaseous Air Contaminants /Removal Equip. (30/30) Screen/Electric**

- Tuesday (6/27) 1:00 pm – 3:30 pm 101B (LBCC-1)**  
TC 2.3 Research (20/10) Screen/Electric  
Sunday (6/25) 5:00 pm – 7:00 pm 202 AB (LBCC-2)  
TC 2.3 Standards (20/10) Screen/Electric  
Monday (6/26) 2:15 pm – 3:15 pm Nieto (R-2)  
TC 2.3 Publications (combined with TC 2.4 Publications)  
(20/10) Screen/Electric  
Monday (6/26) 3:15 pm – 4:15 pm Nieto (R-2)  
TC 2.3 Handbook (5/5) Screen/Electric  
Monday (6/26) 4:15 pm – 6:30 pm Nieto (R-2)  
TC 2.3 Planning (15/5) Screen/Electric  
Tuesday (6/27) 6:30 am – 8:00 am 202C (LBCC-2)

TC 2.3 Programs (20/10) Screen/Electric  
Tuesday (6/27) 12:00 pm – 12:45 pm 202C (LBCC-2)

## **TC 2.4 Particulate Air Contaminants / Removal Equipment (20/40) Screen**

**Tuesday (6/27) 3:30 pm – 6:00 pm 101B (LBCC-1)**  
TC 2.4 Handbook (10/15) Screen/Electric  
Saturday (6/24) 1:00 pm – 2:30 pm 201B (LBCC-2)  
TC 2.4 1649-RP PMS (5/20) Screen/Electric  
Saturday (6/24) 1:30 pm – 2:30 pm 202AB (LBCC-2)  
TC 2.4 Research (20/30) Screen/Electric  
Sunday (6/25) 3:00 pm – 5:00 pm 202AB (LBCC-2)  
TC 2.4 Publications (combined with TC 2.3 Publications) (20/10) Screen/Electric  
Monday (6/26) 3:15 pm – 4:15 pm Nieto (R-2)  
TC 2.4 Standards (20/20) Screen/Electric  
Monday (6/26) 4:15 pm – 5:15 pm Wilmore (R-2)  
TC 2.4 Planning (20/10) Screen/Electric  
Tuesday (6/27) 8:00 am – 10:00 am 202C (LBCC-2)  
TC 2.4 Program (20/10) Screen/Electric  
Tuesday (6/27) 10:00 am – 11:00 am 202C (LBCC-2)

## **TC 2.5 Global Climate Change (20/10) Screen**

**Tuesday (6/27) 1:30 pm – 3:30 pm Broadlind 2 (R-2)**  
TC 2.5 Research, Programs (10/15) Screen/Electric  
Monday (6/26) 2:15 pm – 4:15 pm Seaside 6 (LBCC-SS)

## **TC 2.6 Sound and Vibration (20/30) Screen/Electric**

**Monday (6/26) 2:15 pm – 4:15 pm 202C (LBCC-2)**  
TC 2.6 Vibration Isolation (20/30) Screen/Electric  
Sunday (6/25) 9:00 am – 10:00 am 202C (LBCC-2)  
TC 2.6 RP 1408 (20/30) Screen/Electric  
Sunday (6/25) 10:00 am – 11:00 am 202C (LBCC-2)  
TC 2.6 Hot Topic 1 – Mech Equipment Vibrations and Structural Interaction (20/30) Screen/Electric  
Sunday (6/25) 11:00 am – 12:00 pm 202C (LBCC-2)  
TC 2.6 Programs (20/30) Screen/Electric  
Sunday (6/25) 3:00 pm – 4:00 pm 202C (LBCC-2)  
TC 2.6 Hot Topic 2 (20/30) Screen/Electric  
Sunday (6/25) 4:00 pm – 5:00 pm 202C (LBCC-2)  
TC 2.6 Executive Committee (20/30) Screen/Electric  
Sunday (6/25) 5:00 pm – 6:00 pm 202C (LBCC-2)  
TC 2.6 Publications (20/30) Screen/Electric  
Monday (6/26) 9:00 am – 10:00 am 202C (LBCC-2)  
TC 2.6 Research (20/30) Screen/Electric  
Monday (6/26) 10:00 am – 11:00 am 202C (LBCC-2)  
TC 2.6 Standards/Criteria (20/30) Screen/Electric  
Monday (6/26) 11:00 am – 12:00 pm 202C (LBCC-2)

## **TC 2.7 Seismic and Wind Restraint Design (17/24) Screen**

**Tuesday (6/27) 3:30 pm – 6:00 pm Wilmore (R-2)**  
TC 2.7 Programs, Publications, Research, Long Range Planning (15/10) Screen/Electric  
Tuesday (6/27) 1:00 pm – 3:30 pm Alford (R-2)

## **TC 2.8 Building Environmental Impacts and Sustainability (20/50)**

- Sunday (6/25) 5:30 pm – 7:00 pm Seaside 7 (LBCC-SS)**  
TC 2.8 Green Guide (8/10) Screen/Electric
- Sunday (6/25) 12:00 pm – 12:30 pm Seaside 7 (LBCC-SS)  
TC 2.8 Existing & Future Building Challenges (6/10) Screen/  
Electric
- Sunday (6/25) 12:30 pm – 1:00 pm Seaside 7 (LBCC-SS)  
TC 2.8 Water-Energy Nexus (6/10) Screen/Electric
- Sunday (6/25) 1:30 pm – 2:30 pm Seaside 7 (LBCC-SS)  
TC 2.8 International (4/10) Screen/Electric
- Sunday (6/25) 2:30 pm – 3:00 pm Seaside 7 (LBCC-SS)  
TC 2.8 Research (4/6) Screen/Electric
- Sunday (6/25) 3:00 pm – 4:00 pm Seaside 7 (LBCC-SS)  
TC 2.8 Handbook (6/6) Screen/Electric
- Sunday (6/25) 4:00 pm – 4:30 pm Seaside 7 (LBCC-SS)  
TC 2.8 Programs (8/8) Screen/Electric
- Sunday (6/25) 4:30 pm – 5:00 pm Seaside 7 (LBCC-SS)

## **TC 2.9 Ultraviolet Air and Surface Treatment (10/20) Screen**

- Monday (6/26) 10:00 am – 12:00 pm Wilmore (R-2)**  
TC 2.9 Programs (8/5)
- Sunday (6/25) 8:00 am – 10:00 am Ebell (R-3)  
TC 2.9 Handbook (5/5)
- Sunday (6/25) 10:00 am – 12:00 pm Ebell (R-3)  
TC 2.9 Standards (6/6)
- Sunday (6/25) 1:00 pm – 3:00 pm Ebell (R-3)  
TC 2.9 Research (10/8)
- Monday (6/26) 8:00 am – 10:00 am Wilmore (R-2)

## **TC 3.1 Refrigerants and Secondary Coolants (10/30) Screen/Electric**

- Monday (6/26) 4:15 pm – 6:30 pm Pike 3 (R-1)**  
TC 3.1 Research (combined with 3.2, 3.3, 3.4 and 3.8  
Research) (15/40) Screen/Electric
- Sunday (6/25) 3:00 pm – 6:00 pm 203AB (LBCC-2)  
TC 3.1 Program (Combined with 3.2, 3.3, 3.4 and 3.8  
Program) (15/40) Screen/Electric
- Monday (6/26) 10:30 am – 12:00 pm Seaside Ballroom B  
(LBCC-SS)

## **TC 3.2 Refrigerant System Chemistry (12/40) Screen/Electric**

- Monday (6/26) 2:15 pm – 4:15 pm Seaside Ballroom B  
(LBCC-SS)**  
TC 3.2 Research (combined with 3.1, 3.3, 3.4, 3.8 Research)  
(15/40) Screen/Electric
- Sunday (6/25) 3:00 pm – 6:00 pm 203AB (LBCC-2)  
TC 3.2 Program (Combined with 3.1, 3.3, 3.4 and 3.8  
Program) (15/40) Screen/Electric
- Monday (6/26) 10:30 am – 12:00 pm Seaside Ballroom B  
(LBCC-SS)

## **TC 3.3 Refrigerant Contaminant Control (14/25) Screen**

- Tuesday (6/27) 3:30 pm – 6:00 pm Seaside 3A (LBCC-SS)**

TC 3.3 Research (combined with 3.1, 3.2, 3.4, 3.8 Research) (15/40) Screen/Electric

Sunday (6/25) 3:00 pm – 6:00 pm 203AB (LBCC-2)

TC 3.3 Program (Combined with 3.1, 3.2, 3.4 and 3.8 Program) (15/40) Screen/Electric

Monday (6/26) 10:30 am – 12:00 pm Seaside Ballroom B (LBCC-SS)

### **TC 3.4 Lubrication (20/40) Screen**

**Tuesday (6/27) 1:30 pm – 3:30 pm Bixby 4 (R-2)**

TC 3.4 Research (combined with 3.1, 3.2, 3.3, 3.8 Research) (15/40) Screen/Electric

Sunday (6/25) 3:00 pm – 6:00 pm 203AB (LBCC-2)

TC 3.4 Program (Combined with 3.1, 3.2, 3.3 and 3.8 Program) (15/40) Screen/Electric

Monday (6/26) 10:30 am – 12:00 pm Seaside Ballroom B (LBCC-SS)

### **TC 3.6 Water Treatment (18/10) Screen**

**Tuesday (6/27) 1:00 pm – 3:30 pm Seaside 3A (LBCC-SS)**

TC 3.6 Handbook/Program/Research (15/10) Electric

Sunday (6/25) 4:00 pm – 6:00 pm Pike 1 (R-1)

### **TC 3.8 Refrigerant Containment (9/5) Screen**

**Monday (6/26) 4:15 pm – 6:30 pm Tichenor (R-2)**

TC 3.8 Research (combined with 3.1, 3.2, 3.3, 3.4 Research) (15/40) Screen/Electric

