

# Your Guide to the ASHRAE Winter Conference

January 23-27, 2010



## Included Inside:

- Complete technical program
- Social events schedule
- All educational courses
- Maps of meeting areas

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**2010 ASHRAE WINTER CONFERENCE  
ORLANDO, FLORIDA  
JANUARY 23–27, 2010**



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*First-time meeting attendees, see Seminar 18 description on page 33.*

*\*Designated with colored tabs on the edge of the program.*

**Personal Program**—Plan your own meeting schedule!

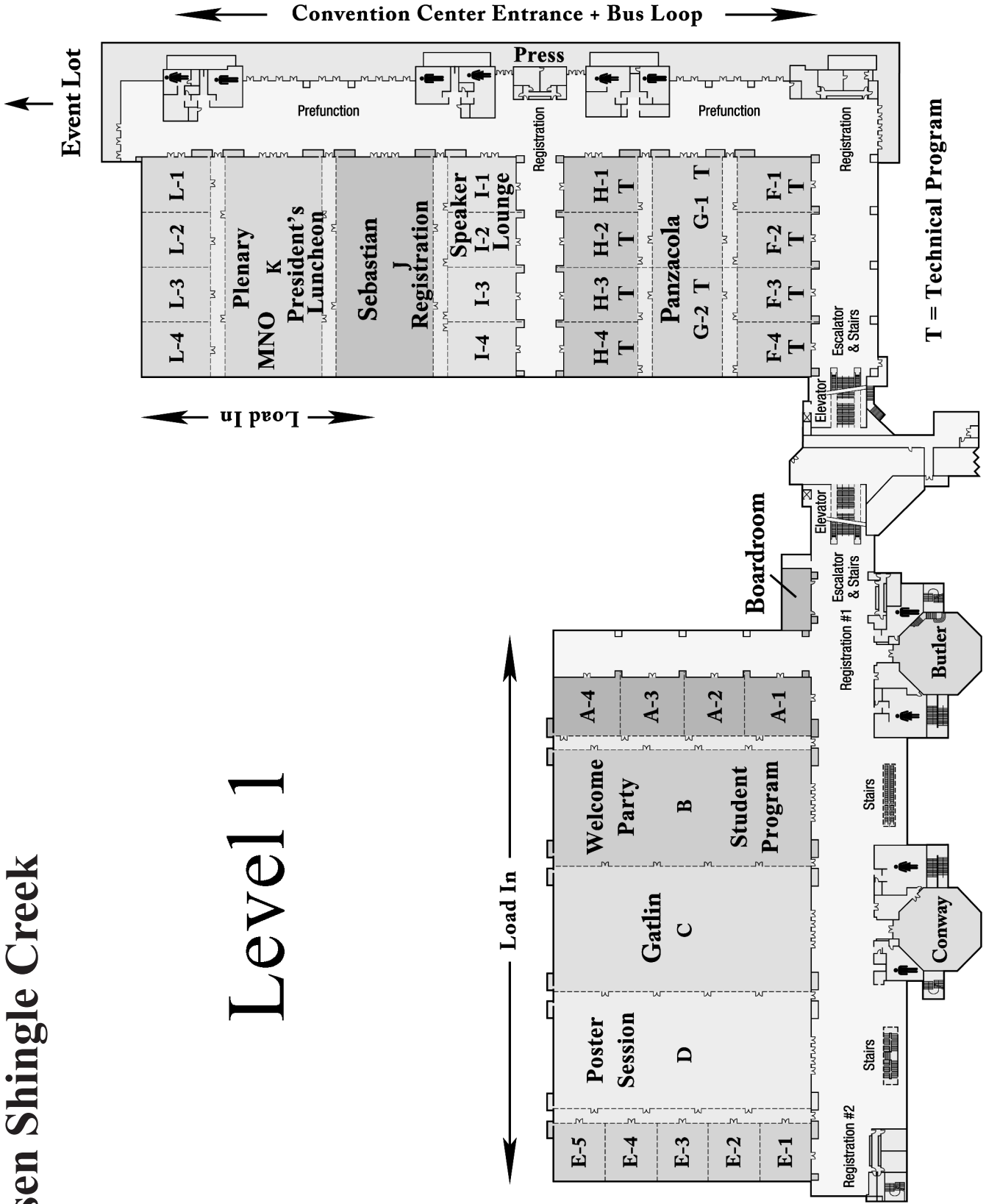
FRIDAY, JANUARY 22	SATURDAY, JANUARY 23	SUNDAY, JANUARY 24
8:00 am–9:30 am	7:30 am–9:00 am	8:00 am–9:30 am
9:45 am–11:00 pm	9:00 am–11:00 pm	9:45 am–10:45 am
11:00 am–12:30 pm	11:00 am–1:00 pm	11:00 am–12:30 pm
12:30 pm–2:00 pm	1:00 pm–3:00 pm	1:30 pm–3:00 pm
2:00 pm–3:30 pm	3:00 pm–5:00 pm	3:00 pm–5:00 pm
3:30 pm–5:00 pm	5:00 pm–8:30 pm	5:00 pm–7:00 pm

NOTES:

MONDAY, JANUARY 25	TUESDAY, JANUARY 26	WEDNESDAY, JANUARY 27
8:00 am–9:30 am	8:00 am–9:30 am	8:00 am–9:30 am
9:45 am–10:45 am	9:45 am–10:45 am	9:45 am–10:45 am
11:00 am–12:00 noon	11:00 am–12:30 pm	11:00 am–12:30 pm
2:00 pm–4:00 pm	1:00 pm–3:00 pm	
4:00 pm–6:00 pm	3:00 pm–5:00 pm	
6:00 pm–8:00 pm	5:00 pm–7:00 pm	

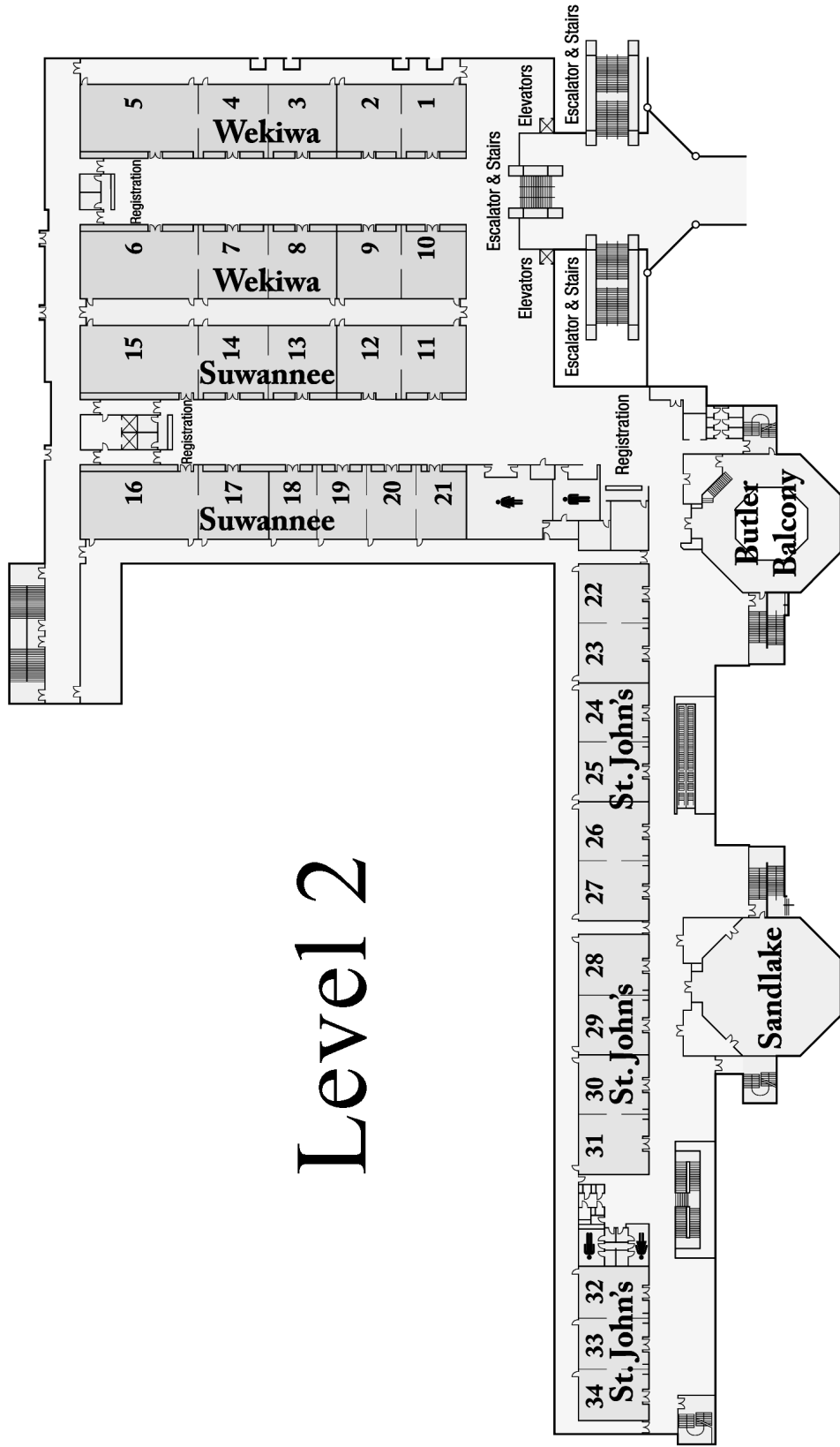
# Rosen Shingle Creek

## Level 1



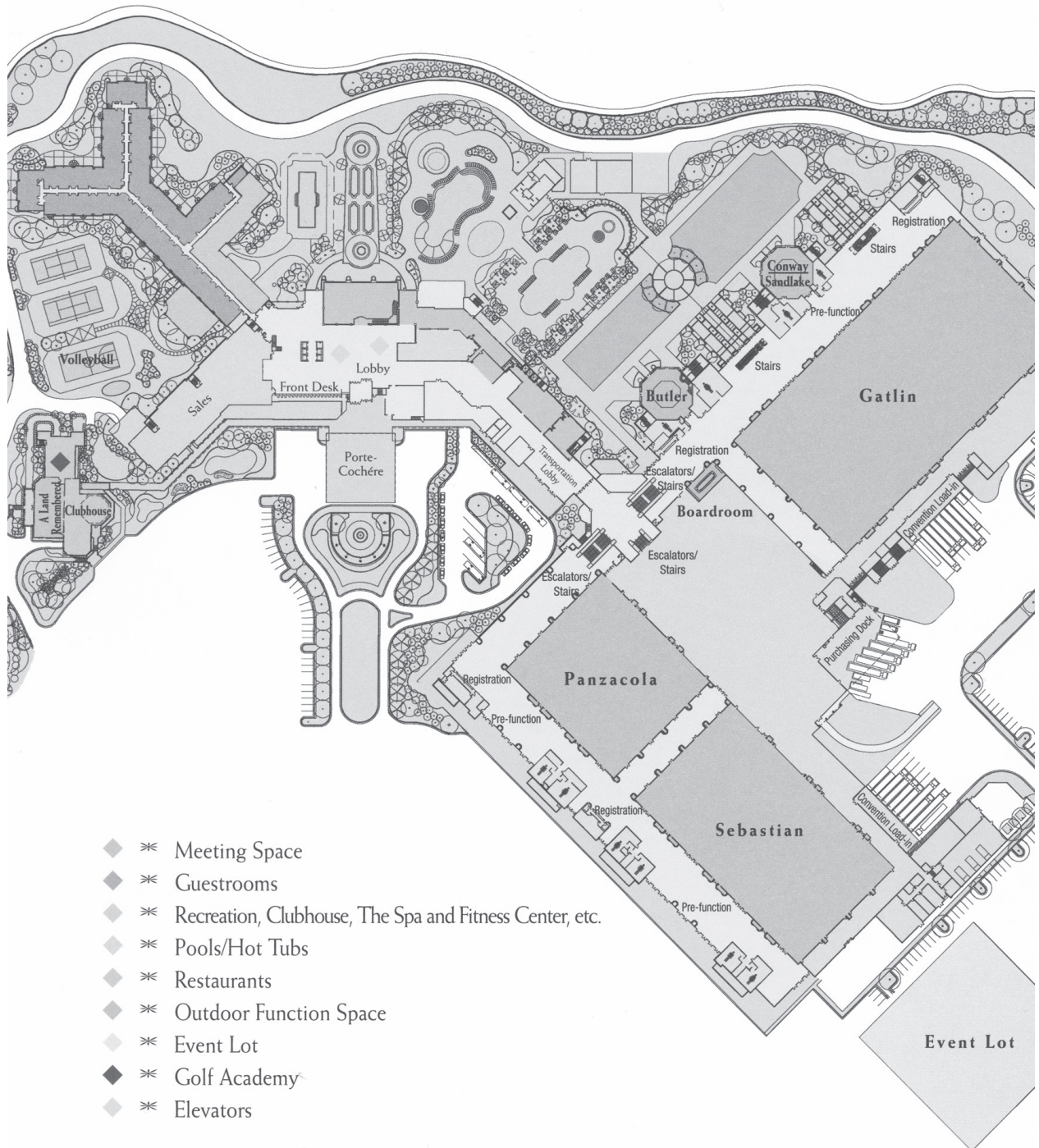
# Rosen Shingle Creek

## Level 2





# ROSEN SHINGLE CREEK





## CHAPTER AND SOCIETY OFFICIALS

*A special thanks to all the members in the Central Florida chapter who helped make the meeting a success!*