Sunday (6/25) 3:00 pm – 6:00 pm 203AB (LBCC-2)

TC 3.8 Program (Combined with 3.1, 3.2, 3.3 and 3.4 Program) (15/40) Screen/Electric

Monday (6/26) 10:30 am – 12:00 pm Seaside Ballroom B (LBCC-SS)

### **TC 4.1 Load Calculation Data and Procedures (20/10) Screen**

**Monday (6/26) 2:15 pm – 4:15 pm Wilmore (R-2)**

TC 4.1 RP-1729 PMS (8/5) Screen

Sunday (6/25) 8:00 am – 9:00 am Alford (R-2)

TC 4.1 RP-1681 PMS (15/10)

Sunday (6/25) 2:00 pm – 3:00 pm Seaside 6 (LBCC-SS)

TC 4.1 Handbook (15/10)

Sunday (6/25) 3:00 pm – 4:00 pm Bixby 2 (R-2)

TC 4.1 Research (15/10)

Sunday (6/25) 4:00 pm – 5:00 pm Bixby 2 (R-2)

TC 4.1 Programs and Standards (15/10)

Sunday (6/25) 5:00 pm – 6:00 pm Bixby 2 (R-2)

TC 4.1 RP-1742 PMS (8/5) Screen

Sunday (6/25) 6:00 pm – 7:00 pm Bixby 2 (R-2)

TC 4.1/4.3 PMS for RP1747 Implementation of DCV for Multiple Zone Systems (12/0)

Tuesday (6/27) 9:00 am – 10:00 am Suite 334 (R-3)

### **TC 4.2 Climatic Information (20/10) Screen**

**Tuesday (6/27) 1:00 pm–3:30 pm Delker (R-3)**

TC 4.2 Handbook (7/7) Screen/Electric

Sunday (6/25) 2:30 pm – 3:30 pm Harbor A (H-1)

TC 4.2 Program (7/7) Screen/Electric

Sunday (6/25) 3:30 pm – 4:30 pm Harbor A (H-1)

TC 4.2 Research (7/12) Screen/Electric

Monday (6/26) 4:15 pm – 6:00 pm Pacific (H-1)

### **TC 4.3 Ventilation Requirements and Infiltration (10/20)**

**Monday (6/26) 4:15 pm – 6:30 pm 101B (LBCC-1)**

TC 4.1/4.3 PMS for RP1747 Implementation of DCV for Multiple Zone Systems (12/0)

Tuesday (6/27) 9:00 am – 10:00 am Suite 334 (R-3)

### **TC 4.4 Building Materials and Building Envelope Performance (40/10) Screen**

**Monday (6/26) 2:15 pm – 4:15 pm Seaside 7 (LBCC-SS)**

TC 4.4 PMS 1696-RP (20/10) Screen

Sunday (6/25) 11:00 am – 12:30 pm Seaside 4B (LBCC-SS)

TC 4.4 Program (30/15) Screen/Electric

Sunday (6/25) 1:00 pm – 2:30 pm Seaside 4B (LBCC-SS)

TC 4.4 Handbook (30/15) Screen/Electric

Sunday (6/25) 2:30 pm – 3:30 pm Seaside 4B (LBCC-SS)

TC 4.4 Research (30/15) Screen/Electric

Sunday (6/25) 3:30 pm – 5:00 pm Seaside 4B (LBCC-SS)

TC 4.4 Standards (30/15) Screen/Electric

Sunday (6/25) 5:00 pm – 5:30 pm Seaside 4B (LBCC-SS)

### **TC 4.5 Fenestration (10/8)**

**Tuesday (6/27) 2:00 pm – 4:00 pm Suite 334 (R-3)**

TC 4.5 Research (10/10)

Monday (6/26) 2:15 pm – 3:15 pm Seaside 5B (LBCC-SS)

TC 4.5 Program (10/10)

Monday (6/26) 3:15 pm – 4:15 pm Seaside 5B (LBCC-SS)

TC 4.5 Handbook (10/10)

Monday (6/26) 4:15 pm – 5:30 pm Seaside 5B (LBCC-SS)

TC 4.5 Calculation Methods (15/10)

Tuesday (6/27) 1:00 pm – 2:00 pm Suite 334 (R-3)

### **TC 4.7 Energy Calculations (25/50) Screen**

**Tuesday (6/27) 6:00 pm – 8:30 pm 101A (LBCC-1)**

TC 4.7 Simulation and Component Models (20/20) Screen/Electric

Monday (6/26) 6:00 pm – 7:30 pm Dawson (R-3)

TC 4.7 Data-Driven Models (20/20) Screen/Electric

Monday (6/26) 7:30 pm – 9:00 pm Dawson (R-3)

TC 4.7 Applications (20/20) Screen/Electric

Tuesday (6/27) 3:30 pm – 5:00 pm 101A (LBCC-1)

TC 4.7 Handbook (20/10) Screen/Electric

Tuesday (6/27) 5:00 pm – 6:00 pm 101A (LBCC-1)

### **TC 4.10 Indoor Environmental Modeling (20/20) Screen**

**Monday (6/26) 2:15 pm – 4:15 pm Pike 2 (R-1)**

TC 4.10 RP-1675 PMS (5/10) Screen/Electric

Sunday (6/25) 2:00 pm – 3:00 pm Seaside 5A (LBCC-SS)

TC 4.10 Program (14/10) Screen/Electric

Sunday (6/25) 3:00 pm – 4:00 pm Seaside 5A (LBCC-SS)

TC 4.10 Handbook (14/10) Screen/Electric

Sunday (6/25) 4:00 pm – 5:00 pm Seaside 5A (LBCC-SS)

TC 4.10 Research (14/10) Screen/Electric

Sunday (6/25) 5:00 pm – 6:00 pm Seaside 5A (LBCC-SS)

## TC 5.1 Fans (20/20)Screen

- Monday (6/26) 4:15 pm – 6:30 pm 201A (LBCC-2)**  
TC 5.1 Handbook (12/12) Screen/Electric  
Sunday (6/25) 2:00 pm – 3:00 pm Seaside 5B (LBCC-SS)  
TC 5.1 Research (10/10) Screen  
Sunday (6/25) 3:00 pm – 4:00 pm Seaside 5B (LBCC-SS)  
TC 5.1 Program (10/10) Screen  
Sunday (6/25) 4:00 pm – 4:30 pm Seaside 5B (LBCC-SS)  
TC 5.1 Hot Topics (15/15) Screen  
Sunday (6/25) 4:30 pm – 6:00 pm Seaside 5B (LBCC-SS)

## TC 5.2 Duct Design (12/20) Screen

- Tuesday (6/27) 3:30 pm – 6:00 pm Seaside 4B (LBCC-SS)**  
TC 5.2 Duct Design Guide (30/20) Screen/Electric  
Monday (6/26) 8:00 am – 12:00 pm Seaside Ballroom A (LBCC-SS)

## TC 5.3 Room Air Distribution (30/30) Screen/Electric

- Tuesday (6/27) 1:00 pm – 3:30 pm 101A (LBCC-1)**  
TC 5.3 Handbook (20/10) Screen/Electric  
Friday (6/23) 12:00 pm – 5:00 pm Bixby 4 (R-2)  
TC 5.3 Handbook (20/10) Screen/Electric  
Saturday (6/24) 8:00 am – 3:00 pm Dawson (R-3)  
TC 5.3 Fan Coils (20/10) Screen/Electric  
Sunday (6/25) 8:00 am – 9:00 am Pike 2 (R-1)  
TC 5.3 Chilled Beams (20/10) Screen/Electric  
Sunday (6/25) 9:00 am – 10:00 am Pike 2 (R-1)  
TC 5.3 Air Curtains (20/10) Screen/Electric  
Sunday (6/25) 10:00 am – 10:45 am Pike 2 (R-1)  
TC 5.3 1629-TRP Testing and Modeling Energy Performance of Active Chilled Beams systems (6/10) Screen/Electric  
Sunday (6/25) 10:00 am – 11:00 am Alford (R-2)  
TC 5.3 Underfloor Air Distribution (20/10) Screen/Electric  
Sunday (6/25) 10:45 am – 11:45 am Pike 2 (R-1)  
TC 5.3 Research, Programs (25/10)Screen/Electric  
Sunday (6/25) 12:30 pm – 2:30 pm Pike 2 (R-1)

## TC 5.4 Industrial Process Air Cleaning (Air Pollution Control) (11/6)

- Monday (6/26) 2:15 pm – 4:15 pm Seaside 2 (LBCC-SS)**

## TC 5.5 Air-to-Air Energy Recovery (30/10) Screen

- Tuesday (6/27) 3:30 pm – 6:00 pm Bixby 2 (R-2)**  
TC 5.5 Handbook, Program, Research (15/5) Screen/Electric  
Tuesday (6/27) 1:00 pm – 3:30 pm Tichenor (R-2)

## TC 5.6 Control of Fire and Smoke (23/30) Screen

- Monday (6/26) 4:15 pm – 6:30 pm Pike 2 (R-1)**  
TC 5.6 Program/Research/Handbook (13/20)  
Sunday (6/25) 3:00 pm – 6:30 pm Bixby 1 (R-2)

## TC 5.7 Evaporative Cooling (20 /10)

- Monday (6/26) 4:15 pm – 6:30 pm Bixby 3 (R-2)**

## TC 5.8 Industrial Ventilation (Combined with TC 9.2 Main) (45/15) Screen/Electric

- Tuesday (6/27) 1:00 pm – 3:30 pm Bixby 5 (R-2)**

TC 5.8 Industrial Ventilation Systems (30/15) Screen/Electric  
Monday (6/26) 4:15 pm – 6:30 pm Seaside 7 (LBCC-SS)

### **TC 5.9 Enclosed Vehicular Facilities (30/10) Screen**

**Tuesday (6/27) 3:30 pm – 6:00 pm Bixby 3 (R-2)**  
TC 5.9 Program, Standards, Handbook, Research (30/10)  
Screen/Electric

Tuesday (6/27) 1:00 pm – 3:30 pm Bixby 3 (R-2)

### **TC 5.10 Kitchen Ventilation (20/15) Screen**

**Monday (6/26) 6:30 pm – 7:30 pm Broadlind 1(R-2)**

TC 5.10 Handbook (20/15) Screen/Electric

Monday (6/26) 2:00 pm – 3:30 pm Broadlind 1 (R-2)

TC 5.10 Program (20/15)Screen/Electric

Monday (6/26) 3:30 pm – 4:30 pm Broadlind 1 (R-2)

TC 5.10 Research (20/15)Screen/Electric

Monday (6/26) 4:30 pm – 6:30 pm Broadlind 1 (R-2)

### **TC 5.11 Humidifying Equipment (10/5) Screen/Electric**

**Monday (6/26) 2:15 pm – 4:15 pm Seaside 4A (LBCC-SS)**

TC 5.11 Research (6/4) Screen/Electric

Sunday (6/25) 3:00 pm – 5:00 pm Seaside 3A (LBCC-SS)

### **TC 6.1 Hydronic and Steam Equipment and Systems (20/25) Screen**

**Tuesday (6/27) 1:00 pm – 3:30 pm Bixby 1 (R-2)**

TC 6.1 Handbook (12/8) Screen /Electric

Sunday (6/25) 5:00 pm – 6:00 pm Alford (R-2)

TC 6.1 Chilled Water Plant (12/8) Screen /Electric

Sunday (6/25) 6:00 pm – 7:00 pm Alford (R-2)

TC 6.1 Program (12/8) Screen /Electric

Monday (6/26) 2:15 pm – 3:15 pm Tichenor (R-2)

TC 6.1 Research (12/8) Screen /Electric

Monday (6/26) 3:15 pm – 4:15 pm Tichenor (R-2)

### **TC 6.2 District Energy (20/10)**

**Sunday (6/25) 3:00 pm – 5:00 pm Shoreline B (H-1)**

TC 6.2 Programs, Research, Handbook (20/10)

Screen/Electric

Sunday (6/25) 1:00 pm – 3:00 pm Shoreline B (H-1)

### **TC 6.3 Central Forced Air Heating and Cooling Systems (20/12) Screen**

**Tuesday (6/27) 1:00 pm – 3:30 pm Wilmore (R-2)**

TC 6.3 Research, Standards and Program (10/10) Electric

Monday (6/26) 2:15 pm – 4:15 pm Harbor A (H-1)

### **TC 6.5 Radiant Heating and Cooling (30/10)**

**Screen/Electric**

**Monday (6/26) 2:15 pm – 4:15 pm Seaside Ballroom A (LBCC-SS)**

TC 6.5 RP-1766 PMS (15/20) Screen/Electric

Sunday (6/25) 2:00 pm – 3:00 pm Seaside 4A (LBCC-SS)

TC 6.5 Research (15/20) Screen/Electric

Sunday (6/25) 3:00 pm – 4:00 pm Seaside 4A (LBCC-SS)

TC 6.5 Program (15/20) Screen/Electric

Sunday (6/25) 4:00 pm – 5:00 pm Seaside 4A (LBCC-SS)

TC 6.5 Handbook (15/20) Screen/Electric

Sunday (6/25) 5:00 pm – 6:00 pm Seaside 4A (LBCC-SS)

## **TC 6.6 Service Water Heating Systems (20/10) Screen**

**Monday (6/26) 4:15 pm – 6:30 pm Bixby 5 (R-2)**  
TC 6.6 Research, Handbook, and Program (20/10) Screen/  
Electric

Monday (6/26) 2:15 pm – 4:15 pm Bixby 5 (R-2)

## **TC 6.7 Solar Energy Utilization (20/55) Screen**

**Tuesday (6/27) 1:00 pm – 3:30 pm 201A (LBCC-2)**  
TC 6.7 Research, Standards, Programs and Handbook (15/10)  
Screen/Electric

Monday (6/26) 4:15 pm – 8:15 pm Broadlind 2 (R-2)

## **TC 6.8 Geothermal Heat Pump and Energy Recovery Applications (16/25) Screen/Electric**

**Tuesday (6/27) 3:30 pm – 6:00 pm 102AB (LBCC-1)**  
TC 6.8 Handbook: Applied Heat Pump and Heat Recovery  
Systems (10/15) Screen/Electric

Sunday (6/25) 1:00 pm – 3:00 pm Bixby 1 (R-2)

TC 6.8 Handbook: Geothermal Energy (10/10)  
Screen/Electric

Sunday (6/25) 3:00 pm – 5:00 pm Tichenor (R-2)

TC 6.8 Research, Programs, Standards (15/10) Screen/Electric

Sunday (6/25) 5:00 pm – 7:00 pm Tichenor (R-2)

## **TC 6.9 Thermal Storage (14/25) Screen/Electric**

**Monday (6/26) 4:30 pm – 6:00 pm Seaside 1 (LBCC-SS)**  
TC 6.9 Standards, Programs, Handbook, Research & LRP  
(11/20) Electric

Monday (6/26) 2:15 pm – 4:15 pm Seaside 1 (LBCC-SS)

## **TC 6.10 Fuels and Combustion (20/10) Screen**

**Tuesday (6/27) 3:30 pm – 6:15 pm 202C (LBCC-2)**  
TC 6.10 Handbook

Monday (6/26) 4:15 pm – 6:00 pm 101A (LBCC-1)

## **TC 7.1 Integrated Building Design (25/10)**

**Monday (6/26) 8:15 am – 10:30 am Seaside Ballroom B  
(LBCC-SS)**

TC 7.1 Research, Program, Handbook

*Met prior to Long Beach Conference via web meeting*

## **TC 7.2 HVAC&R Construction and Design Build Technologies (10/5)**

**Sunday (6/25) 10:00 am – 12:00 pm Seaside 4A (LBCC-SS)**

## **TC 7.3 Operations & Maintenance Management (25/7) Electric**

**Tuesday (6/27) 1:00 pm – 3:30 pm Seaside 4B (LBCC-SS)**  
TC 7.3 Standards, Programs (15/10) Electric

Monday (6/26) 2:15 pm – 4:15 pm Seaside 3A (LBCC-SS)

TC 7.3 Research, Handbook (15/10) Electric

Monday (6/26) 4:15 pm – 6:30 pm Seaside 3A (LBCC-SS)

TC 7.3 RP-1650 PMS (6/0)

Tuesday (6/27) 8:00 am – 9:00 am Seaside 2 (LBCC-SS)

## **TC 7.4 Exergy Analysis for Sustainable Buildings (14/8)**

**Sunday (6/25) 8:00 am – 10:00 am Seaside 4A (LBCC-SS)**



## **TC 7.5 Smart Building Systems (11/50) Screen**

- Tuesday (6/27) 3:30 pm – 6:00 pm 204 (LBCC-2)**  
TC 7.5 Fault Detection & Diagnosis (11/50) Electric  
Sunday (6/25) 2:30 pm – 3:15 pm 204 (LBCC-2)  
TC 7.5 Enabling Technologies (11/50) Electric  
Sunday (6/25) 3:15 pm – 4:00 pm 204 (LBCC-2)  
TC 7.5 Smart Grid (11/50) Electric  
Sunday (6/25) 4:00 pm – 4:45 pm 204 (LBCC-2)  
TC 7.5 Handbook (11/50) Electric  
Sunday (6/25) 4:45 pm – 5:30 pm 204 (LBCC-2)  
TC 7.5 Program (11/50) Electric  
Sunday (6/25) 5:30 pm – 6:00 pm 204 (LBCC-2)  
TC 7.5 Buildings Operations Dynamics (11/50) Electric  
Monday (6/26) 4:30 pm – 5:15 pm 202 AB (LBCC-2)  
TC 7.5 Research (11/50) Electric  
Monday (6/26) 5:15 pm – 6:00 pm 202 AB (LBCC-2)

## **TC 7.6 Building Energy Performance (10/30)**

- Tuesday (6/27) 1:00 pm – 3:30 pm 202 AB (LBCC-2)**  
TC 7.6 Federal Buildings (25/25) Electric  
Saturday (6/24) 9:00 am – 3:00 pm Bixby 3 (R-2)  
TC 7.6 Federal Buildings (25/25) Electric  
Sunday (6/25) 9:00 am – 12:00 pm Pike 3 (R-1)  
TC 7.6 Project Monitoring Committee for 1702-RP (8/0)  
Electric  
Sunday (6/25) 11:30 am – 1:00 pm Alford (R-2)  
TC 7.6 Research (10/10) Electric  
Sunday (6/25) 1:00 pm – 2:00 pm Alford (R-2)  
TC 7.6 Commercial Building Energy Audit (10/10) Electric  
Sunday (6/25) 2:00 pm – 3:00 pm Alford (R-2)  
TC 7.6 Handbook (10/10)  
Sunday (6/25) 3:00 pm – 4:00 pm Alford (R-2)  
TC 7.6 Monitoring and Energy Performance (10/30)  
Monday (6/26) 2:15 pm – 4:15 pm Bixby 4 (R-2)  
TC 7.6 Energy Management (10/15) Electric  
Monday (6/26) 4:15 pm – 5:15 pm Bixby 4 (R-2)  
TC 7.6 Standards and Programs (10/10) Electric  
Monday (6/26) 5:15 pm – 6:15 pm Bixby 4 (R-2)  
TC 7.6 Executive (10/0) Electric  
Monday (6/26) 6:15 pm – 7:00 pm Bixby 4 (R-2)