### Central Florida Chapter Officers

Richard B. King, *President*  
Jason Alphonso, *President-Elect*  
Leonardo Rocha, *Vice President*  
John C. Miller, *Treasurer*  
Megan Tosh, *Secretary*

### Orlando Host Committee

General Chair	William M. Dillard
Vice Chairman	Wade Conlan
Sessions	Megan Tosh, Chair Firouz Keikavousi, Co-Chair
Entertainment	Brian Mirus, Chair Kyle Davis, Co-Chair
Sessions	Wade Conlan, Chair John Elsea, Co-Chair
Tours	Todd Moore, Chair Jason Alphonso, Co-Chair
Information	Mike Dillard, Chair Wade Conlan, Co-Chair
Publicity	Anik Patel, Chair Tom Edwards, Co-Chair

### ASHRAE Officers

Gordon V.R. Holness, PE, *President*  
Lynn Bellenger, *President-Elect*  
Ronald Jarnagin, *Treasurer*  
William Bahnfleth, PhD, PE, *Vice President*  
James Fields, *Vice President*  
Sheila J. Hayter, PE, *Vice President*  
Thomas Watson, PE, *Vice President*  
Jeff H. Littleton, *Executive Vice President*

### Conferences and Expositions Committee

M. Ginger Scoggins, *Chair*  
William E. Dietrich, *Vice Chairman*  
Bryan R. Becker  
Donald L. Brandt  
Kelley P. Cramm  
Eckhard Achim Groll  
Matt Hargan  
Charles E. Henck  
Julia A. Keen  
William K. Klock  
Ben A. Leppard  
Dustan L. Macauley III  
Michael J. McDermott  
Keith C. Newcomer  
Robert B. Risley  
Larry Sun  
Monte G. Troutman  
Alan C. Veeck  
Dennis J. Wessel  
David L. Zimmerman  
A. Damon Gowan  
Kirk T. Mescher  
Richard B. Hayter

## CONFERENCE SPONSORS

*ASHRAE thanks the following sponsors for their support of the 2010 Winter Conference.*

# Autodesk®



## GENERAL INFORMATION

### BADGES MUST BE WORN FOR ADMISSION TO SESSIONS

Your ASHRAE Conference badge is required for admission to the technical program. Room monitors will be checking for badges at the rooms. The room monitors will also 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 transactions and poster sessions. Questions are given to the authors for reply and published in *ASHRAE Transactions*.

### HOTEL INFORMATION

Rosen Shingle Creek  
9939 Universal Boulevard  
Telephone: 407-996-9939  
Guest Fax: 407-996-9938

### MESSAGE CENTER

During the conference a Message Center will be in operation in Rosen Shingle Creek in the ASHRAE registration area. Hours will be 8:00 a.m.–5:00 p.m. Saturday through Tuesday and 8:00 a.m.–10:00 a.m. on Wednesday. You should also leave a message in the guest room.

### INTERNET ACCESS

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

### NOTICE

ASHRAE regards the materials presented at conference 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.

### CELL PHONES/PAGERS

Please be considerate and turn off your phones and pagers in committee meetings and transactions sessions, seminars, forums, and the poster session.

### 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 ASHRAE's headquarters hotel.

### SALE OF MERCHANDISE

Sale of merchandise, or the solicitation to sell merchandise, of any type at the Winter and Annual 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. All affiliate meeting information must be displayed in the literature kiosk. No literature will be displayed on tables.

### PHOTO RELEASE

Photographs will be taken at the ASHRAE Winter and Annual Conferences. By registering for this conference, you agree to allow ASHRAE to use your photo in any ASHRAE-related publications or Web sites.

### WHAT TO WEAR

Normal business attire is appropriate for meetings and social events; however, the Welcome Party will be casual. For Members' Night Out, men should wear sports coats and dress shirts (ties optional), and women should wear casual coordinates.

### New at This Conference—

#### NEW MEMBER RECEPTION

**Sunday, January 24, 2:45-3:45, Conway Room**


*Reception for first time conference attendees, new members, and nonmembers.*

If you've never attended an ASHRAE conference before, join us and meet some of your fellow first timers. New members, nonmembers, and first-time meeting attendees and their families are invited. The event is sponsored and hosted by the ASHRAE Membership Promotion Committee and will follow the First Time at an ASHRAE Conference session on Sunday, January 24, 2010.

### SHUTTLE SERVICE AVAILABLE

**Mears Transportation** operates a shuttle service to the airport. Make reservations by calling 407-423-5566 or go online at the ASHRAE.org/Orlando website. One-way shuttle service is \$18.

### 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 American Institute of Architect (AIA) Learning Units (LUs). Those programs are indicated with a  symbol. In order to report your attendance at the session, please sign the PDH and AIA sign-in sheets in the session room. Sessions are approved for 1, 1.5, or 2 PDHs depending on the length of the session. Certificates will be available following the conference. An e-mail will be sent to registered attendees with a link to the certificates. Please keep track of the sessions that you attend at the conference.

### CONFERENCE PAPERS

Abstracts of all technical papers and sessions are included in this program. During the conference, papers presented at poster and transactions sessions can be purchased in the ASHRAE Bookstore. After the conference, papers will be

available from ASHRAE Headquarters in Atlanta, Georgia. Papers are not available for seminars or forums. Poster and transactions sessions papers will be published with discussion in *ASHRAE Transactions*.

Other conference papers can be purchased in the online bookstore at [www.ASHRAE.org](http://www.ASHRAE.org) or searched online in the Abstract Center. The Abstract Center is a searchable database of abstracts on everything ASHRAE has published since 1980. This service is free to ASHRAE members, but a subscription fee will be charged to nonmembers. For ordering information, contact ASHRAE Customer Service at 1-800-527-4723.

### NEW VIRTUAL CONFERENCE

#### *Free for Paid Conference Registrants*

For the first time ever, ASHRAE is adding a virtual conference option so you won't miss the state-of-the-art concepts and latest design techniques presented in the Society's technical program. The Orlando Virtual Conference allows you to view presentations and to interact with an online audience through a discussion board. All conference attendees paying the full registration fee should have received via email their password and link prior to arriving in Orlando. If you do not have your password and link Go to [www.ashrae.org/orlandovirtual](http://www.ashrae.org/orlandovirtual) 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
- Access to all seminar presentations
- Access to selected transactions session paper presentations
- Access to posters presented in the poster session
- Ability to post questions or answers for selected sessions through Friday, Feb. 5. Presentations available online for one year.

A full slate of technical programs will be posted beginning Monday, January 25, of the sessions that were presented the previous day, with additional content posted through Thursday, January 28.

On-site registration is available for those who would like to purchase the Virtual Conference. To sign up, go to ASHRAE Registration, Rosen Shingle Creek, Sebastian J.

**\$299 ASHRAE Member**

**\$464 Nonmember**

### SOME COMMON SENSE 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 conference badge. Wearing a badge is an advertisement that you are a visitor to the city and that you are probably unfamiliar with your location. Walk "smart" when you leave the convention site—know your destination and the best way to reach it. Walk along lighted sidewalks at night and don't walk alone. Be on the lookout for pickpockets. Carry purses close to your body and wallets in a front pocket or inside your jacket. Separate your cash. Keep small bills in a purse or pocket and hide larger bills somewhere else. Trust your instincts—if you're uncomfortable with a situation, get out of it.

**Hotel Safety.** Some general guest safety tips include:

- 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

Hotel emergencies should be directed to the hotel operator; for police and fire department emergencies, dial 911. Hotel security is trained in emergency response and can get to the scene of an emergency quickly if medical assistance is needed. In case of an emergency, Dr. P. Phillips Hospital is located at 9400 Turkey Lake Road. The phone number is 407-351-8500

#### **Fire Emergency... Preparedness in Hotels**

The hotel's PA system will advise you of the need to evacuate in the event of a fire. The PA system is used on all sleeping and meeting room floors.

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.

## ROOMS/HOURS

### FINDING THE ASSIGNED MEETING ROOM

To assist you in finding your meeting room at the Winter Conference, please refer to the floor plans located in the front of this program. All meetings, with the exception of the ALI Short Courses, are scheduled in Rosen Shingle Creek. Meeting room names are listed in this program followed by parentheses indicating the number of the floor the room is located on. ALI Short Courses are scheduled in the Orange County Convention Center.

### CONFERENCE REGISTRATION

#### Rosen Shingle Creek, Sebastian J, Level 1

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

Friday, January 22	11:00 a.m.–4:00 p.m.
Saturday, January 23	7:30 a.m.–6:00 p.m.
Sunday, January 24	7:00 a.m.–5:00 p.m.
Monday, January 25	7:00 a.m.–4:00 p.m.
Tuesday, January 26	7:30 a.m.–4:00 p.m.
Wednesday, January 27	7:30 a.m.–10:00 a.m.

Computers with internet access will be available for e-mail.

### ASHRAE BOOKSTORE

#### Rosen Shingle Creek, Sebastian J, Level 1

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. The ASHRAE Bookstore will be open during the following hours:

Friday, January 22	11:00 a.m.–5:00 p.m.
Saturday, January 23	7:30 a.m.–6:00 p.m.
Sunday, January 24	7:00 a.m.–5:00 p.m.
Monday, January 25	7:00 a.m.–4:00 p.m.
Tuesday, January 26	7:30 a.m.–4:00 p.m.
Wednesday, January 27	7:30 a.m.–1:00 p.m.

There will be a Demo Center near the Bookstore where visitors can preview ASHRAE CD-ROMs and other electronic products.

ASHRAE's eLearning system, from the ASHRAE Learning Institute, will also be demonstrated at the bookstore. Find out how you can participate in a hands-on demonstration and learn about new ways to earn CEUs on demand online.

*Make the bookstore your meeting place!!*

### AHR EXPO®

#### Orange County Convention Center, North/South 9800 International Drive

#### Hours:

Monday, January 25	10:00 a.m.–6:00 p.m.
Tuesday, January 26	10:00 a.m.–6:00 p.m.
Wednesday, January 27	10:00 a.m.–4:00 p.m.

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

If you are attending the exposition only and you did not register in advance, the fee for admission is \$20.00 and can be paid at the Orange County Convention Center. **Registration for the AHR Expo® will be open from Noon–5:00 p.m. on Sunday, January 24. Starting Monday, you can register one hour before the doors open.**

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

Shuttle service to and from the Orange County Convention Center will be provided from Rosen Shingle Creek all day Monday through Wednesday. Shuttle pick-up will be from the transportation lobby of Rosen Shingle Creek. Signs will advertise the shuttle schedule, which will begin on Monday, January 25. Shuttle service does not operate from hotel to hotel.

### AHR EXPOCARDS HAVE BEEN REPLACED WITH A BAR CODE

Please note that the plastic Expocard previously provided for the AHR Expo has been replaced with the bar code on your badge. Exhibitors will scan your badge if you have interest in receiving product information. This is another step toward greening our events. Contact information provided on the bar code may be distributed to all AHR exhibitors.

### ASHRAE LOUNGE

#### Rosen Shingle Creek, Butler, Level 1

The ASHRAE Lounge is open to all individuals who are registered for the conference. Admission to the lounge is by badge only. Orlando Host Committee members will be available to answer questions.

This room will be open during the following hours:

Saturday, January 23	7:30 a.m.–3:00 p.m.
Sunday, January 24	7:30 a.m.–4:00 p.m.
Monday, January 25	7:30 a.m.–4:00 p.m.
Tuesday, January 26	7:30 a.m.–4:00 p.m.
Wednesday, January 27	7:30 a.m.–1:00 p.m.

Coffee and danish will be served from 7:30 a.m. to 9:30 a.m. each morning.

### MESSAGE CENTER

#### Rosen Shingle Creek, Sebastian J, Level 1

During the conference a Message Center will be in operation in Rosen Shingle Creek in the ASHRAE registration area. Hours will be 8:00 a.m.–5:00 p.m. Saturday through Tuesday and 8:00 a.m.–10:00 a.m. on Wednesday. You should also leave a message with the appropriate hotel.

### TOURS

For information on the tours offered during the Winter Conference, see general tour information in the Tours section of this program.