## **TC 7.7 Testing and Balancing (20/30)**

- Monday (6/26) 2:15 pm – 4:15 pm 201A (LBCC-2)**  
TC 7.7 Program, Handbook, Research (5/3) Electric  
Sunday (6/25) 5:00 pm – 7:00 pm Delker (R-3)

## **TC 7.8 Owning and Operating Costs (20/5)**

- Monday (6/26) 2:15 pm – 4:15 pm 101B (LBCC-1)**  
TC 7.8 Handbook, Program, Research  
*Met prior to the Long Beach Conference via web meeting*

## **TC 7.9 Building Commissioning (40/20) Screen/Electric**

- Sunday (6/25) 3:00 pm – 5:00 pm 101A (LBCC-1)**  
TC 7.9 Handbook, Programs, Research (15/10) Electric  
Saturday (6/24) 7:00 am – 10:00 am 203AB (LBCC-2)

## **TC 8.1 Positive Displacement Compressors (12/14) Screen**

**Tuesday (6/27) 3:30 pm – 6:00 pm Delker (R-3)**  
TC 8.1 Research and Programs (8/4) Electric  
Sunday (6/25) 4:00 pm – 5:00 pm Alford (R-2)

## **TC 8.2 Centrifugal Machines (20/8)**

**Monday (6/26) 2:15 pm – 4:15 pm Broadlind 2 (R-2)**  
TC 8.2 Programs, Research and Handbook (17/8) Screen/  
Electric  
Sunday (6/25) 5:00 pm – 7:00 pm 201A (LBCC-2)

## **TC 8.3 Absorption and Heat Operated Machines (20/10) Screen**

**Monday (6/26) 3:30 pm – 6:00 pm Dawson (R-3)**  
TC 8.3 Research/Handbook (8/5) Electric  
Monday (6/26) 2:15 pm – 3:30 pm Dawson (R-3)

## **TC 8.4 Air-to-Refrigerant Heat Transfer Equipment (20/10) Screen**

**Tuesday (6/27) 3:30 pm – 6:00 pm Broadlind 2 (R-2)**  
TC 8.4 Research, Standards, Handbook (15/30) Screen/Electric  
Monday (6/26) 6:00 pm – 9:00 pm Bixby 1 (R-2)

## **TC 8.5 Liquid-to-Refrigerant Heat Exchangers (47/18) Screen**

**Monday (6/26) 4:15 pm – 6:30 pm Seaside Ballroom A (LBCC-SS)**  
TC 8.5/1.3 Research Subcommittee Meeting and Project Review (20/30) Screen/Electric  
Sunday (6/25) 3:00 pm – 7:00 pm 102AB (LBCC-1)

## **TC 8.6 Cooling Towers and Evaporative Condensers (20/5)**

**Monday (6/26) 2:15 pm – 4:15 pm 203AB (LBCC-2)**  
TC 8.6 Handbook/Program/Research (8/0)  
Monday (6/26) 9:00 am – 10:00 am Harbor A (H-1)

## **TC 8.7 Variable Refrigerant Flow (VRF) (20/30)**

**Monday (6/26) 4:15 pm – 6:30 pm 203AB (LBCC-2)**

## **TC 8.8 Refrigerant System Controls and Accessories (10/10) Screen/Electric**

**Tuesday (6/27) 1:00 pm – 3:30 pm 204 (LBCC-2)**  
TC 8.8 Research, Program, Handbook (5/5)  
Sunday (6/25) 6:30 pm – 7:30 pm Harbor B (H-1)

## **TC 8.9 Residential Refrigerators and Food Freezers (6/10)**

**Monday (6/26) 2:15 pm – 4:15 pm Harbor B (H-1)**

## **TC 8.10 Mechanical Dehumidification and Heat Pipes (16/10)**

**Tuesday (6/27) 3:30 pm – 5:00 pm Regency D (H-4)**  
TC 8.10 Program/Handbook/Research/Standards (20/10) Electric  
Tuesday (6/27) 1:00 pm – 3:30 pm Regency D (H-4)

## **TC 8.11 Unitary and Room Air Conditioners and Heat Pumps (20/40)**

**Monday (6/26) 4:15 pm – 6:30 pm 202C (LBCC-2)**

TC 8.11 Handbook, Program, Research (12/20) Electric

Sunday (6/25) 3:00 pm – 5:00 pm 201A (LBCC-2)

## **TC 8.12 Desiccant Dehumidification Equipment and Components (15/15)**

**Monday (6/26) 2:15 pm – 4:15 pm Pacific (H-1)**

## **TC 9.1 Large Building Air-Conditioning Systems (14/10) Screen/Electric**

**Tuesday (6/27) 1:00 pm – 3:30 pm Ebell (R-3)**

TC 9.1 Program and Handbook (10/2) Screen/Electric

Tuesday (6/27) 12:00 pm – 1:00 pm Ebell (R-3)

## **TC 9.2 Industrial Air-Conditioning (Combined with TC 5.8 Main) (45/15) Screen/Electric**

**Tuesday (6/27) 1:00 pm – 3:30 pm Bixby 5 (R-2)**

TC 9.2 Programs/Research/Handbook (10/5) Electric

Sunday (6/25) 4:00 pm – 6:00 pm Seaside 3B (LBCC-SS)

## **TC 9.3 Transportation Air-Conditioning (14/20) Screen/Electric**

**Monday (6/26) 3:00 pm – 5:00 pm Bixby 1 (R-2)**

TC 9.3 Rail/Mass Transit Subcommittee (14/20)

Monday (6/26) 10:00 am – 12:00 pm Bixby 1 (R-2)

TC 9.3 Handbook Subcommittee (14/20)

Monday (6/26) 2:15 pm – 3:00 pm Bixby 1 (R-2)

## **TC 9.4 Justice Facilities (20/5) Electric**

**Sunday (6/25) 3:00 pm – 5:00 pm 101B (LBCC-1)**

TC 9.4 Justice Facilities Design Guide (8/6) Electric

Sunday (6/25) 5:00 pm – 7:00 pm 101B (LBCC-1)

## **TC 9.6 Healthcare Facilities (18/50) Screen/Electric**

**Sunday (6/25) 5:00 pm – 7:00 pm 101A (LBCC-1)**

TC 9.6 Infectious Diseases (30/15) Electric

Sunday (6/25) 8:30 am – 10:30 am Pike 1 (R-1)

TC 9.6 Handbook (15/15) Electric

Sunday (6/25) 10:30 am – 11:30 am Pike 1 (R-1)

TC 9.6 Leadership (20/15) Electric

Sunday (6/25) 12:00 pm – 1:00 pm Pike 1 (R-1)

TC 9.6 Water, Energy (20/15) Electric

Sunday (6/25) 1:00 pm – 2:00 pm Pike 1 (R-1)

TC 9.6 Research (15/15) Electric

Sunday (6/25) 2:00 pm – 3:00 pm Pike 1 (R-1)

TC 9.6 Program (15/15) Electric

Sunday (6/25) 3:00 pm – 3:30 pm Pike 1 (R-1)

## **TC 9.7 Educational Facilities (13/10)**

**Sunday (6/25) 1:00 pm – 3:00 pm Tichenor (R-2)**

## **TC 9.8 Large Building Air-Conditioning Applications (20/10)**

**Monday (6/26) 2:15 pm – 4:15 pm Bixby 3 (R-2)**

TC 9.8 Handbook (10/5) Screen/Electric

Monday (6/26) 9:00 am – 10:00 am Ebell (R-3)

TC 9.8 Programs (10/5) Screen/Electric

Monday (6/26) 10:00 am – 11:00 am Ebell (R-3)

TC 9.8 International and Membership (10/5) Screen/Electric

Monday (6/26) 11:00 am – 12:00 pm Ebell (R-3)

### **TC 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment (25/75) Screen**

**Monday (6/26) 2:15 pm – 6:30 pm 201B (LBCC-2)**

TC 9.9 Programs, Handbook and Research (15/55)

Screen/Electric

Sunday (6/25) 5:00 pm – 7:00 pm 201B (LBCC-2)

TC 9.9 RP-1755 PMS (8/7) Screen/Electric

Monday (6/26) 7:30 am – 9:00 am Tichenor (R-2)

### **TC 9.10 Laboratory Systems (20/40) Screen/Electric**

**Tuesday (6/27) 3:30 pm – 5:30 pm 201B (LBCC-2)**

TC 9.10 RP-1573 PMS Monitoring Subcommittee (10/2) Electric

Sunday (6/25) 1:00 pm – 3:30 pm Seaview A (H-1)

TC 9.10 Standards (20/5) Screen/Electric

Sunday (6/25) 3:00 pm – 3:30 pm Seaview A (H-1)

TC 9.10 Research (25/5) Screen/Electric

Sunday (6/25) 3:30 pm – 4:15 pm Seaview A (H-1)

TC 9.10 Program (25/5) Screen/Electric

Sunday (6/25) 4:15 pm – 4:45 pm Seaview A (H-1)

TC 9.10 Handbook (20/5) Screen/Electric

Tuesday (6/27) 1:00 pm – 1:45 pm 201B (LBCC-2)

TC 9.10 Lab Classifications (25/5) Screen/Electric

Tuesday (6/27) 1:45 pm – 2:30 pm 201B (LBCC-2)

TC 9.10 Labs Energy Efficiency (25/5) Screen/Electric

Tuesday (6/27) 2:30 pm – 3:00 pm 201B (LBCC-2)

TC 9.10 Standard 110 (20/5) Screen/Electric

Tuesday (6/27) 3:00 pm – 3:30 pm 201B (LBCC-2)

### **TC 9.11 Clean Spaces (30/45) Screen**

**Monday (6/26) 3:00 pm – 4:15 pm 102AB (LBCC-1)**

TC 9.11 Research (12/6) Screen/Electric

Monday (6/26) 2:15 pm – 3:00 pm 102AB (LBCC-1)

TC 9.11 Energy Efficiency (12/6) Screen/Electric

Monday (6/26) 4:30 pm – 5:00 pm 102AB (LBCC-1)

TC 9.11 Handbook (12/6) Screen/Electric

Monday (6/26) 5:00 pm – 5:30 pm 102AB (LBCC-1)

TC 9.11 Design Guide (12/6) Screen/Electric

Monday (6/26) 5:30 pm – 6:00 pm 102AB (LBCC-1)

### **TC 9.12 Tall Buildings (12/8)**

**Tuesday (6/27) 3:30 pm – 6:00 pm Nieto (R-2)**

### **TC 10.1 Custom Engineered Refrigeration Systems (30/10) Screen**

**Monday (6/26) 2:00 pm – 4:00 pm Beacon B (H-4)**

### **TC 10.2 Automatic Ice Making Plants and Skating Rinks (12/3) Screen/Electric**

**Monday (6/26) 4:30 pm – 6:30 pm Ebell (R-3)**

## **TC 10.3 Refrigerant Piping, Controls and Accessories (20/10) Screen**

**Tuesday (6/27) 1:00 pm – 3:30 pm Nieto (R-2)**

TC 10.3 RP-1569 PMS (15/0)

Tuesday (6/26) 8:00 am – 10:00 am Bixby 1 (R-2)

## **TC 10.5 Refrigerated Processing and Storage (15/10)**

**Tuesday (6/27) 3:30 pm – 6:00 pm Bixby 1 (R-2)**

## **TC 10.6 Transport Refrigeration (8/10) Screen/Electric**

**Monday (6/26) 4:45 pm – 7:00 pm Seaside 3B (LBCC-SS)**

TC 10.6 Handbook (5/5) Electric

Monday (6/26) 2:15 pm – 4:15 pm Seaside 3B (LBCC-SS)

## **TC 10.7 Commercial Food and Beverage Refrigeration Equipment (30/40) Screen**

**Monday (6/26) 2:15 pm – 4:15 pm Pike 3 (R-1)**

TC 10.7 Program (10/4)

Sunday (6/25) 5:00 pm – 5:30 pm Broadlind 2 (R-2)

TC 10.7 Research (10/4)

Sunday (6/25) 6:00 pm – 6:30 pm Broadlind 2 (R-2)

TC 10.7 Handbook (10/4)

Sunday (6/25) 6:30 pm – 7:30 pm Broadlind 2 (R-2)

## **TC 10.8 Refrigeration Load Calculations (10/10)**

**Sunday (6/25) 3:00 pm – 5:00 pm Seaside 2 (LBCC-SS)**

## **TASK GROUPS (TG), TECHNICAL RESOURCE GROUPS (TRG), AND MULTIDISCIPLINARY TASK GROUPS (MTG)**

### **TG2 HVAC Security (10/5) Screen/Electric**

**Tuesday (6/27) 9:00 am – 12:00 pm Seaside 4A (LBCC-SS)**

### **TRG4.IAQP–Indoor Air Quality Procedure (12/8) Screen/Electric**

**Sunday (6/25) 10:30 am – 12:00 pm Bixby 2 (R-2)**

### **TRG9 Cold Climate Building Design Guide (20/0) Screen/Electric**

**Wednesday (6/28) 9:00 am – 11:00 am Pacific (H-1)**

TRG9 Cold Climate Building Design Guide 2018 Working  
Session (12/0)

Monday (6/26) 8:00 am – 12:00 pm Harbor C (H-1)

### **MTG.BIM – Building Information Modeling (20/0) Screen**

**Monday (6/26) 10:15 am – 12:00 pm Broadlind 2 (R-2)**

### **MTG.ET–Energy Targets (10/10)**

**Tuesday (6/27) 12:00 pm – 3:00 pm Harbor A (H-1)**

### **MTG.HCDG – Hot Climate Design Guide (20/0)**

**Sunday (6/25) 8:00 am – 9:00 am Pike 3 (R-1)**

**MTG.IAST – Impact of ASHRAE Standards and Technology on Energy Savings/Performance (15/10) Electric**

**Saturday (6/24) 1:00 pm – 2:30 pm Delker (R-3)**

**MTG.LowGWP – Lower Global Warming Potential Alternative Refrigerants (25/36) Screen**

**Sunday (6/25) 5:00 pm – 6:00 pm 203C (LBCC-2)**

**Wednesday (6/28) 10:00 am – 12:00 pm 204 (LBCC-2)**

MTG.LowGWP Research Subcommittee (20/20) Screen/  
Electric

Sunday (6/25) 12:00 pm – 2:00 pm 204 (LBCC-2)

MTG.LowGWP Codes & Standards (20/15) Screen/Electric

Tuesday (6/27) 1:00 pm – 3:30 pm 202C (LBCC-2)

**MTG.OBB – Occupant Behavior in Buildings (30/10) Screen**

**Monday (6/26) 8:00 am – 10:00 am Bixby 1 (R-2)**

**MTG.O&MEE – Operations and Maintenance Activities That Impact Energy Efficiency (25/10) Electric**

**Sunday (6/25) 7:30 am – 8:15 am Bixby 4/5 (R-2)**

**STANDARD PROJECT COMMITTEES (SPC)  
AND STANDING STANDARD PROJECT  
COMMITTEES (SSPC)**

**PC Chairs Training Breakfast (100/0) Screen**

**Sunday (6/25) 7:30 am – 9:00 am Regency DEF (H-4)**

**SSPC 15 Safety Standards for Refrigeration Systems (20/40) Screen/Electric**

**Sunday (6/25) 1:00 pm – 5:00 pm Seaside 1 (LBCC-SS)**

SSPC 15 Safety Standards for Refrigeration Systems Rewrite  
(20/40) Screen/Electric

Saturday (6/24) 1:00 pm – 4:00 pm Beacon B (H-4)

SSPC 15 Safety Standards for Refrigeration Systems Ad Hoc  
and Rewrite (20/40) Screen/Electric

Sunday (6/25) 9:00 am – 12:00 pm Seaside 1 (LBCC-SS)

SSPC 15 Subcommittee 15.2 Safety Standard for  
Refrigeration Systems in Residential Applications (15/15)  
Screen/Electric

Tuesday (6/27) 8:00 am – 12:00 pm Bixby 2 (R-2)

**SPC 20 Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers (6/4) Screen/Electric**

**Sunday (6/25) 12:00 pm – 2:00 pm Seaside 5A (LBCC-SS)**

**SPC 24 Methods of Testing for Rating Liquid Coolers (6/10) Screen/Electric**

**Tuesday (6/27) 8:00 am – 12:00 pm Dawson (R-3)**

**SPC 25 Methods of Testing Forced-Circulation Free-Delivery Unit Coolers for Refrigeration (5/3)**

**Monday (6/26) 7:30 pm – 9:30 pm Alford (R-2)**

**SPC 26 Mechanical Refrigeration & Air-Conditioning Installation Aboard Ship (4/4) Screen /Electric**

Tuesday (6/27) 8:00 am – 12:00 pm Seaside 4B (LBCC-SS)

**SPC 28 MOT Flow Capacity of Refrigerant Capillary Tubes (5/5) Electric**

Sunday (6/25) 5:00 pm – 7:00 pm Seaside 3A (LBCC-SS)

**SPC 30 Method of Testing Liquid-Chilling Packages (7/5) Screen/Electric**

Monday (6/26) 8:00 am – 11:00 am Seaside 4A (LBCC-SS)

**SPC 32.2 MOT for Rating Pre-Mix and Post-Mix Beverage Dispensing Equipment (5/3) Screen**

Tuesday (6/27) 8:00 am – 12:00 pm Seaside 5B (LBCC-SS)

**SSPC 34 Designation and Safety Classification of Refrigerants (18/55) Screen /Electric**

Monday (6/26) 6:30 pm – 10:00 pm Pike 3 (R-1)

SSPC 34 Designation and Nomenclature Subcommittee (13/45) Screen/Electric

Saturday (6/24) 7:00 am – 10:00 am 201A (LBCC-2)

SSPC 34 Flammability Subcommittee (15/51) Screen/Electric

Saturday (6/24) 10:00 am – 3:00 pm 201A (LBCC-2)

SSPC 34 Toxicity Subcommittee (10/26) Screen/Electric

Sunday (6/25) 6:30 pm – 10:00 pm Bixby 1 (R-2)

**SPC 37 MOT for Rating Electrically Driven Unitary Air-Conditioners and Heat Pump Equipment (20/30) Screen/Electric**

Wednesday (6/28) 10:00 am – 12:00 pm 202C (LBCC-2)

**SSPC 41 Standard Methods for Measurement (18/10) Electric**

Sunday (6/25) 1:00 pm – 3:00 pm Broadlind 2 (R-2)

41.3 Subcommittee, Standard Methods for Pressure Measurement (10/5) Screen/Electric

Sunday (6/25) 10:00 am – 12:00 pm Broadlind 2 (R-2)

SSPC 41 Uncertainty Ad Hoc Committee (18/10) Electric

Sunday (6/25) 3:00 pm – 4:00 pm Broadlind 2 (R-2)

41.6 Subcommittee, Standard Methods for Humidity Measurement (10/5) Screen/Electric

Monday (6/26) 10:00 am – 12:00 pm Alford (R-2)

41.11 Subcommittee, Standard Methods for Power Measurement (10/5) Screen/Electric

Monday (6/26) 2:15 pm – 4:15 pm Alford (R-2)

41.4 Subcommittee, Standard Methods for Proportion of Lubricant in Liquid Refrigerant Measurement (10/5) Screen/Electric

Monday (6/26) 4:15 pm – 6:15 pm Alford (R-2)

41.10 Subcommittee, Standard Methods for Refrigerant Mass Flow Measurement Using Flowmeters (10/5) Screen/Electric

Tuesday (6/27) 8:00 am – 10:00 am Alford (R-2)