**SPEAKERS' LOUNGE****Rosen Shingle Creek, Sebastian I 1 /2, Level 1**

The Speakers' Lounge will be open during the following hours:

Saturday, January 23	1:00 p.m.–3:00 p.m.
Sunday, January 24	7:00 a.m.–3:30 p.m.
Monday, January 25	7:00 a.m.–12:15 p.m.
Tuesday, January 26	7:00 a.m.–1:00 p.m.
Wednesday, January 27	7:00 a.m.–1:00 p.m.

**PRESS ROOM****Rosen Shingle Creek, Sebastian Registration Office**

The Press Room will be open during the following hours:

Saturday, January 23	8:00 a.m.–2:30 p.m.
Sunday, January 24	8:00 a.m.–5:00 p.m.
Monday, January 25	10:00 a.m.–4:00 p.m.
Tuesday, January 26	8:00 a.m.–4:00 p.m.
Wednesday, January 27	8:00 a.m.–10:00 a.m.

**HEADQUARTERS OFFICE****Rosen Shingle Creek, Sandlake, Level 2**

The ASHRAE Headquarters Office offers members complimentary copying, services of a typist, and access to printers for laptop computers. The Headquarters Office will be open during the following hours:

Friday, January 22	Noon–5:00 p.m.
Saturday, January 23	8:00 a.m.–5:00 p.m.
Sunday, January 24	8:00 a.m.–5:00 p.m.
Monday, January 25	8:00 a.m.–5:00 p.m.
Tuesday, January 26	8:00 a.m.–5:00 p.m.
Wednesday, January 27	8:00 a.m.–1:00 p.m.

**MEMBERSHIP INFORMATION DESK**

A Membership Information Desk is available for paying dues, applying for membership, updating membership information, and purchasing ASHRAE logo items. 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.

**NEW AT THIS MEETING!****INVITATION TO ALL NEW MEMBERS, FIRST-TIME ATTENDEES, AND NONMEMBERS****Rosen Shingle Creek, Conway, Level 1**

*Sunday, January 24, 2:45 p.m.–3:45 p.m.*

If you've never attended an ASHRAE meeting before, join us and meet some of your fellow first timers. New members, non-members, and first time meeting attendees are invited, and feel free to bring your family members. The event is sponsored and hosted by the ASHRAE Membership Promotion Committee, and will follow the First Time At An ASHRAE Meeting session on Sunday, January 24.

**YOUNG ENGINEERS IN ASHRAE (YEA)****HOSPITALITY ROOM****Rosen Shingle Creek, Conway Room, Level 1**

Attention members age 35 and younger! You are invited to visit the Young Engineers in ASHRAE (YEA) Hospitality room to be held on Sunday, January 24, from 4:00 p.m.–7:00 p.m. The hospitality event offers social and networking opportunities as well as planned activities including meeting tips, leadership development, and more! Light refreshments will be available.

A YEA/student mixer will be held Saturday, January 23, from 5:00 p.m.–6:30 p.m. in the Butler room, Level 1 of Rosen Shingle Creek. Come join us to meet other young ASHRAE members!

**STUDENT ACTIVITIES****Rosen Shingle Creek, Gatlin B, Level 1**

The Student Breakfast and Program will be held in the Gatlin B Ballroom at Rosen Shingle Creek on Sunday, January 24 from 7:30 a.m.–11:00 a.m. Take advantage of this opportunity to learn more about ASHRAE while becoming acquainted with your fellow students and ASHRAE members.

There will be a speaker, design competition and grant award presentations, and a career panel. Don't miss the free student items and the raffle for your chance to win cool prizes! Activities for students are a unique feature of the ASHRAE Winter Conference—a foundation on which to build your network of resources for your future in the HVAC&R industry.

**Student Tour of Florida Hospital**

1:30 departure, 2 p.m. tour, return 3:30 p.m.
2:15 departure, 2:45 p.m. tour, return 4:15 p.m.
3:00 departure, 3:30 p.m. tour, return 5:00 p.m.
3:45 departure, 4:15 p.m. tour, return 5:45 p.m.

\*Buses leave promptly from the Transportation Lobby of hotel

\*\*Tour tickets are \$17 and can be purchased at meeting registration

**ORLANDO HOST COMMITTEE INFORMATION DESK****Rosen Shingle Creek, Sebastian J, Level 1**

The Host Committee will have an information desk located at the ASHRAE registration area. General information about the sights of the city will be available, and a host committee member will be present to answer questions about Orlando.

Information Desk hours will be Saturday and Sunday from 8:00 a.m.–2:00 p.m. and Monday and Tuesday from 8:00 a.m.–Noon. Please take a few minutes to stop by and discover some of the activities available to you in Orlando.

**ALBUQUERQUE CONFERENCE INFORMATION****Rosen Shingle Creek, Sebastian J, Level 1**

Information on the upcoming Annual Conference scheduled for June 26–June 30, 2010, in Albuquerque, NM, will be available in the registration area.

## GREEN CONFERENCES—CONSERVING FOR THE FUTURE

ASHRAE members and staff are asked to work together to increase the level of greening for all future ASHRAE Winter and Annual Conferences. ASHRAE is appreciative of the efforts made by Harry Rosen to conserve resources in all his hotels.

### WHAT ARE ROSEN GREEN MEETINGS®?

#### Harris Rosen Green Lodging Quote:

“We take environmental responsibilities to heart. We made it a point in the design phase of Rosen Shingle Creek to conserve water and energy and reduce waste as much as possible, and as a result, we save valuable resources,” said Harris Rosen, President/COO, Rosen Hotels & Resorts. “Guests may never notice the small changes we’ve made to help save our planet, but we do them because it’s simply the right thing to do. Those guests who do take note applaud our efforts because they too, are socially responsible citizens who are concerned about the effects man has on his environment.

**Rosen Shingle Creek, Rosen Centre, and Rosen Plaza have the Florida Green Lodge Certification. What does this mean? What do we do as a facility to display our commitment to the Green Lodge Program?**

### Water Conservation Programs

- We offer a towel reuse program in our guest rooms
- We offer a linen reuse program in our guest rooms
- We use only low flow faucets in our guest rooms
- We use only low flow showerheads in our guest rooms
- Our guest rooms are equipped with low flow toilets
- We use only water efficient laundry machines

### Energy Conservation Programs

- We use only energy star rated equipment in our Kitchens and laundry facilities
- We use programmable thermostats
- We have sensor outdoor lighting (100%)
- We use sensor lighting in the back of the building (30%)
- We use high energy efficient lighting (fluorescent)
- We have an energy management system
- Our programmable energy system allows us to schedule when temperature control units are turned on and off. They are programmed to come on 1 hour before the meeting starts, and go off 1 hour after meeting’s end
- Lights are turned off after meetings are over and when the space is unoccupied

### Waste Reduction

- We recycle all newspapers and office paper on the property
- We provide an opportunity for our guest to recycle aluminum and plastic - bins are available in vending rooms on each floor
- We participate in reduced packaging programs
- Water dispensers are provided in the meeting rooms to save waste from plastic bottles

### Clean Air Practices

- We use only cleaning products that have earned the Green Seal. (All-Purpose, Glass Cleaners and Bathroom Cleaners)
- We use environmentally preferable High Efficiency Particulate Air (HEPA) filters
- We clean all air handler units and coils at least annually and follow a preventative maintenance schedule and keep a record of these activities

### Rosen Recycling Program

- Company-wide – all pads and paper purchased for use by Rosen Shingle Creek staff will be recycled paper
- Recycle containers are provided when requested
- Banquet set-up teams recycle all items left on tables when readying rooms for our meeting guests
- Any usable items left over from conventions, such as notebooks and binders are donated to local schools. For example: We recently donated over 100 boxes of note pads to Tangelo Park Elementary, a local underprivileged school, that were left by a previous convention

## SCHEDULE

### LOCATION OF MEETINGS

To assist you in finding your meeting room at the Winter Conference, please refer to the floor plans located in the front of this program. All meetings are scheduled in Rosen Shingle Creek.

### MEETING SCHEDULE

#### FRIDAY, JANUARY 22

- 8:00 am–5:00 pm **Committee Meetings**  
*See listing on pages 64–82.*
- 11:00 am–4:00 pm **Registration**, Rosen Shingle Creek, Sebastian J, Level 1
- 11:00 am–5:00 pm **ASHRAE Bookstore**, Sebastian J, Level 1

#### SATURDAY, JANUARY 23

- 7:30 am–3:00 pm **ASHRAE Lounge**, Rosen Shingle Creek, Butler, Level 1
- 7:30 am–6:00 pm **Registration, ASHRAE Bookstore**, Rosen Shingle Creek, Sebastian J, Level 1
- 8:00 am–2:30 pm **Press Room**, Rosen Shingle Creek, Sebastian Registration Office Level 1
- 8:00 am–5:00 pm **Committee Meetings**  
*See listing on pages 64–82.*
- 12:00 pm–2:30 pm **Tour: Farris and Foster’s Famous Chocolate Factory Party**  
*See description on page 19.*
- 1:00 pm–3:00 pm **Speakers’ Lounge**, Rosen Shingle Creek, Sebastian I 1/2, Level 1

#### Special Event

- 3:15 pm–5:00 pm **Meeting of the Members, Plenary Session**, Rosen Shingle Creek, Sebastian K, Level 1
- Opening and Welcoming Remarks by ASHRAE President Gordon V.R. Holness
  - Welcome by Director and Chair, Region XII, Ross D. Montgomery
  - Secretary’s Report by Executive Vice President Jeff H. Littleton
  - Awards Presentation  
*See pages 16–17 for details.*
  - Keynote Speaker, David Zach  
*See page 14 for details.*

#### Special Event

- 6:30 pm–8:30 pm **Welcome Party**, Rosen Shingle Creek, Gatlin B, Level 1  
*See page 18 for details.*
- Note:* \$52 ticket per person required. Tickets may be purchased/picked up at the ASHRAE Registration Desk; advance-purchase tickets may be picked up at the door if after registration hours.

#### SUNDAY, JANUARY 24

- 7:00 am–3:30 pm **Speakers’ Lounge**, Rosen Shingle Creek, Sebastian I 1/2, Level 1
- 7:00 am–5:00 pm **Registration, ASHRAE Bookstore**, Rosen Shingle Creek, Sebastian J, Level 1
- 7:30 am–4:00 pm **ASHRAE Lounge**, Rosen Shingle Creek, Butler, Level 1
- 7:30 am–8:30 am **Student Breakfast**, Rosen Shingle Creek, Gatlin B, Level 1
- 8:00 am–3:30 pm **Technical Sessions**  
*See Technical Program on pages 26–63.*
- 8:00 am–5:00 pm **Press Room**, Rosen Shingle Creek, Sebastian Registration Office, Level 1
- 8:00 am–5:00 pm **Committee Meetings**  
*See listing on pages 64–82.*
- 8:30 am–11:30 am **Student Program**, Rosen Shingle Creek, Gatlin B, Level 1
- 8:30 am–4:30 pm **Tour: Kennedy Space Center**  
*See description on page 19.*
- 9:45 am–10:45 am **Technical Plenary Session**, Rosen Shingle Creek, Panzacola G1, Level 1  
*Note: Conference badge required.*
- 1:30 pm–2:30 pm **Seminar 18 (Open Session—no badge required)**, Rosen Shingle Creek, Panzacola F4, Level 1  
**First Time at an ASHRAE Meeting? This Seminar’s for You!**  
*See Seminar 18 on page 33 for more details.*
- 1:30 pm–3:30 pm **Student Tour to Florida Hospital Energy Plant**  
*See description on page 20.*
- 2:15 pm–4:15 pm **Student Tour to Florida Hospital Energy Plant**  
*See description on page 20.*
- 2:45 pm–3:45 pm **First Time Attendee/New Member Reception**, Rosen Shingle Creek, Conway, Level 1  
*See page 18 for details.*
- 3:00 pm–5:00 pm **Student Tour to Florida Hospital Energy Plant**  
*See description on page 20.*
- 3:15 pm–4:15 pm **ASHRAE Foundation Seminar—Endowing the Future (Open Session-no badge required)**, Rosen Shingle Creek, Panzacola F4, Level 1
- 3:15 pm–6:15 pm **Technical Tour: Darden Restaurant Headquarters**  
*See description on page 21.*



## Schedule

3:45 pm–5:45 pm **Student Tour to Florida Hospital Energy Plant**

*See description on page 20.*

4:00 pm–7:00 pm **Young Engineers in ASHRAE (YEA) Hospitality Room**, Rosen Shingle Creek, Conway, Level 1 **Attention members age 35 and younger**—You are invited to visit the YEA Hospitality room, offering social and networking opportunities including meeting tips, leadership development, and more. Light refreshments will be available.