41.1 Subcommittee, Standard Methods for Temperature Measurement (10/5) Screen/Electric

Tuesday (6/27) 10:00 am – 12:00 pm Alford (R-2)

**SSPC 52.2 Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size (16/45) Screen/Electric**

**Saturday (6/24) 8:00 am – 12:00 pm Broadlind 1 (R-2)**

**SSPC 55 Thermal Env. Cond. for Human Occupancy (15/5) Screen/Electric**

**Saturday (6/24) 8:00 am – 3:00 pm Tichenor (R-2)**

**Sunday (6/25) 9:00 am – 12:00 pm Seaside 7 (LBCC-SS)**

**SSPC 62.1 Ventilation for Acceptable Indoor Air Quality (30/30) Screen/Electric**

**Saturday (6/24) 8:00 am – 12:00 pm Pike 3 (R-1)**

**Sunday (6/25) 1:00 pm – 7:00 pm Pike 3 (R-1)**

SSPC 62.1 IAQ Guideline Subcommittee (15/15)  
Screen/Electric

Friday (6/23) 8:00 am – 12:00 pm Pike 2 (R-1)

SSPC 62.1 Administration Subcommittee (15/15)

Screen/Electric

Friday (6/23) 1:00 pm – 3:00 pm Pike 1 (R-1)

Saturday (6/24) 1:00 pm – 3:00 pm Alford (R-2)

SSPC 62.1 Research and Education Subcommittee (15/15)

Screen/Electric

Friday (6/23) 1:00 pm – 3:00 pm Pike 2 (R-1)

Saturday (6/24) 1:00 pm – 3:00 pm Broadlind 2 (R-2)

SSPC 62.1 Buildings, Systems and Equipment (15/15)

Screen/Electric

Friday (6/23) 3:00 pm – 5:00 pm Pike 1 (R-1)

Saturday (6/24) 1:00 pm – 3:00 pm Pike 3 (R-1)

SSPC 62.1 Ventilation Subcommittee (15/15) Screen/Electric

Friday (6/23) 3:00 pm – 5:00 pm Pike 2 (R-1)

Saturday (6/24) 1:00 pm – 3:00 pm Nieto (R-2)

SSPC 62.1 Natural Ventilation Working Group (15/30)

Screen/Electric

Monday (6/26) 8:00 am – 12:00 pm Pike 2 (R-1)

**SSPC 62.2 Ventilation and Acceptable IAQ in Residential Buildings (30/20) Screen/Electric**

**Friday (6/23) 9:00 am – 2:30 pm Pike 3 (R-1)**

**Saturday (6/24) 8:00 am – 3:00 pm Pike 1 (R-1)**

SSPC 62.2 Envelope Subcommittee (20/20) Screen/Electric

Friday (6/23) 2:30 pm – 5:00 pm Pike 3 (R-1)

SSPC 62.2 IAQ Subcommittee (12/20) Screen/Electric

Friday (6/23) 2:30 pm – 5:00 pm Bixby 1 (R-2)

SSPC 62.2 System Subcommittee (12/20) Screen/Electric

Friday (6/23) 2:30 pm – 5:00 pm Nieto (R-2)

**SPC 63.1 Method of Testing Liquid-Line Refrigerant Driers (5/6)**

**Sunday (6/25) 6:00 pm – 8:00 pm Harbor C (H-1)**

**SPC 63.2 Method of Testing Liquid-Line Filter Drier Filtration Capability (9/3) Screen/Electric**

**Sunday (6/25) 2:00 pm – 3:00 pm Harbor C (H-1)**



**SPC 64 Methods of Lab Testing Remote Mechanical Draft Evaporative Refrigerant Condensers (6/5)**

Monday (6/26) 10:00 am – 11:00 am Suite 334 (R-3)

**SPC 70 Method of Testing for Rating the Performance of Air Outlets and Air Inlets (15/10) Screen/Electric**

Monday (6/26) 10:00 am – 12:00 pm Shoreline B (H-1)

**SSPC 72 Method of Testing Open and Closed Commercial Refrigerators and Freezers (16/14) Electric**

Sunday (6/25) 1:00 pm – 5:00 pm Shoreline A (H-1)

**SPC 78 Method of Testing Flow Capacity of Suction Line Filters and Filter-Driers (6/6)**

Sunday (6/25) 3:00 pm – 4:00 pm Harbor C (H-1)

**SPC 84 Method of Testing Air-to-Air Heat/Energy Exchangers (8/12) Screen/Electric**

Monday (6/26) 4:15 pm – 6:30 pm Seaside Ballroom B (LBCC-SS)

**SSPC 90.1 Energy Eff. Design of New Bldg. (50/60) Screen/Electric**

Saturday (6/24) 8:00 am–12:00 pm Bixby 4/5 (R-2)

Sunday (6/25) 9:00 am–12:00 pm Bixby 4/5 (R-2)

Monday (6/26) 8:00 am–12:00 pm Bixby 4/5 (R-2)

**SSPC 90.1 Envelope Subcommittee (15/30) Screen/Electric**

Friday (6/23) 9:00 am – 10:00 pm Bixby 3 (R-2)

Saturday (6/24) 1:00 pm – 8:00 pm Bixby 2 (R-2)

Sunday (6/25) 1:00 pm – 8:00 pm Bixby 3 (R-2)

**SSPC 90.1 Envelope Subcommittee Working Group (15/30) Screen /Electric**

Friday (6/23) 4:00 pm – 6:00 pm Broadlind 2 (R-2)

Saturday (6/24) 4:00 pm – 6:00 pm Bixby 3 (R-2)

**SSPC 90.1 Lighting Subcommittee (12/10) Screen/Electric**

Friday (6/23) 9:00 am – 10:00 pm Broadlind 1 (R-2)

Saturday (6/24) 1:00 pm – 7:00 pm Broadlind 1 (R-2)

Sunday (6/25) 1:00 pm – 8:00 pm Broadlind 1 (R-2)

**SSPC 90.1 Mechanical Subcommittee (25/25) Screen/Electric**

Friday (6/23) 9:00 am – 10:00 pm Bixby 2 (R-2)

Saturday (6/24) 1:00 pm – 7:00 pm Bixby 4/5 (R-2)

Sunday (6/25) 1:00 pm – 8:00 pm Bixby 4/5 (R-2)

**SSPC 90.1 ECB Subcommittee (12/18) Screen/Electric**

Friday (6/23) 3:00 pm – 8:00 pm Wilmore (R-2)

Saturday (6/24) 1:00 pm – 5:00 pm Wilmore (R-2)

Sunday (6/25) 1:00 pm – 4:00 pm Wilmore (R-2)

**SSPC 90.1 Format & Compliance Subcommittee (6/6) Electric**

Friday (6/23) 5:00 pm – 10:00 pm Tichenor (R-2)

Saturday (6/24) 1:00 pm – 5:00 pm Ebell (R-3)

Sunday (6/25) 4:00 pm – 7:00 pm Wilmore (R-2)

**SSPC 90.2 Energy-Efficient Design of Low-Rise Residential Buildings (20/15) Screen/Electric**

Monday (6/26) 2:15 pm – 6:15 pm Bixby 2 (R-2)

Tuesday (6/27) 1:00 pm – 5:00 pm Broadlind 1 (R-2)

**SSPC 90.2 Envelope (10/10) Screen/Electric**

Monday (6/26) 6:30 pm – 9:30 pm Bixby 2 (R-2)  
Tuesday (6/27) 8:00 am – 12:00 pm Broadlind 1 (R-2)

**SSPC 90.2 Lighting (3/5) Electric**

Monday (6/26) 6:30 pm – 9:30 pm Tichenor (R-2)  
Tuesday (6/27) 8:00 am – 12:00 pm Tichenor (R-2)

**SSPC 90.2 Mechanical (5/10) Screen/Electric**

Monday (6/26) 6:30 pm – 9:30 pm Nieto (R-2)  
Tuesday (6/27) 8:00 am – 12:00 pm Nieto (R-2)

**SPC 90.4 Energy Standard for Data Centers and Telecommunications Buildings (17/20) Screen**

Saturday (6/24) 9:00 am – 1:00 pm Bixby 2 (R-2)  
Monday (6/26) 7:30 am – 11:30 am Dawson (R-3)

**SPC 97 Sealed Glass Tube Method to Test the Chemical Stability of Materials for Use Within Refrigerant Systems (8/4) Screen/Electric**

Tuesday (6/27) 9:30 am – 11:00 am Seaside 2 (LBCC-SS)

**SSPC 100 Energy Efficiency in Existing Buildings (20/10) Screen/Electric**

Tuesday (6/27) 8:00 am – 12:00 pm 204 (LBCC-2)  
SSPC 100 Alternative to EUI (WG5) (16/10) Screen/Electric  
Sunday (6/25) 12:00 pm – 2:00 pm Seaside 6 (LBCC-SS)  
SSPC 100 International Target Table and Climate Zones (WG4) (4/5) Screen/Electric  
Sunday (6/25) 4:00 pm – 6:00 pm Seaside 6 (LBCC-SS)

**SPC 111 Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation and Air-Conditioning Systems (12) (7/5) Screen/Electric**

Tuesday (6/27) 8:00 am – 12:00 pm Regency D (H-4)

**SPC 113 Method of Testing for Room Air Diffusion (10/10) Screen/Electric**

Tuesday (6/27) 3:30 pm – 5:00 pm Seaside 6 (LBCC-SS)

**SPC 118.1 Method of Testing for Rating Commercial Gas, Electric and Oil Service Water Heating Equipment (15/20) Screen/Electric**

Sunday (6/25) 9:00 am – 11:00 am Seaside 4B (LBCC-SS)

**SPC 118.2 Method of Testing for Rating Residential Water Heaters (15/15)**

Tuesday (6/27) 1:00 pm – 5:00 pm Seaside 5B (LBCC-SS)

**SPC 124 MOT/Rating Combinations Space-Heating and Water Heating Appliances (13/7) Electric**

Tuesday (6/27) 9:00 am – 12:00 pm Delker (R-3)

**SPC 127 Method of Testing for Rating Air Conditioning Units Serving Data Center (DC) and Other Information Technology Equipment (ITE) Spaces (12/12) Screen/Electric**

Tuesday (6/27) 8:00 am – 12:00 pm Seaside 5A (LBCC-SS)

**SPC 128 Method of Rating Portable Air Conditioners (10/0)**

Tuesday (6/27) 11:00 am – 12:00 pm Seaside 2 (LBCC-SS)

**SPC 130 MOT/for Rating Ducted Air Terminal Units (15/20)**

Sunday (6/25) 2:00 pm – 6:00 pm Pacific (H-1)

**SSPC 135 BACnet (40/10) Electric**

Friday (6/23) 8:00 am – 5:00 pm Delker (R-3)

Saturday (6/24) 8:00 am – 3:30 pm Pike 2 (R-1)

Monday (6/26) 8:00 am – 12:00 pm Pike 3 (R-1)

**SSPC 135 BACnet Working Groups (20/5) Electric**

Thursday (6/22) 8:00 am – 5:00 pm Dawson (R-3)

Friday (6/23) 8:00 am – 5:00 pm Dawson (R-3)

Sunday (6/25) 8:00 am – 5:00 pm Dawson (R-3)

Sunday (6/25) 8:00 am – 5:00 pm Delker (R-3)

**SSPC 140 Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs (15/12) Screen/Electric**

Monday (6/26) 2:15 pm – 6:15 pm Delker (R-3)

**SSPC 145 Test Method for Assessing the Performance of Gas Phase Air Cleaning Equipment (10/15) Screen/Electric**

Sunday (6/25) 12:00 pm – 3:00 pm Bixby 2 (R-2)

**SSPC 146 Method of Testing and Rating Pool Heaters (7/5) Electric**

Tuesday (6/27) 8:00 am – 12:00 pm Suite 332 (R-3)

**SSPC 147 Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Systems (5/5) Screen/Electric**

Tuesday (6/27) 8:00 am – 12:00 pm Broadlind 2 (R-2)

**SPC 150-2000: Method of Testing for Performance of Cool Storage Systems (8/2) Electric**

Sunday (6/25) 5:00 pm – 6:00 pm Dawson (R-3)

**SSPC 154 Ventilation for Commercial Cooking Operations (15/10) Screen/Electric**

Sunday (6/25) 8:00 am – 12:00 pm Seaside 5A (LBCC-SS)

**SPC 155P Method of Testing for Rating Commercial Space Heating Boiler Systems (10/8) Screen/Electric**

Sunday (6/25) 8:00 am – 12:00 pm Seaside 3A (LBCC-SS)

**SPC 158.1 MOT Capacity of Refrigerant Solenoid Valves (5/5) Electric**

Sunday (6/25) 5:00 pm – 7:00 pm Seaside 3A (LBCC-SS)

**SPC 158.2 MOT Capacity of Refrigerant Pressure Regulators (7/5) Electric**

Sunday (6/25) 5:00 pm – 7:00 pm Seaside 3A (LBCC-SS)

**SSPC 160 Criteria for Moisture Control Design Analysis in Buildings (20/5) Screen/Electric**

Tuesday (6/27) 8:00 am – 12:00 pm Wilmore (R-2)

**SSPC 161P Air Quality Within Commercial Aircraft**

*Met prior to Long Beach Conference via web meeting  
(June 19, 11:30-2:30 p.m. ET)*

**SPC 164 MOT for Humidifiers (6/4) Screen/Electric**

Monday (6/26) 9:00 am – 11:00 am Seaside 2 (LBCC-SS)

**SSPC 169 Climatic Data for Building Design Standards (10/5) Screen**

Monday (6/26) 10:00 am – 12:00 pm Broadlind 1 (R-2)

**SSPC 170 Ventilation of Healthcare Facilities (18/30) Screen/Electric**

Monday (6/26) 4:00 pm – 6:00 pm Pike 1 (R-1)

Tuesday (6/27) 8:00 am – 1:00 pm Pike 1 (R-1)

SSPC 170 Ventilation of Health Care Facilities, Natural Ventilation Work Group (15/0) Screen/Electric

Monday (6/26) 2:00 pm – 4:00 pm Pike 1 (R-1)

**SPC 174P Method of Test for Rating Desiccant Based Dehumidification Equipment (5/2)**

Monday (6/26) 10:00 am – 12:00 pm Seaside 5A (LBCC-SS)

**SPC 180 Standard Practice for Inspection and Maintenance of HVAC Systems (20/10) Screen /Electric**

Friday (6/23) 2:00 pm – 6:00 pm Bixby 5 (R-2)

**SPC 182 Method of Test for Absorption Chillers (5/5) Electric**

Monday (6/26) 11:00 am – 12:00 pm Suite 334 (R-3)

**SPC 184 Method of Test for Field Performance of Liquid-Chilling Systems (10/6) Screen**

Tuesday (6/27) 8:00 am – 10:00 am Seaside 3B (LBCC-SS)

**SSPC 185 Methods of Test to Inactivate Micro-organisms in HVAC Systems with UV-C Lights (6/6)**

Saturday (6/24) 8:00 am – 9:00 am Ebell (R-3)

**SPC 188 Legionellosis: Risk Management for Building Water Systems (50/15) Screen/Electric**

Tuesday (6/27) 8:00 am – 12:00 pm Bixby 5 (R-2)

Tuesday (6/27) 3:30 pm – 5:30 pm Bixby 5 (R-2)

Wednesday (6/28) 8:00 am – 12:00 pm 102C (LBCC-1)

**SSPC 189.1 ASHRAE/USGBC/IES Standard for the Design of High-Performance Green Buildings except Low-Rise Residential Buildings (45/50) Screen/Electric**

Tuesday (6/27) 8:00 am – 10:00 am Pike 3 (R-1)

Wednesday (6/28) 8:00 am – 12:00 pm Pike 3 (R-1)

SSPC 189.1 Working Group 6 (Water Use) (20/20) Screen/Electric

Tuesday (6/27) 10:00 am – 12:30 pm Pike 2 (R-1)

SSPC 189.1 Working Group 7 (Energy Efficiency) (30/30)  
Screen/Electric

Tuesday (6/27) 10:00 am – 1:00 pm Pike 3 (R-1)

SSPC 189.1 Working Group 9 (Materials and Resources)  
(20/20) Screen/Electric

Tuesday (6/27) 1:00 pm – 3:00 pm Pike 2 (R-1)

SSPC 189.1 Working Group 8 (IEQ) (30/30) Screen/Electric

Tuesday (6/27) 1:00 pm – 4:00 pm Pike 1 (R-1)

SSPC 189.1 Working Group 7.5 (30/30) Screen/Electric

Tuesday (6/27) 1:30 pm – 4:30 pm Pike 3 (R-1)

SSPC 189.1 Working Group 5 (Site Sustainability) (20/20)  
Screen/Electric

Tuesday (6/27) 4:00 pm – 6:00 pm Pike 1 (R-1)

SSPC 189.1 Working Group 10 (20/20) Screen /Electric

Tuesday (6/27) 5:00 pm – 7:00 pm Pike 2 (R-1)

### **SPC 189.3P Design, Construction and Operation of Sustainable High Performance Health Care Facilities (18/12)Screen/Electric**

Monday (6/26) 8:00 am – 12:00 pm Seaside 7 (LBCC-SS)

### **SPC 191 Standard for the Efficient Use of Water in Building and Mechanical Systems (12/6)Screen/Electric**

Tuesday (6/27) 10:00 am – 12:00 pm Bixby 1 (R-2)

### **SPC 194 MOT/Direct-Expansion Ground Source Heat Pumps (5/10)**

Sunday (6/25) 1:00 pm–3:00 pm Seaside 3A (LBCC-SS)

### **SPC 195 Method of Test for Rating Air Terminal Unit Controls (8/4) Electric**

Tuesday (6/27) 10:00 am – 12:00 pm Seaside 6 (LBCC-SS)

### **SPC 196 Method of Test for Measuring Refrigerant Leak Rates (10/10) Screen/Electric**

Sunday (6/25) 6:00 pm – 10:00 pm Pike 1 (R-1)

### **SPC 198 Method of Test for Rating DX-Dedicated Outdoor Air Systems for Moisture Removal Capacity and Moisture Removal Efficiency (16/10)**

Tuesday (6/27) 5:00 pm – 6:00 pm Regency D (H-4)

### **SPC 199P Method of Testing the Performance of Industrial Pulse Cleaned Dust Collectors (10/10)**

Sunday (6/25) 8:00 am – 12:00 pm Seaside 3B (LBCC-SS)

### **SPC 200 MOT Chilled Beams (15/10) Electric**

Monday (6/26) 8:00 am – 10:00 am Broadlind 2 (R-2)

### **SSPC 202 Commissioning Process for Buildings and Systems (15/15) Screen/Electric**

Monday (6/26) 8:00 am – 12:00 pm Bixby 2 (R-2)

SSPC 202 Guideline 0 subcommittee, The Commissioning Process (15/10) Screen/Electric

Saturday (6/24) 10:00 am – 11:30 am 203AB (LBCC-2)

SSPC 202 Guideline 1.1 subcommittee, The HVAC Commissioning Process (12/6) Screen/Electric

Saturday (6/24) 12:00 pm – 1:30 pm 203AB (LBCC-2)

SSPC 202 Standard 202 subcommittee, The Commissioning Process for Buildings and Systems (15/10) Screen/Electric  
Saturday (6/24) 1:30 pm – 3:00 pm 203AB (LBCC-2)  
SSPC 202 GPC 1.4 subcommittee meeting, Systems Manual (10/6) Screen/Electric  
Sunday (6/25) 10:00 am – 12:00 pm Seaside 5B (LBCC-SS)