*See page 11 for more details.*

### MONDAY, JANUARY 25

7:00 am–12:15 pm **Speakers' Lounge**, Rosen Shingle Creek, Sebastian I 1/2, Level 1

7:00 am–4:00 pm **Registration, ASHRAE Bookstore**, Rosen Shingle Creek, Sebastian J, Level 1

7:30 am–4:00 pm **ASHRAE Lounge**, Rosen Shingle Creek, Butler, Level 1

8:00 am–12:15 pm **Technical Sessions**

*See Technical Program on pages 26–63.*

10:00 am–4:00 pm

**Press Room**, Rosen Shingle Creek, Sebastian Registration Office, Level 1

8:00 am–5:00 pm

**Committee Meetings**

*See listing on pages 64–82.*

10:00 am–6:00 pm

**AHR Expo®**, Orange County Convention Center, 9800 International Blvd.

*If you are registered for the ASHRAE Conference, your conference badge is admission into the exposition; if attending exposition only and not registered in advance, admission is \$20.00 at the exposition.*

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

**Shuttle service to and from Orange County Convention Center will be provided from Rosen Shingle Creek. Shuttle pick-up will be from the transportation lobby entrance (on the lobby level between the lobby and the meeting space). Signs will advertise the shuttle schedule. The shuttle service does not operate from hotel to hotel. See page 10 for more details.**

## KEYNOTE SPEAKER—DAVID ZACH

**Saturday, January 23**

**3:15 p.m.–5:00 p.m.**

### An Owner's Guide to the Future

So what does the future hold for the members of ASHRAE? Will automation take away your jobs? Will the computer on your desk outsource its own jobs to India? Will major appliances learn to argue with us? Will the automation of health care lead to the automation of caring? Will someone be able to “google” a furnace just by looking at it? And, how come your teenagers can pay attention to ten things at once and still be, like, bored? Futurist David Zach asks some funny questions. In his thought-provoking tour of modern times he'll offer some useful answers that will get people talking. With a friendly style and a few down-to-earth suggestions, he'll help you face the future with a solid sense of hope and inspiration.

As one of the very few professionally trained futurists on the planet, David Zach blends the funny with the profound in this surprisingly practical keynote to help you decide what really matters. You'll rethink the balance between change and tradition – and the need to hold on to that which shouldn't change. At the end you'll find yourself either thoughtfully quiet or engaged in some of the best conversations you've ever had at a meeting. Dave may not be the futurist you expected, but he is the one you'll remember. (Oh, and he spent the first two years of his career working for one of the largest HVAC corporations in the world.)



10:15 am–11:45 am **Student Congress**, Rosen Shingle Creek, Suwannee 17, Level 2

### Special Event

12:15 pm–2:00 pm **President's Luncheon (doors open at noon)**, Rosen Shingle Creek, Sebastian K, Level 1

*President Gordon V.R. Holness will speak on the State of the Society and the Golden Circle Awards will be presented "in honor of contributors who have consistently and significantly supported ASHRAE research." Spouses and guests are cordially invited to attend.*

*Note:* Ticket required.

2:00 pm–3:00 pm **Construction Management**, Open Session at Orange County Convention Center South Hall, Room S310 E, Level 3

*See description on page 41.*

2:15 pm–4:30 pm **Technical Tour: Burnett School of Biomedical Sciences**

*See description on page 21.*

2:30 pm–4:30 pm **Technical Tour: Orange County Convention Center—Climate Change Education Center (CCEC)**

*See description on page 21.*

2:15 pm–6:30 pm **Tour: Dolphins, Manatees Pontoon Boat Wildlife Cruise**

*See description on page 20.*

### Regional Dinners

Sign up in ASHRAE Registration area.

## TUESDAY, JANUARY 26

7:00 am–1:00 pm **Speakers' Lounge**, Rosen Shingle Creek, Sebastian I 1/2, Level 1

7:30 am–4:00 pm **Registration, ASHRAE Bookstore**, Rosen Shingle Creek, Sebastian J, Level 1

7:30 am–4:00 pm **ASHRAE Lounge**, Rosen Shingle Creek, Butler, Level 1

8:00 am–12:30 pm **Technical Sessions**  
*See Technical Program on pages 26–63.*

8:00 am–4:00 pm **Press Room**, Rosen Shingle Creek, Sebastian Registration Office, Level 1

8:00 am–5:00 pm **Committee Meetings**  
*See listing on pages 64–82.*

9:00 am–5:00 pm **Tour: Winter Park Cultural Tour**  
*See description on page 20.*

10:00 am–6:00 pm

**AHR Expo®**, Orange County Convention Center, 9800 International Blvd.

*If you are registered for the ASHRAE Conference, your conference badge is admission into the exposition; if attending exposition only and not registered in advance, admission is \$20.00 at the exposition.*

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

**Shuttle service to and from Orange County Convention Center will be provided from Rosen Shingle Creek. Shuttle pick-up will be from the transportation lobby entrance (on the lobby level between the lobby and the meeting space). Signs will advertise the shuttle schedule. The shuttle service does not operate from hotel to hotel. See page 10 for more details.**

11:30 am–2:00 pm

**Life Members' Luncheon**, Conway, Level 1

*Note:* Ticket required.

1:30 pm–3:00 pm

**Technical Tour: Orange County Convention Center—Climate Change Education Center (CCEC)**

*See description on page 21.*

1:30 am–5:30 pm

**Technical Tour: Florida Solar Energy Center (FSEC)**

*See description on page 21.*

2:00 pm–3:00 pm

**Cost/Benefit Analysis Methodology and Tools Needed by Owners**, Open Session at Orange County Convention Center, South Hall, Room S310 E, Level 3

*See description on page 56.*

### Special Event

6:15 pm–7:00 pm

**Reception**, Rosen Shingle Creek, Sebastian K foyer, Level 1

7:00 pm–10:30 pm

**Members' Night Out**, Rosen Shingle Creek, Sebastian K, Level 1

*See page 18 for details.*

*Note:* Ticket required.

## WEDNESDAY, JANUARY 27

7:30 am–10:00 am

**Registration**, Rosen Shingle Creek, Sebastian J, Level 1

7:30 am–1:00 pm

**ASHRAE Bookstore**, Rosen Shingle Creek, Sebastian J, Level 1

7:30 am–1:00 pm

**ASHRAE Lounge**, Rosen Shingle Creek, Butler, Level 1

## Schedule

- 7:00 am–1:00 pm **Speakers' Lounge**, Rosen Shingle Creek, Sebastian I 1/2, Level 1
- 8:00 am–10:00 am **Press Room**, Rosen Shingle Creek, Sebastian Registration Office, Level 1
- 8:00 am–5:00 pm **Committee Meetings**  
*See listing on pages 64–82.*
- 8:00 am–12:30 pm **Technical Sessions**  
*See Technical Program on pages 26–63.*
- 10:00 am–4:00 pm **AHR Expo®**, Orange County Convention Center, 9800 International Blvd.  
*If you are registered for the ASHRAE Conference, your conference badge is admission into the exposition; if attending exposition only and not registered in advance, admission is \$20.00 at the exposition.*
- Note:* You must be 16 years or older to be admitted to the show floor. Ages 16 and 17 will be admitted only if accompanied by an adult.
- Shuttle service to and from Orange County Convention Center will be provided from Rosen Shingle Creek. Shuttle pick-up will be from the transportation lobby entrance (on the lobby level between the lobby and the meeting space). Signs will advertise the shuttle schedule. The shuttle service does not operate from hotel to hotel. *See page 10 for more details.***

## AWARDS PRESENTATION

**Saturday, January 23, 3:15–5:30 p.m.**  
**Plenary Session, Rosen Shingle Creek, Sebastian K, Level 1**

### STUDENT DESIGN PROJECT COMPETITION

*Given in recognition of outstanding student research and design projects.*

#### HVAC System Selection

**First Place:** Fred Hasler (advisor), Julia Keen (advisor), Kelly M. Griffith, James M. Newman, Phillip Podlasek, Darren Rottinghaus, Kansas State University, Manhattan, KS

#### HVAC System Design

**First Place:** Jesse Maddren (advisor), Craig N. Allen, Chan Kim, William R. Raschefskey III, Brian W. Sybesma, Elyse Widin, California Polytechnic State University, San Luis Obispo, CA

#### Integrated Sustainable Building Design

**First Place:** Filimon Tsionas (advisor), Ivan S. J. Fernandes, Jaime P. Gonsalves, Troy C. White, Edward G. Wood, Seneca College of Applied Arts and Technology, Toronto, Ontario, Canada

### TECHNOLOGY AWARDS

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

#### First Place

##### Category I—Commercial Buildings—New

Michael J. Hedrick, Thomas J. Marseille, PE, and Long Lam for *The Terry Thomas*, Seattle, Washington

##### Category I – Commercial Buildings – Existing

Peter H. Rumsey, P.E., for IDEAs Design Facility, San Jose, California

##### Category II—Institutional Buildings—New

Donald J. McLauchlan, PE, Steven D. Maze, and David Lavan, for *Richard J. Klarchek Information Commons Building*, Chicago, Illinois

##### Category IV—

##### Industrial Facilities/Processes—New

Martin Roy, PEng, for *Sobey's Warehouse*, Trois-Rivières, Quebec, Canada

#### Second Place

##### Category I—Commercial Buildings—New

Stephan L. Weidner, PE, and Jerome W. Doerger, PE, for *100 Howe Building*, Covington, Kentucky

##### Category I—Commercial Buildings—Existing

Caroline Paquet, PEng, for *National Bank Tower*, Montreal, Quebec, Canada

##### Category II—Institutional Buildings—New

Cole Roberts for *Kirsch Center for Environmental Studies*, Cupertino, California

##### Category II—Institutional Buildings—New

Robert N. Roop for *New Whitmore Lake High School*, Whitmore Lake, Michigan

#### **Category II—Institutional Buildings—Existing**

**Brett J. Kelley, PE, and Charles T. Meagher** for *cGMP Cell Therapy Facility, Chicago, Illinois*

#### **Category III—Health Care Facilities—New**

**Paul B. Switenki, PE,** for *Kaiser Permanente Temple Hospitals, Oakland, California*

#### **Category IV—**

#### **Industrial Facilities/Processes—New**

**Ronald Gagnon and Louis Raciot** for *Logistik Unicorp, St-Jean sur Richelieu, Quebec, Canada*

#### **Category IV—**

#### **Industrial Facilities/Processes—Existing**

**Mukesh K. Khattar, PhD,** for *High Density Data Center Cooling/Heat Containment, Austin, Texas*

#### **Honorable Mention**

#### **Category I—Commercial Buildings—Existing**

**Roland Charneux, PEng,** for *Place Desjardins Inc.—Office Towers Energy Retrofit, Montreal, Quebec, Canada*

#### **Category I—Institutional Buildings—Existing**

**Mark M. Hydeman, PE, and Molly E. McGuire, PE,** for *Stanford University Stauffer Building I Laboratory VAV Conversion, Stanford, California*

#### **Category II—Institutional Buildings—New**

**Surrander Naganathan, PE,** for *Deer Ridge Correctional Institution, Madras, Oregon*

#### **Category II—Institutional Buildings—New**

**Rejean Blais** for *Poste de Police de la Surete du Quebec a Vaudreuil—Dorion Vaudreuil—Dorion, Quebec, Canada*

#### **Category II—Institutional Buildings—New**

**Nicolas Lemire** for *Kahnawake Survival School, Kahnawake Mohawk Territory, Quebec, Canada*

#### **Category II—Institutional Buildings—Existing**

**Genevieve Lussier, PEng,** for *Pavilion Environtron, Quebec, Quebec, Canada*

#### **Category III—Health Care Facilities—New**

**Don M. Iverson, PE,** for *Harborview Medical Center—New Norm Maleng Building, Seattle, Washington*

#### **Category III – Health Care Facilities – New**

**Michael T. Stark** for *Northwestern Memorial Hospital—New Prentice Women’s Hospital, Chicago, Illinois*

#### **Category IV—**

#### **Industrial Facilities/Processes—New**

**Jonathan M. Mesik, PE,** for *Oak Park Public Works Center, Oak Park, Illinois*

#### **Category VI—Residential—New**

**Glenn Friedman, PE,** for *University of California Merced—Sierra Dormitory Buildings I and II, Merced, California*

#### **JOHN F. JAMES INTERNATIONAL AWARD**

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

**Leo P. Stambaugh, Dallas, TX**

#### **LOU FLAGG HISTORICAL AWARD**

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

**Roderic S. Potter, Carp, Canada**

#### **ASHRAE FELLOWS**

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

**Robert G. Baker, ASHRAE Certified OPMP, Ruskin, FL**

**Darryl K. Boyce, PEng, Nepean, Canada**

**Michael R. Brambley, PhD, Richland, WA**

**Michael J. Brandemuehl, PhD, PE, Bolder, CO**

**Donald J. Cleland, PhD, Palmerston North, New Zealand**

**Drury B. Crawley IV, PhD, Washington, DC**

**Charles J. Cromer, PhD, PE, Cocoa Beach, FL**

**Hakim Elmahdy, PhD, PEng, Ottawa, Canada**

**Forrest B. Fencl, Huntington Beach, CA**

**Daniel E. Fisher, PhD, PE, Stillwater, OK**

**Lewis G. Harriman III, Portsmouth, NH**

**Glenn C. Hourahan, PE, Arlington, VA**

**Anthony M. Jacobi, PhD, Urbana, IL**

**Srinivas Katipamula, PhD, Richland, WA**

**H. Ezzat Khalifa, PhD, Syracuse, NY**

**Essam E. Khalil, PhD, Cairo, Egypt**

**Mukesh K. Khattar, PhD, Redwood City, CA**

**Carl N. Lawson, Zephyrhills, FL**

**John Budi Harjanto Listijono, Jakarta, Indonesia**

**Kecha Thirakomen, PE, Bangkok, Thailand**

**Marija S. Todorovic, PhD, Belgrade, Serbia**

#### **E.K. CAMPBELL AWARD OF MERIT**

**Presented by the Life Members’ Club**

*Given in recognition of outstanding service and achievement in teaching.*

**Eckhard A. Groll, PhD, Purdue University, West Lafayette, IN**

#### **ASHRAE HALL OF FAME AWARD**

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

**William J. Collins, Jr.**

**J. Donald Kroeker, PE**

#### **F. PAUL ANDERSON AWARD**

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

**Gerald C. Groff, Cazenovia, NY**

## 2010 ASHRAE WINTER CONFERENCE WELCOME PARTY

Saturday, January 23

6:30–8:30 p.m.

Gatlin B, Level 1

Get swept into this kick-off event, which features a hurricane theme along with good food and great friends.

### Menu

- Red Bliss Potato Salad
- Fruit Salad
- Half Pound Grilled Angus Burgers
- All Beef Sabrett Hot Dogs, Sauerkraut
- Fried Grouper
- Oven Baked Beans with Tupelo Honey
- Macaroni and Cheese
- American, Swiss and Provolone Cheeses
- Relish Tray with Sweet Pickles
- Assorted Condiments
- Hot Dog and Hamburger Rolls
- Dessert Stations of PB&J Shots and Smores
- Freshly Brewed Starbucks® Regular and Decaffeinated Coffees, Gourmet Teas
- Two drink tickets included

**Dress:** Casual

**Note:** \$52 ticket per person required. Tickets include two drink tickets. Tickets may be purchased/picked up at the ASHRAE Registration Desk; advance-purchase tickets may be picked up at the door if after registration hours.

## MEMBERS' NIGHT OUT

Tuesday, January 26

6:15 p.m.–7:00 p.m. (Reception—cash bar)

Sebastian K Foyer

7:00–10:30 p.m. (Dinner and Entertainment)

Sebastian K

Rosen Shingle Creek

Come Wii with us! ASHRAE hosts its first ever Wii Tourney, featuring members battling it out in the video game system. Who will be our ASHRAE Wii champion? Dinner served to help keep up your strength.

### Menu:

- La La Rosa Salad (tossed with Club Iceberg, Romaine and Escarole Radicchio, Roasted Peppers, Cucumbers and Grape Tomatoes)
- Roast Sirloin of Beef, Pinot Noir Demi-Glace
- Garlic Smashed Potatoes
- Creamed Spinach in Brioche
- Crème Brulee
- Coffee, Tea

If you have purchased a ticket for this event, you will receive an exchange coupon. Take this coupon to the Member's Night Out desk located in ASHRAE Registration and exchange it for a reserved seat ticket by 2:00 p.m. Monday, January 25. Each table seats ten. A seating chart is available to help in deciding table preference. Seats are available on a first-come-first-served basis. When reserving your seat, please advise us of any special dietary requirements to ensure that we are able to accommodate your requests during the evening.

**Dress:** Sport coat and sport shirt (tie optional) for the men; casual coordinates for the ladies.

**Note:** \$52 ticket per person required.

## NEW MEMBER RECEPTION

*New at This Conference*

Sunday, January 24

2:45–3:45 p.m.

Conway Room

*Reception for first-time conference attendees, new members, and nonmembers.*

If you've never attended an ASHRAE conference before, join us and meet some of your fellow first timers. New members, nonmembers, and first-time meeting attendees and their families are invited. The event is sponsored and hosted by the ASHRAE Membership Promotion Committee and will follow the First Time at an ASHRAE Conference session on Sunday, January 24, 2010.



## SPOUSE/GUEST GUIDE

### MEET AND GREET

Monday, January 25

9:30 a.m.–11:00 a.m.

Rosen Shingle Creek, Butler, Level 1

Enjoy a brief informational session about the benefits of skin and body care from the Spa at Shingle Creek. Learn some tips and tricks that can enhance your skin's appearance. Q&A to follow (time permitting).

### ASHRAE LOUNGE

Rosen Shingle Creek, Butler, Level 1

The ASHRAE Lounge is open to all individuals who are registered for the conference. Refreshments are available from 7:30 to 9:30 a.m. each day, and beverages are available all afternoon. This room will be open during the following hours:

Saturday, January 23	7:30 a.m.–3:00 p.m.
Sunday, January 24	7:30 a.m.–4:00 p.m.
Monday, January 25	7:30 a.m.–4:00 p.m.
Tuesday, January 26	7:30 a.m.–4:00 p.m.
Wednesday, January 27	7:30 a.m.–1:00 p.m.

### ORLANDO HOST COMMITTEE INFO DESK

Rosen Shingle Creek, Sebastian J, Level 1

The Host Committee will have an information desk located at the ASHRAE registration area. General information about the sights of the city will be available, and a host committee member will be present to answer questions about Orlando.

Information Desk hours will be Saturday and Sunday from 8:00 a.m.–2:00 p.m. and Monday and Tuesday from 8:00 a.m.–Noon. Please take a few minutes to stop by and discover some of the activities available to you in Orlando.

### TOURS

For information on the tours offered during this conference, see the general tour and technical tour information in the Tours section of this program.

## TOURS

All tours depart from the Transportation Lobby of Rosen Shingle Creek. The Transportation Lobby is on the lobby level between the main hotel registration and the meeting space. See the diagram of the hotel located in this program.

Tour tickets may be purchased at the ASHRAE Registration desk in the Sebastian J Ballroom, Level 1 of Rosen Shingle Creek.

Stand-by tour tickets are distributed after a tour sells out. Stand-by tickets are provided to ensure that a tour is filled in the event of no-shows or last minute cancellations. If you have a stand-by ticket, please have the exact amount of the ticket cost available to pay at the bus.

### FARRIS AND FOSTER'S FAMOUS CHOCOLATE FACTORY PARTY

Saturday, January 23

Noon–2:30 p.m.

**Price:** \$54 per person (Tour has a maximum attendance of 40 so register early.)

Enter a glorious world of chocolate that would make Willy Wonka green with envy. However, you don't need a golden ticket to visit Farris and Foster's Famous Chocolate Factory. If you've ever dreamed of chocolate rivers, waterfalls and bubbling vats of creamy, rich, dark and milk chocolate, this is your dream come true.

At Farris and Foster's, there are multiple ways to express your love for chocolate. Choose from hundreds of molds to make your own chocolate confections, decorate pre-molded chocolate creations, cover your favorite fruit in chocolate or fill chocolate cups. If you are a chocoholic, this activity is for you!

**Note:** Those with allergies to nuts or milk are discouraged from participating. Participants are required to wear a hairnet or hat.

### KENNEDY SPACE CENTER

Sunday, January 24

8:30 a.m.–4:30 p.m.

**Price:** \$69 per person (lunch on your own);  
\$57 per child (ages 3–11)

3, 2, 1...blast off! Worlds apart from Orlando's theme parks, but only 45 minutes away, Kennedy Space Center is NASA's launch headquarters. Each year, millions of visitors tour this hub of technology and discovery. Experience NASA's launch and landing facilities, live shows, and jaw-dropping encounters with massive rockets and real members of NASA's Astronaut Corps.

A bus tour of NASA landmarks takes you by the massive launch pads, the Vehicle Assembly Building, the awe-inspiring Apollo/Saturn V Center and the International Space Station Center. Tour the Visitor Complex with live-action theatrical shows and an educational astronaut encounter

briefing. View 10-story high rockets from all eras of space exploration in the Rocket Garden, walk through a full-size space shuttle mock-up, enjoy IMAX Theater space films and see an actual Gemini program capsule on display.

Launch your own vibrant journey of the space shuttle's rush to Earth's orbit on the newest attraction, Shuttle Launch Experience. See, feel and live the trip to 17,500 mph. As the cargo bay doors open, see a breath-taking view of Earth from space. Brace yourself for the sights, sounds, feelings and excitement of a vertical launch in mankind's most complex vehicle.

- For security purposes, the following items are not permitted into Kennedy Space Center: coolers, luggage or large bags, wrapped items, firearms, ammunition, pepper/mace spray, knives and other sharp objects. Backpacks are not permitted on launch days. Detailed searches are conducted on all bags and purses. All electronic devices must be in working condition. No outside food items are permitted on property.
- The Kennedy Space Center bus tour runs approximately 2-2½ hours. Tours start at 10 a.m. and end at 2:15 p.m. running continuously every 15 minutes.
- This tour involves walking. Participants are encouraged to wear comfortable shoes and dress for the weather.

### **DOLPHINS, MANATEES PONTOON BOAT WILDLIFE CRUISE** **Monday, January 25** **2:15–6:30 p.m.**

**Price:** \$69 per person

\$62 per child (ages 3–11) Children under 8 are not recommended to participate. Participants are encouraged to wear comfortable shoes and dress for the weather.

Begin your tour cruising the smooth, inland waters of the Banana River aboard a shallow-draft, 50-passenger pontoon boat. As you travel in safety and comfort, you'll learn of the river's significance from a certified Eco-Guide. The Banana River, a backwater estuary and a wilderness waterway used by the indigenous Ais Indians, is considered a sanctuary for the endangered West Indian manatees and bottlenose dolphins. Keep an eye open for these marine mammals as your captain and guide narrates this two-hour cruise tour while you enjoy the sights and sounds of the river's wildlife.

### **WINTER PARK CULTURAL TOUR** **Tuesday, January 26** **9 a.m.-5 p.m.**

**Price:** \$89 per person. Lunch included.

Downtown Winter Park's charm is magnified in its details: hidden gardens and side streets that are home to unique stores, a Saturday morning farmer's market and festive parades that mark the seasons. Running through the heart of Winter Park is Park Avenue, often called "Little Europe." Bordered by a park that hosts concerts and art festivals, Park Avenue is home to

one-of-a-kind boutiques, well-known shops, sidewalk cafés and world-renowned art collections.

To maximize your experience, take a scenic boat tour through three of the city's lakes which border the area's most prestigious homes. The relaxing, narrated, one-hour, 12-mile cruise through the lakes and canals is the best way to see the true beauty of Winter Park.

Following the boat tour, enjoy a stroll down Park Avenue to The Charles Hosmer Morse Museum of American Art. The Morse Museum houses a comprehensive collection of Louis Comfort Tiffany's works, major holdings of American art pottery and representative collections of late-19th and early-20th century American paintings, graphics and decorative arts. Dine on traditional French cuisine at Chez Vincent after touring the museum. Spend the remainder of your day shopping on Park Avenue.

- This tour involves walking. Participants are encouraged to wear comfortable shoes and dress for the weather.
- Backpacks and large parcels are not permitted in The Morse Museum's galleries.

## **TECHNICAL TOURS**

All tours depart from the Transportation Lobby of Rosen Shingle Creek. The Transportation Lobby is on the lobby level between the main hotel registration and the meeting space. See the diagram of the hotel in the program.

Tour tickets may be purchased at the ASHRAE Registration desk in the Sebastian J Ballroom, Level 1 of Rosen Shingle Creek.

Stand-by tour tickets are distributed after a tour sells out. Stand-by tickets are provided to ensure that a tour is filled in the event of no-shows or last minute cancellations. If you have a stand-by ticket, please have the exact amount of the ticket cost available to pay at the bus.

### **ASHRAE STUDENT TECHNICAL TOUR: FLORIDA HOSPITAL**

**Price:** \$17 per person

*Four tours will be offered:*

- 1:30–3:30 p.m.
- 2:15–4:15 p.m.
- 3:00–5:00 p.m.
- 3:45–5:45 p.m.

Since 1908, Florida Hospital Orlando has cared for the Central Florida community as well as patients from around the world. At the core of the Florida Hospital system, Florida Hospital Orlando is an acute-care, tertiary hospital caring for more than 1.5 million patients a year. As the primary campus for more than 1,000 physicians, Florida Hospital Orlando is home to nationally recognized Centers of Excellence for cancer, cardiology, children, diabetes, neuroscience, orthopaedics, and transplant. Florida Hospital Orlando



continues to meet the growing needs of our community with the addition of the Ginsburg Tower, a \$255 million 15-story facility that is home to the Florida Hospital Cardiovascular Institute and a football-field-sized emergency department that can accommodate the treatment of more patients in less time.