**SPC 204 Method of Test for Rating Micro Combined Heat and Power Devices (15/10) Electric**

**Monday (6/26) 6:30 pm – 9:30 pm Seaside 5A (LBCC-SS)**

**SPC 205 Standard Representation of Performance Simulation Data for HVAC&R and Other Facility Equipment (20/20) Screen /Electric**

**Tuesday (6/27) 8:00 am – 12:00 pm Bixby 4 (R-2)**  
SPC 205 Standard Representation of Performance Simulation Data for HVAC&R and Other Facility Equipment -- Working Groups (20/10) Screen/Electric  
Sunday (6/25) 9:00 am – 12:00 pm Nieto (R-2)

**SPC 207P Laboratory Method of Test of Fault Detection and Diagnostics Applied Commercial Air-Cooled Packaged Systems (20/30) Screen**

**Monday (6/26) 8:00 am – 10:00 am 204 (LBCC-2)**  
SPC 207 Scope, Usability, and Verification (20/0) Screen  
Monday (6/26) 10:00 am – 12:00 pm 204 (LBCC-2)  
SPC 207 Draft Development (20/0) Screen  
Monday (6/26) 4:30 pm – 6:30 pm 204 (LBCC-2)  
SPC 207 Refrigeration and Airflow (20/0) Screen  
Monday (6/26) 6:30 pm – 8:30 pm 204 (LBCC-2)

**SPC 210 Method of Testing for Rating Commercial Walk-in Cooler and Freezer Equipment (15/15) Screen/ Electric**

**Monday (6/26) 8:00 am – 12:00 pm Seaside 3A (LBCC-SS)**

**SPC 211 Commercial Building Energy Audits (19/15) Screen/Electric**

**Monday (6/26) 8:00 am – 12:00 pm Seaside 4B (LBCC-SS)**

**SPC 212 MOT/for Determining Energy Performance and Water-Use Efficiency of Add-On Evaporative Pre-Coolers for Unitary Air Conditioning Equipment (7/4) Screen/Electric**

**Tuesday (6/27) 1:00 pm – 5:00 pm Seaside 4A (LBCC-SS)**

**SPC 213P Method of Calculating Moist Air Thermodynamics (8/5)**

**Tuesday (6/27) 8:00 am – 12:00 pm Ebell (R-3)**

**SPC 215P Method of Test to Determine Leakage of Operating HVAC Air-Distribution Systems (15/15) Screen /Electric**

**Monday (6/26) 2:15 pm – 6:15 pm Seaside 5A (LBCC-SS)**

**SPC 216 MOT for Determining Application Data of Overhead Circulator Fans (12/12) Screen/Electric**

**Monday (6/26) 2:15 pm – 5:15 pm Suite 334 (R-3)**

**SPC 217 Non-Emergency Ventilation in Enclosed Road, Rail and Mass Transit Facilities (12/5) Screen/Electric**

Tuesday (6/27) 7:30 am – 12:00 pm Seaside 3A (LBCC-SS)

**SPC 218P–MOT for Lubricant and Refrigerant Miscibility Determination (9/4) Screen/Electric**

Monday (6/26) 8:00 am – 10:00 am Suite 334 (R-3)

**SPC 219 Method of Testing the Ability of Liquid Line Filter Driers or Absorbents to Remove Organic Acid (5/3) Screen/Electric**

Wednesday (6/28) 8:00 am – 12:00 pm 103C (LBCC-1)

**SPC 220 Method of Testing for Rating Small Commercial Blast Chillers, Blast Chiller-Freezers, and Blast Freezers (12/10) Electric**

Monday (6/26) 5:00 pm – 6:30 pm Seaside 4A (LBCC-SS)

**SPC 221 Test Method to Measure and Score the Operating Performance of an Installed Constant Volume Unitary HVAC System (12/10) Screen/Electric**

Monday (6/26) 8:00 am – 12:00 pm Pike 1 (R-1)

**SPC 222P Standard Method of Test for Electrical Power Drive Systems (5/5) Screen/Electric**

Sunday (6/25) 8:00 am – 12:00 pm Seaside 6 (LBCC-SS)

**GUIDELINE PROJECT COMMITTEE (GPC),  
(SPC) AND (SGPC)**

**GPC 1.2 The Commissioning Process for Existing HVAC&R Systems (18/10) Screen/Electric**

Friday (6/23) 8:00 am – 12:00 pm Nieto (R-2)

**GPC 1.3 Building Operation and Maintenance Training for the HVAC&R Commissioning Process (8/2) Electric**

Tuesday (6/27) 1:00 pm – 5:00 pm Seaside 2 (LBCC-SS)

**GPC 4-2008R Preparation of Operating and Maintenance Documentation for HVAC&R Systems (6/2)**

Sunday (6/25) 8:00 am – 12:00 pm Seaside 2 (LBCC-SS)

**GPC 11 Field Testing of HVAC Controls Components (8/4) Screen/Electric**

Saturday (6/24) 9:00 am – 12:00 pm Alford (R-2)

**GPC 14 Measurement of Energy, Demand and Water Savings (6/6) Electric**

Sunday (6/25) 6:00 pm – 10:00 pm Dawson (R-3)

**GPC 21 Guideline for the Ventilation and Thermal Management of Batteries for Stationary Applications (5/5)**

Tuesday (6/27) 10:00 am – 12:00 pm Seaside 3B (LBCC-SS)

**GPC 22 Instrumentation for Monitoring Central Chilled Water Plants (5/3)**

Tuesday (6/27) 10:00 am – 12:00 pm Suite 334 (R-3)

**GPC 27P Measurement Procedures for Gaseous Contaminants in Indoor Environments (7/4) Electric**

Sunday (6/25) 3:00 pm – 5:00 pm 201B (LBCC-2)

**GPC 29 Guideline for Risk Management (8/2)**

Sunday (6/25) 1:00 pm – 3:00 pm Seaside 2 (LBCC-SS)

**GPC 32 Sustainable, High Performance Operations & Maintenance (7/2) Electric**

Saturday (6/24) 12:00 pm – 2:00 pm Suite 334 (R-3)

**GPC 35 Method for Determining the Energy Consumption Caused By Air-Cleaning and Filtration Devices (12/40) Screen/Electric**

Monday (6/26) 8:00 am – 12:00 pm Bixby 3 (R-2)

**GPC 36P High Performance Sequences of Operation for HVAC Systems (20/25) Screen/Electric**

Monday (6/26) 8:00 am – 12:00 PM Seaside 1 (LBCC-SS)

**GPC 37 Upper Room Ultraviolet Germicidal (UV-C) Devices to Control the Transmission of Airborne Pathogens (6/6)**

Saturday (6/24) 9:00 am – 12:00 pm Suite Ebell (R-3)

**GPC 38 Guideline for Using Pressure Metal Vessels to Test Materials Used in Refrigeration Systems (7/5)**

Monday (6/26) 4:15 pm – 6:15 pm Harbor A (H-1)

**GPC 41 Design, Installation and Commissioning of Variable Refrigerant Flow Systems (24/8) Electric**

Tuesday (6/27) 8:00 am–12 :00 pm Seaside 1 (LBCC-SS)

**SGPC 10 Interaction Affecting the Achievement of Acceptable Indoor Environments (10/10) Electric**

Sunday (6/25) 9:00 am – 12:00 pm 204 (LBCC-2)

**SGPC 13 Specifying Building Automation Systems (10/15) Screen/Electric**

Saturday (6/24) 8:00 am–12:00 pm Delker (R-3)

**US TAG to ISO/TC 86 (20/10) Screen/Electric**

Monday (6/26) 8:00 am – 10:00 am Nieto (R-2)

**US TAG to ISO/TC 142 Cleaning Equipment for Air and other Gases (30/30) Screen/Electric**

Saturday (6/24) 2:30 pm – 3:15 pm 202C (LBCC-2)

ISO/TC 142 WG 1 (10/5) Screen/Electric

Tuesday (6/27) 8:00 am – 10:00 am Seaside 6 (LBCC-SS)

**US TAG to ISO/TC 163 Thermal Performance and Energy in a Building Environment (18/11) Screen/Electric**

Tuesday (6/27) 3:00 pm – 4:30 pm Dawson (R-3)

JWG ISO/TC 163/WG4 and ISO/TC 205 (18/11) Screen/  
Electric

Tuesday (6/27) 2:30 pm – 3:00 pm Dawson (R-3)



**US Tag to ISO/TC 205 (22/12) Screen/Electric**

**Tuesday (6/27) 1:00 pm – 2:30 pm Dawson (R-3)**

**ISO 817 MA (23/11) Screen/Electric**

**Tuesday (6/27) 8:00 am – 12:00 pm Bixby 3 (R-2)**

**ISO 817 MA-Flammability (15/10) Screen/Electric**

**Monday (6/26) 8:00 am – 9:00 am Broadlind 1 (R-2)**

**ISO 817 MA-Toxicity (15/10) Screen/Electric**

**Monday (6/26) 8:00 am – 10:00 am Alford (R-2)**

**ISO 817 MA – Design and Nomenclature (15/10) Screen/  
Electric**

**Monday (6/26) 9:00 am – 10:00 am Broadlind 1 (R-2)**

**ISO 17584 (15/10) Screen**

**Wednesday (6/28) 7:00 am – 9:00 am 202C (LBCC-2)**

**OTHER**

**gbXML (10/0)**

**Monday (6/26) 2:00 pm – 3:00 pm Harbor C (H-1)**

**USNC/IIR (20/20)**

**Tuesday (6/27) 2:00 pm – 4:00 pm Shoreline A (H-1)**

**USNT/IEA (20/10)**

**Tuesday (6/27) 4:00 pm – 6:00 pm Shoreline A (H-1)**