The ASHRAE 2010 Student Design Competition's project features the addition of The Ginsburg Tower at Florida Hospital in Orlando.

This structure, the tallest hospital building in the state of Florida, is a 15-story patient tower that will contain the Florida Hospital Cardiovascular Institute, 440 patient beds and one of the largest Emergency Departments in the country. Students: don't miss the opportunity to tour this facility!

### **DARDEN RESTAURANT HEADQUARTERS**

**Sunday, January 24**

**3:15–6:15 p.m.**

**Price:** \$23 per person

See what technology is required to cook your favorite dishes at the headquarters of Darden Restaurants – the company behind such brands as Red Lobster, Bahama Breeze, Longhorn Steakhouse, Olive Garden, Seasons 52 and The Capital Grilles.

Their new headquarters, completed in August 2009, features 400,000 pounds of sheet metal, 35,000 pounds of stainless steel (phew! all those test kitchens), 1,750 tons of cooling, 150 tons of attached data center, 26 air handler units, 16 Liebert units, 24,000 feet of control wiring and 22 air-to-air energy recovery units. Darden is pursuing a LEED-NC Silver rating.

The 450,000 square foot building is a mixed-use facility with office space, training space, commercial test kitchens, food laboratories and state of the art audio-visual capabilities.

Tour the facility on a weekend to see a first-class commercial office building with a unique flavor (literally).

### **BURNETT SCHOOL OF BIOMEDICAL SCIENCES**

**Monday, January 25**

**2:15–4:30 p.m.**

**Price:** \$23 per person

The Burnett School of Biomedical Sciences supports the University of Central Florida College of Medicine as a research intensive medical school where cutting edge medical research spans the entire spectrum from the laboratory bench to bedside. Research is focused on the fields of cancer, cardiovascular disease, infectious disease, neurodegenerative disease and other specialty areas.

Completed in August 2009, the 198,000-square-foot five-story building features a major transgenic animal facility/vivarium and Biosafety Level 3 (BSL-3) laboratory. The building is pursuing LEED-Silver certification.

This is a great high-tech tour for those interested in the latest in laboratory design.

### **ORANGE COUNTY CONVENTION CENTER— CLIMATE CHANGE EDUCATION CENTER (CCEC)**

**Monday, January 25**

**2:30–4:30 p.m.**

**Tuesday, January 26**

**1:30–3:30 p.m.**

**Price:** \$5

Located inside the Orange County Convention Center (OCCC), the Climate Change Education Center seeks to inform the public of the environmental, health and economic benefits of renewable energy and energy efficiency, as well as exemplify ways to reduce GHG emissions.

The center features a hands-on approach with an eco-friendly room setting, graphical and electronic real-time displays of the photovoltaic systems located at the OCCC, alternative fuel vehicles displays, educational audio and video tapes, eco-friendly products from selected industries and a variety of other educational programs. Visitors can see the products and displays and get further information from a representative available to answer questions.

This technical tour is great for members and their families. Please use shuttle service from Rosen to the convention center. Meet at the Orange County Convention Center inside south concourse at OCCC-CCEC's front door, room S222-South Hall, Level 2.

### **FLORIDA SOLAR ENERGY CENTER (FSEC)**

**Tuesday, January 26**

**1:30–5:30 p.m.**

**Cost per person:** \$28

Tour the Florida Solar Energy Center (FSEC) to discover how HVAC&R, window technology, natural lighting, controls and other building technologies were integrated to produce one of the most energy efficient buildings for hot, humid climates. Also find out what's new in alternative energy sources and energy saving technologies. FSEC is the largest and most active state-supported renewable energy and energy efficiency research, training, testing and certification institute in the United States.

FSEC's mission is to research and develop energy technologies that enhance Florida's and the nation's economy and environment and to educate the public, students and practitioners on the results of the research. Research at FSEC is based on field monitoring, computer simulations and controlled experiments in highly-instrumented laboratories. These research efforts are developed in partnership with industry, nonprofit organizations, private sponsors and national laboratories.

FSEC's 20-acre research complex on Florida's Space Coast is adjacent to UCF's Cocoa Campus. This state-of-the-art research campus is composed of a number of buildings that provide office, laboratory and test facilities.

This tour involves walking. Participants should wear comfortable shoes and dress for the weather.



## CONTINUING EDUCATION COURSES

The ASHRAE Learning Institute (ALI) will offer 5 full-day courses and 17 half-day courses during the 2010 Winter Conference. Full-day and half-day courses will be held at either the Rosen Shingle Creek Hotel or the Orange County Convention Center.

All courses carry professional development hours (PDHs), continuing education units (CEUs), and/or American Institute of Architect Learning Units (AIA LUs), which can be applied toward maintaining PE licensure.

Registration for courses at Rosen Shingle Creek will be in the Sebastian J Ballroom, Level 1. Registration for courses at the Orange County Convention Center will be in the South Concourse, Level II, across from Room S220.

## FULL-DAY COURSES

**Registration fees per course:** \$395 (ASHRAE members); \$485 (nonmembers).

Completion of a course earns 6 PDHs/AIA LUs or .6 CEUs.

**Saturday, January 23**  
**8:00 a.m.–3:00 p.m.**

### **Complying with Requirements of ASHRAE Standard 62.1-2007**

*Rosen Shingle Creek, St. John's 31, Level 2*

This course provides an overview of the requirements of ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality, with emphasis on changes from the 2004 version. Practice in use of an available spreadsheet is included as a closing exercise. Attendees receive a discount toward the purchase of Standard 62.1-2007 and 62.1 User's Manual.

**Instructor:** Hoy Bohanon

**Saturday, January 23**  
**8:00 a.m.–3:00 p.m.**

### **New! Energy Management in New and Existing Buildings: A Sustainable Activity**

*Rosen Shingle Creek, Sebastian L2, Level 1*

Buildings use 40 percent of U.S. energy, only one-third of which can be easily saved. To achieve this goal, building professionals can utilize energy management—an orderly process in which managers use resources at their disposal to accomplish clear, energy-savings objectives. Sustained energy management is the quickest, cheapest, cleanest way to expand our world's energy supplies and reduce greenhouse gas emissions. This course weaves together energy management

principles of the ASHRAE Handbook, HVAC Applications, Energy Star guidelines and practical experience of successful energy managers. Case studies are presented, including a hospital, high-rise building, bank and convention center. Attendees receive a discount toward the purchase of Standard 100-2006, Energy Conservation.

**Instructors:** Richard J. Pearson and Kevin Little

**Saturday, January 23**  
**8:00 a.m.–3:00 p.m.**

### **Complying with ANSI/ASHRAE/IESNA Standard 90.1-2007**

*Rosen Shingle Creek, Sebastian L4, Level 1*

Standard 90.1 has served as the benchmark for commercial building energy codes in the United States and a key basis for standards in more than 15 countries around the world. Given the significant changes in the 2004 standard, the course begins with a review of those, including reduction in the number of climate zones, refinement of HVAC provisions, improvement of stringency of lighting power requirements and addition of an appendix with new, more flexible rules when using 90.1 for LEED certification. This course also includes an overview of the addenda added in the 2007 version and the Standard's requirements and methods for compliance. In addition to the course manual, attendees receive a discount toward the purchase of Standard 90.1-2007 and the Standard 90.1 User's Manual.

**Instructors:** McHenry Wallace and Joseph Deringer

**Saturday, January 23**  
**8:00 a.m.–3:00 p.m.**

### **Data Center Energy Efficiency**

*Rosen Shingle Creek, Sebastian L3, Level 1*

Data centers offer plenty of opportunities to save energy due to the increasing amount of the total energy used by commercial facilities. However, these increases have a downside in that they have caused a significant increase in the power required and the heat dissipated by the computing equipment. This power requirement and heat dissipation is to the point that it has become difficult to power and cool these systems in data centers and telecommunications rooms. This course examines the best practices for data center energy efficiency by focusing on thermal guidelines for data processing, datacom facility energy efficiency and actual high density data centers in operation today. Gain an understanding of equipment environment specifications while learning methods for measuring performance and developing means to evaluate effectiveness of data center cooling. Also, instructions are provided on the use of the U.S. DOE's DCPro web-based energy modeling tools for data centers. In addition to the course manual, attendees receive a discount toward the purchase of Thermal Guidelines for Data Processing Environments, Design Considerations for Datacom Equipment Center, and High Density Data Center – Case Studies and Best Practices.

**Instructors:** Roger Schmidt, Don Beaty and Jack Glass

**Saturday, January 23**  
**8:00 a.m.–3:00 p.m.**

### **The Commissioning Process in New and Existing Buildings**

*Rosen Shingle Creek, Sebastian LI, Level 1*

The fundamentals of the commissioning process through each step of a new construction project, from predesign to occupancy and operations, are presented in this course. Learn the benefits of commissioning, how the application of the commissioning process in existing facilities differs from new construction and gain an appreciation for how the process can improve the building environment, reduce environmental impacts through responsible resource utilization, improve the quality of design and construction and raise the professional reputation of the entire commissioning team. The course discusses commissioning documentation, including an overview of commissioning specifications for new construction. Attendees receive a discount toward the purchase of *ASHRAE Guideline 0-2005, The Commissioning Process*.

**Instructor:** Richard Casault

### **HALF-DAY COURSES**

**Registration fees per course:** \$119 (ASHRAE member); \$159 (nonmember).

Completion of a course earns 3 PDHs/AIA LUs or .3 CEUs (except for Successful Solar Application, which earns 2 PDHs/AIA LUs or .2 CEUs).

**For Sunday courses, a shuttle service will be offered with two departures from Rosen Shingle Creek. Departure times are 1:15 and 1:40 p.m. Return from the Convention Center will be at 5:15 and 5:40 p.m. Shuttle service will depart from the Transportation Lobby of Rosen Shingle Creek.**

**Sunday, January 24**  
**2:00 p.m.–5:00 p.m.**

### **The Basics of Panel Heating & Cooling**

*Orange County Convention Center, Room S310A*

The fundamentals of radiant panel heating and cooling, heat transfer mechanisms in operation, radiant to convective heat transfer split benefits, operative temperature control benefits, hybrid panels, comfort and energy benefits and design precautions are discussed as part of this course. Special attributes and example applications from the field are given. This course is oriented to a multi-level audience profile, ranging from lay-men to the most advanced designers, architects and HVAC engineers.

**Instructors:** Birol Kilkis and Robert Bean

**Sunday, January 24**  
**2:00 p.m.–5:00 p.m.**

### **Using Standard 90.1 to Meet LEED® Requirements**

*Orange County Convention Center, Room S310 G/H*

Appendix G—an informative appendix of 90.1, added in 2004—is the focus of this course Targeted toward design

professionals and building owners, it provides specific guidance on the rules and procedures to use to simulation building energy use when the objective is to substantially exceed the requirements of 90.1. Appendix G is especially useful for energy simulations connected with LEED credits and with energy tax credits. In addition to the course manual, attendees receive a discount toward the purchase of Standard 90.1-2007 and the Standard 90.1-2007 User's Manual.

**Instructors:** McHenry Wallace and Joseph Deringer

**Sunday, January 23**  
**2:00 p.m.–5:00 p.m.**

### **Engineering for Sustainability: Understanding Air-to-Air Energy Recovery Technologies & Applications**

*Orange County Convention Center, Room S310 B*

As we move toward net-zero energy buildings, air-to-air energy recovery provides one of the most cost-effective and efficient ways to recycle waste energy and create superior indoor environments. Unfortunately, these technologies remain underutilized and misunderstood. The course examines current and proposed standards, codes and guidelines, reviews commercially available technologies and explores how they can be employed in various configurations and applications to meet today's stringent energy and indoor environmental quality requirements. In addition to the course manual, attendees receive a discount toward the purchase of ASHRAE Standard 84-2008, Method of Testing Air-to-Air Heat Exchanges.

**Instructors:** Paul Pieper

**Sunday, January 24**  
**2:00 p.m.–5:00 p.m.**

### **Chilled Beam Technology for Excellent Indoor Climate in an Energy Efficient Manner**

*Orange County Convention Center, Room S310C/D*

Chilled beam technology and products are relatively well known in Europe. Now the ASHRAE Learning Institute is helping to bring understanding of this technology to the U.S. Participants learn the general principles of chilled beam technology and products, become better able to use chilled beam technology by taking into account the specific climate conditions and building requirements and design a chilled beam system to achieve excellent indoor climate conditions. This course provides the designer and operator with one more option to meet energy and comfort requirements.

**Instructor:** Maija Virta

**Monday, January 25**  
**2:30 p.m.–5:30 p.m.**

### **Successful Solar Applications**

*Orange County Convention Center, Room S310 A*

This course introduces sustainable design principles and provides the knowledge necessary to evaluate and implement cost-effective solar applications for commercial and industrial (C&I) facilities. It gives attendees the knowledge and skills required for the development, evaluation, procurement and installation of commercial and industrial solar projects. While



the technical focus is on cost-effective solar water heating and photovoltaic applications for C&I facilities, a wide variety of solar applications, including site-built process water and air heating, is discussed. Attendees learn to economically evaluate, procure and monitor the design and installation of a wide variety of cost-effective solar applications.

**Instructor:** H. Healey

**Monday, January 25**  
**2:30 p.m.–5:30 p.m.**

**New! District Cooling & Heating Systems: Central Plants**  
*Orange County Convention Center, Room S310B*

Design principles for an efficient and reliable district cooling/heating plant that serves multi-building facilities are described and demonstrated. The course addresses each component of equipment and the relationship with other equipment within the plant. Types of equipment and the choices available within a type such as chillers are reviewed, along with the criteria for selection. Also included is a short discussion of special applications such as thermal storage, combined heat and power and deep lake water cooling.

**Instructors:** Donald Bahnfleth and William Bahnfleth

**Monday, January 25**  
**2:30 p.m.–5:30 p.m.**

**NEW! Grooved Mechanical Piping System Technology and Design**  
*Orange County Convention Center, Room S310 F*

An introduction to grooved mechanical pipe joining technology, products and applications is provided in this course, along with comprehensive information on the design capabilities of grooved piping systems. The course reviews technical design guidelines and specification recommendations specifically related to the use of grooved piping as a means for accommodating piping system movement generated by thermal transients, as well as a cost effective alternative for attenuating noise and vibration within piping systems. Finally, the course addresses how grooved mechanical piping systems enhance safety on the jobsite and thereby reduce client risk.

**Instructor:** John Rutt

**Monday, January 25**  
**2:30 p.m.–5:30 p.m.**

**Introduction to BACnet**  
*Orange County Convention Center, Room S310 G/H*

This course helps attendees understand the elements required to successfully plan for BACnet® and the complex issues that must be addressed to achieve interoperability. Attendees learn that interoperability covers a range of possible options and how to simplify interoperability by defining specific areas where interoperability is required. Also discussed are the basic components of any multi-vendor or multi-discipline BACnet control system, how different systems can be merged together using BACnet and how BACnet facilitates the integration of older systems with BACnet-based systems. Attendees receive a discount toward the purchase of Standard 135-2001.

**Instructor:** David Fisher

**Monday, January 25**  
**2:30 p.m.–5:30 p.m.**

**The Basics of a Proposed Standard on High Performance Green Buildings (Standard 189.1)**  
*Orange County Convention Center, Room S310 C/D*

Based on proposed Standard 189.1, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Building, this course provides the minimum requirements for the design, construction and plans for operation of high-performance green buildings, including new buildings and their systems, new portions of buildings and their systems and new systems and equipment in existing buildings. Water use efficiency, indoor environmental quality, energy efficiency, site sustainability and a building's impact on the atmosphere are also covered. The course presents the goals of establishing mandatory criteria in all topical areas, providing simple compliance options and the complement of green building rating programs for Standard 189.1. Upon completion, participants have knowledge of the basic requirements of the standard, the background that led to the development of its requirements, and application of those requirements.

**Instructor:** Tom Lawrence

**Tuesday, January 26**  
**8:00 a.m.–12:00 noon**

**Healthcare Facilities—Best Practice HVAC Design Considerations and Criteria**  
*Orange County Convention Center, Room S310 C/D*

This course introduces many unique and up-to-date design considerations for various diagnostic, treatment and support areas. Common medical terms are introduced and the instructors will explain how some words have very different meanings between the medical and engineering communities. Infection particles and their transport mechanisms are covered, followed by infection control methods. Dealing with existing facilities, smoke and life-safety design issues complete the course. Attendees receive a discount on the purchase of *HVAC Design Manual for Hospitals and Clinics*.  
**Instructors:** Robert L. Cox, Daniel Koenigshofer and Michael Sheerin

**Tuesday, January 26**  
**9:00 a.m.–12:00 noon**

**Determining Energy Savings from Energy Efficiency Projects: Applying IPMVP and Guideline 14 to Performance Contracting and LEED**  
*Orange County Convention Center, Room S310 A*

An overview of measurement and verification (M&V) procedures for determining energy and cost savings is shared in this course. Intended for energy consultants, LEED professionals and facility managers, participants learn principles of baseline definition and baseline adjustment, M&V plan development, IPMVP and Guideline 14 adherence, application to energy-efficiency upgrades and performance contracting projects and application to LEED-NC and LEED-

EB for EA-5. In addition to the course manual, attendees receive a discount toward the purchase of Guideline 14-2002 – Measurement of Energy and Demand Savings.

**Instructor:** Mark Stetz

**Tuesday, January 26**  
9:00 a.m.–12:00 noon

**The Commissioning Process and Guideline 0 (co-sponsored with BCA, IESNA and NEBB)**

*Orange County Convention Center, Room S310 G/H*

This course targets building owners, facility managers, design engineers, building designers, architects, equipment manufacturers and others interested in the commissioning process as outlined in Guideline 0. The course focuses on process intent, activities and deliverables. It is intended as an entry-level course that provides attendees with a fundamental background of the ASHRAE-promoted commissioning process. Attendees receive a discount toward the purchase of *ASHRAE Guideline 0-2005, The Commissioning Process*.

**Instructor:** Walter Grondzik

**Tuesday, January 26**  
9:00 a.m.–12:00 noon

**NEW! Introduction to Cleanrooms**

*Orange County Convention Center, Room S310 B*

Ensuring that a cleanroom meets its desired cleanliness objectives requires an understanding of the key elements of cleanroom designs. These key elements are air filters, air flow management and room layout. This course presents the basic concepts of air filters and their performance, good air flow management and common room layout and designs. A good understanding of these basic concepts will be the first step in gaining proficiency in cleanroom designs and practices as well as proficiency in troubleshooting problems in cleanrooms in operation.

**Instructor:** R. Vijayakumar

**Tuesday, January 26**  
1:00 p.m.–5:00 p.m.

**Healthcare Facilities-Best Practice Applications of HVAC Systems**

*Orange County Convention Center, Room S310 C/D*

Best practice HVAC applications in healthcare facilities, including air distribution designs for surgical and patient rooms, are addressed in this course. Various control and energy efficiency techniques for cooling and heating plants are presented along with O&M and other commissioning topics. Smoke control and life safety best practices and application issues finish the course. Attendees receive a discount on the purchase of the *HVAC Design Manual for Hospitals and Clinics*.

**Instructors:** Robert L. Cox, Daniel Koenigshofer and Michael Sheerin

**Tuesday, January 26**  
2:00 p.m.–5:00 p.m.

**Understanding & Designing Dedicated Outside Air Systems (DOAS)**

*Orange County Convention Center, Room S310A*

This course presents some of the issues that emphasize the advantages of separate dedicated outdoor air systems (DOAS) and the disadvantages of delivering the ventilation via single all-air variable air volume systems. Also examined are the parallel terminal systems available, the inherent problems with VAV systems, DOAS automatic control design and operational issues in a campus building, the energy savings potential of the top HVAC technologies and the engineering design score sheet for a DOAS project.

**Instructor:** Stanley Mumma

**Tuesday, January 26**  
2:00 p.m.–5:00 p.m.

**NEW! Designing Towards Net Zero Energy Commercial Buildings**

*Orange County Convention Center, Room S310 G/H*

Net-zero energy buildings are those which, on an annual basis, use no more energy from the utility grid than is provided by on-site renewable energy sources. These buildings use 50% to 70% less energy than comparable traditional buildings. The course provides application knowledge of the design and operating principles for energy efficient buildings and available technologies and systems to achieve net-zero energy building design. Building design strategies, review of current policy and regulation, energy, environmental and economic assessment of building's performance, energy efficiency in HVAC, lighting and appliances, and on-site renewable energy sources are reviewed.

**Instructors:** Dunstan Macauley and Frank Mills

**Tuesday, January 26**  
2:00 p.m.–5:00 p.m.

**NEW! IEQ & Productivity: How to Maximize Investments in Indoor Climate (co-sponsored with REHVA)**

*Orange County Convention Center, Room S310 B*

It is important to understand that achieving improved indoor environmental quality can be balanced out, and that the additional economic benefits can be enhanced by the increased productivity and reduced health problems due to these investments. The course briefly explains the relationships between temperature, thermal discomfort, air quality, ventilation, office noise and productivity, and discusses their limitations. Case studies in hypothetical or existing office buildings are given, showing the economical benefits of different types of cooling and comparison of these benefits to the costs of these interventions.

**Instructor:** Pawel Wargocki

## ASHRAE WINTER CONFERENCE TECHNICAL PROGRAM

ORLANDO—January 2010

Earn Professional Development Hour (PDH) credits by attending sessions listed in the Technical Program. Each hour attended in a transactions 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. New York State PDHs and American Institute of Architects Learning Units (LUs) will be awarded for select sessions.

All sessions listed as starting at the same time are concurrent.

### ASHRAE'S CONFERENCES AND EXPOSITIONS COMMITTEE WELCOMES YOU TO THE 2010 WINTER CONFERENCE

Four types of sessions are presented:

**Poster Session.** Papers presented at these sessions result from research on fundamental concepts and basic theory. You are invited to comment on these papers. These one-on-one sessions allow attendees to speak directly to authors for further clarification of their data as well as for discussion of pertinent information that may not appear in the written paper. Forms for written comment are available at each poster session, and if received no later than February 12, 2010, comments will be sent to respective authors for reply and publication in *ASHRAE Transactions*. Preprints of papers and a Conference Preprints CD are available for purchase in the ASHRAE Bookstore.

**Transactions Sessions.** These sessions present papers on current applications or procedures, as well as papers resulting from research on fundamental concepts and basic theory. You are invited to comment on these papers. Forms for written comment are available at each session, and if received by February 12, 2010, comments will be sent to respective authors for reply and publication in *ASHRAE Transactions*. Preprints of papers and a Conference Preprints CD are available for purchase in the ASHRAE Bookstore.

**Seminars.** Seminars feature presentations on subjects of current interest. Papers are not available from the Society; however, PowerPoint presentations synched with audio from the presentations are posted online in the Virtual Conference. Access is free for attendees who purchase a conference registration. Additional Virtual Conference registrations can be purchased in ASHRAE Registration.

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



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



### Conference Preprints CD (All Papers on CD)

Transactions Session and Poster Session papers as presented at this Conference

\$98 (includes five FREE hard copies of preprint papers)

Available at the Conference Bookstore



### Conference Preprints (Individual Papers, In Print)

Transactions Session and Poster Session papers as presented at this Conference

\$6 each

Available at the Conference Bookstore



### ASHRAE Transactions (Print Volume)

Transactions Session and Poster Session papers with discussion questions and answers for papers in bound, library-quality form

\$119 (ships May 2010)

### Packages

Conference Preprints CD and *ASHRAE Transactions*

(See descriptions above.)

Get five FREE hard copies of preprint papers when you purchase this package

\$159

Available at the Conference Bookstore

*All prices are special conference-only member prices.*

# Sunday, January 24

All sessions for Sunday are hosted at Rosen Shingle Creek.

8:00 a.m.–9:30 a.m.

## TRANSACTIONS SESSION 1 (INTERMEDIATE)

### Natural Ventilation Applications and Principles in Transit Systems

Track: Green Buildings/Sustainability

Room: Panzacola F4

**Sponsor:** 5.9 Enclosed Vehicular Facilities, 5.1 Fans, 5.6 Control of Fire and Smoke

**Chair:** J. Greg Sanchez, P.E., Member, New York City Transit, New York, NY

This transactions reviews principles and applications of natural ventilation used in mass transit systems. As we move more towards green design, natural ventilation methods and applications have become an attractive engineering feature sought by many. This transactions will discuss how and what to take into account for natural ventilation to be a viable solution, and some examples of where and how they have been applied in the mass transit industry.

#### 1. The Design of Natural Ventilation Systems to Control Smoke Movement in Tunnels (OR-10-001)

Tom O'Dwyer, P.E., Member, Parsons Brinckerhoff, New York, NY

#### 2. Natural Ventilation in London Underground Sub-surface Lines: Modeling for Normal Operations (OR-10-002)

Mohammad Tabarra, Ph.D., Member and John Alexander, P.Eng., ARUP, London, United Kingdom

## SEMINAR 1 (INTERMEDIATE)

### Acoustics in High Performance Buildings

Track: Green Buildings/Sustainability

Room: Panzacola H1/2

**Sponsor:** 2.6 Sound and Vibration Control

**Chair:** Karl Peterman, P.E., Member, Vibro-Acoustics, Scarborough, ON, Canada

High performance building design, construction and operation has become a significant focus for many owners, contractors and engineers. As the United States and the International community at large continue to focus on the impact of buildings on the environment, it must be realized that decisions based on sustainability will also impact Indoor Environmental Quality (IEQ). While minimizing energy consumption is essential, providing an appropriate acoustical environment for the occupants is vital to ensure worker comfort and productivity. This session discusses what ASHRAE is currently doing to address this issue—

including establishing a performance measurement protocol and defining appropriate criteria for sound level and quality within buildings.

#### 1. Performance Measurement Protocol (PMP) for Commercial Buildings

Curt Eichelberger, P.E., Member, Johnson Controls, York, PA

#### 2. How to Measure HVAC System Noise in Rooms

Jerry Lilly, P.E., Member, JGL Acoustics, Issaquah, WA

#### 3. Acoustical Performance Benchmarks

Neil Moiseev, Member, Shen Milsom Wilke, New York, NY

#### 4. LEED Platinum Case Study with Innovation Credit for Acoustic Design

Kenneth P. Roy, Ph.D., Member, Armstrong World Industries, Lancaster, PA

## SEMINAR 2 (INTERMEDIATE)

### Radiant Cooling Projects for 30% Better than ASHRAE Standard 90.1-2004 Energy Use

Track: Green Buildings/Sustainability

Room: Panzacola H3/4

**Sponsor:** 6.5 Radiant and In-Space Convective Heating and Cooling

**Chair:** Michael P. O'Rourke, Member, Radiant Advantage, Highlands Ranch, CO

A variety of successfully designed radiant cooling projects that demonstrate energy use 30% better than Standard 90.1-2004 are presented.

#### 1. 30% below Standard 90.1? It's Easy—Use Radiant

Peter Simmonds, Ph.D., Fellow ASHRAE, IBE Consulting Engineers, Sherman Oaks, CA

#### 2. Decoupled Ventilation and Radiant Cooling Strategy in a University Laboratory/Classroom Building for Maximum Energy Savings

Tim McGinn, P.Eng., Member, Cohos Evamy, Calgary, AB, Canada

#### 3. David Browner Center: Radiant Cooling and other Simple and Elegant Approaches to Lowering Energy Use by 50%

Peter H. Rumsey, P.E., Member, Rumsey Engineers, Inc, Oakland, CA

## Seminar 3 (Intermediate)

### Commercial Benchmark Buildings for Research and Standards Development

Track: ASHRAE Standards

Room: Panzacola G2

**Sponsor:** 7.6 Systems Energy Utilization

**Chair:** Michael Deru, Ph.D., Member, NREL, Golden, CO



Creating complete and accurate building energy simulation models is extremely time consuming and often very frustrating. The U.S. DOE has developed a set of 16 standard benchmark building energy simulation models for new and existing buildings for use in commercial building research and standards development. DOE and other researchers are using the benchmark buildings for research on specific building technologies, energy code development, appliance standards, advanced energy design guides, and measurement of progress toward DOE net-zero energy goals. ASHRAE is using the benchmark models for Standard 90.1 evaluation and development. All assumptions and data sources for each of the 16 buildings are fully documented. This documentation along with energy simulation (EnergyPlus) inputs and summary results are publicly available.

**1. Benchmark Buildings and Models: Concept and Structure**

*Drury Crawley, Ph.D., Member, DOE, Washington, DC*

**2. Development of the Benchmark Building Models**

*Michael Deru, Ph.D., Member, NREL, Golden, CO*

**3. Using the Benchmark Building Models for Standard 90.1 Development**

*Bing Liu, Member, PNNL, Richland, WA*

**SEMINAR 4 (INTERMEDIATE)** 

**Ensuring the Performance of Your UFAD System: TAB, Return Air and Humidity Control Best Practices**

Track: Humidity Control

Room: Panzacola F2

Sponsor: TRG7 Underfloor Air Distribution (UFAD)

Chair: Jim Vallort, Member, Environmental System Design, Chicago, IL

The presentations focus on the performance aspects of underfloor air distribution systems. The control of humidity with an underfloor air system is critical as the design often stipulates a warmer discharge air temperature. The design of the return airflow is discussed and provides designers the basic tools and practical real world examples of design options. The presentations also address the start-up and verification of system performance via test and balance procedures for an underfloor air distribution system.

**1. Humidity Control in Occupied Spaces with UFAD Systems**

*Michael McQueeney, P.E., Member, AirFixture, Kansas City, KS*

**2. Return Air Design for UFAD Systems**

*Jim Megerson, P.E., Member, Larson Binkley, Inc., Overland Park, KS*

**3. TAB for UFAD**

*Gaylon Richardson, Member, Engineered Air Balance Co., Inc, Houston, TX*

**SEMINAR 5 (INTERMEDIATE)**

**Sustainability Enhancements for Commercial Refrigeration Equipment**

Track: Refrigeration

Room: Panzacola F3

Sponsor: 10.7 Commercial Food and Beverage Cooling Display and Storage

Chair: Robert D. Tanner, Member, Product Management, Hill Phoenix, Colonial Heights, VA

Both recent and pending legislation regarding energy efficiency levels for commercial refrigeration equipment have accelerated the development of performance and design enhancements promoting sustainability through increased energy efficiency. This program presents the evaluation of different design approaches utilized to increase energy efficiency and water conservation.

**1. Performance Comparison of Three High Efficiency Open Vertical Display Cases**

*Ramin Faramarzi, P.E., Member, Technology Test Centers, Southern California Edison, Irwindale, CA*

**2. Comparison of a Open Refrigerated Display Case to a Glass-Door Refrigerated Display Case**

*Brian Fricke, Ph.D., Member, and Bryan R. Becker, Ph.D., P.E., Fellow ASHRAE, University of Missouri-Kansas City, Kansas City, MO*

**3. Opportunities for Load Shifting with Cube Type Ice Makers**

*David Cowen, Member, Food Service Technology Center, San Ramon, CA*

**4. Energy Performance Comparison: Nugget vs. Cube Type Ice Makers**

*Devin Rauss, Member, Southern California Edison, Irwindale, CA*

**SEMINAR 6 (INTERMEDIATE)** 

**Energy Conservation Impact of Common Maintenance Strategies for Packaged Rooftop Units**

Track: Energy Conservation and Alternative Energy Sources/Solutions

Room: Panzacola F1

Sponsor: 8.11 Unitary and Room Air Conditioners and Heat Pumps, 8.4 Air-to-Refrigerant Heat Transfer Equipment

Chair: Ram Narayanamurthy, Member, PVT Solar, Inc, Berkeley, CA

Small packaged rooftop units have long been the step-child of the air conditioning industry because of their market segment. In most cases, these are installed by low-bid contracts and are essentially allowed to run till they break, when they are thrown away and replaced. However, during their lifetime, they degenerate into energy hogs because of simple maintenance issues such as stuck economizers, small refrigerant leaks and blocked coils. The seminar focuses on experimental data that looks at how we can improve energy

management of these rooftop units through common or advanced maintenance strategies. Some of the items covered include, proper economizer operation, duct straightening, charge tuning and advanced ventilation packages to reduce energy consumption and create a healthier environment.

**1. An Experimental Approach to Quantify Effects of Common Maintenance Strategies for a 5-ton RTU**

*Ramin Faramarzi, Ph.D., Member, Southern California Edison, Irwindale, CA*

**2. Premium Ventilation Package: Big RTU Savings**

*Reid Hart, Ph.D., Member, PECEI, Portland, OR*

**3. Performance Mapping of Packaged Rooftop Units**

*Eric Kozubal, Member, National Renewable Energy Labs, Golden, CO*

**4. Performance of Packaged Rooftop Systems Designed for Western Climates**

*Mark Modera, Ph.D., Member, University of California, Davis, Davis, CA*

**SEMINAR 7 (INTERMEDIATE)** 

**Don't Let your BIM Go 'BOOM!': Dealing with the Liability Issues of BIM**

Track: Building Information Modeling

Room: Panzacola G1

**Sponsor:** 1.7 Business, Management & General Legal Education, 1.5 Computer Applications, 7.1 Integrated Building Design

**Chair:** E. Mitchell Swann, P.E., Member, MDC Systems, Paoli, PA

Like the wave of green that has been spreading throughout the “built environment” another often heard leader in the ‘tools of the trade’ is building information modeling or “BIM”. BIM offers the opportunity to collect, analyze and share information across the project team in an unprecedented fashion. This interoperability can blur the lines between traditional project roles and responsibilities. The key advantage of BIM is the rapid sharing of ideas and evaluations of design and construction options to find optimized solutions. But haste can sometimes make waste and crossing traffic disciplines can create traffic jams. This session looks at BIM from a legal perspective to help keep your BIM from going “boom.”

**1. Putting BIM in Perspective: A Proactive Approach to Liability Issues**

*Kristine A. Kubes, Esq., J.D., Kube Law Firm, Minneapolis, MN*

**2. This Had Better Be Good! (Owner Expectations in the World of BIM)**

*Stephen del Percio, Esq., J.D., Arent Fox LLP, New York City, MN*

**3. It Seemed Like a Good Idea at the Time (Case Histories of BIM that Went ‘Boom’)**

*E. Mitchell Swann, PE, FCIBSE, P.E., Member, MDC Systems, Paoli, PA*

9:45 A.M.–10:45 A.M.

**TECHNICAL PLENARY**

**H1N1—What Can Ventilation Do?**

Track: IAQ/Comfort

Room: Panzacola G1

**Sponsor:** Environmental Health Committee

**Chair:** Hal Levin, Fellow ASHRAE, Building Ecology Research Group, Santa Cruz, CA

**Keynote Speaker:** Yuguo Li, Ph.D., Fellow ASHRAE, Hong Kong University, Hong Kong, China

Can influenza virus such as 2009 A (H1N1) be transmitted by the airborne route? How important is building ventilation as compared to vaccination and quarantine in infection control? SARS, avian flu and 2009 A(H1N1) viruses might have jumped from animals or birds to human, but it is mostly in buildings that these viruses can spread among us. The 2009 A(H1N1) influenza pandemic has become a new reminder for the possible rapid spread of emerging respiratory infectious diseases in modern built environment. Lower respiratory infections and tuberculosis still are and will remain among the top 7 causes of world disease burden in the near future. Since the 2003 SARS epidemic, there has been a renewed interest in engineering control of respiratory airborne infection such as building ventilation. In this talk, we will revisit the fascinating evolution of our understanding of airborne infection and ventilation, and what we can learn from it, the basic and evolving concepts of airborne transmission and droplet transmission, examples of large SARS and 2009 A(H1N1) outbreaks, the importance of body microenvironment, the effectiveness of ventilation, UVGI and HEPA, emerging issues such as new ventilation technologies, implications for commissioning and maintenance, and finally suggestions of the important roles that ASHRAE community can play in collaboration with WHO and CDC.

11:00 A.M.–12:30 P.M.

**TRANSACTIONS 2 (INTERMEDIATE)**  

**High Density Cooling Issues Update**

Track: Energy Conservation and Alternative Energy Sources/Solutions

Room: Panzacola F4

**Sponsor:** 9.9 Mission Critical Facilities, Technology Spaces and Electronic Equipment

**Chair:** Ecton English, Member, Department of Defense, Ft. Meade, MD

Cooling of high-density electronic equipment installations such as data centers and telecommunication facilities are addressed. Data center power densities of 400 watts per square foot or higher are increasingly commonplace. The papers in this session will aid the engineer with some methods to reduce energy usage in a data center.

**1. Top-Level Energy and Environmental Dashboard for Data Center Monitoring (OR-10-003)**

Magnus Herrlin, Ph.D., Member, ANCIS Incorporated, San Francisco, CA and Craig Compiano, Associate Member, Modius, Inc., Oakland, CA

**2. System Architectures and Fluids for High Heat Density Cooling Solutions (OR-10-004)**

Lennart Stahl, Member, Emerson, McKinney, TX

**3. Cold Aisle Containment Re-thinking The Data Center Space (OR-10-005)**

Herb Villa, Member, Switch & Data Corp., Tampa, FL

**TRANSACTIONS 3 (INTERMEDIATE)**   

**Simulation Tools for Evaluating Control Algorithms and Diagnostic Methods for Air-handling Units**

Track: Energy Conservation and Alternative Energy Sources/Solutions

**Room: Panzacola F2**

**Sponsor:** 7.5 Smart Building Systems

**Chair:** John House, Ph.D., Member, Johnson Controls, Inc., St-Leonard, QC, Canada

Modeling and simulation aid the development of technologies and processes that help assure the energy efficient operation of HVAC&R components and systems. This session will present models and simulation platforms that build on the results of several ASHRAE research projects conducted over the past 15 years.

**1. The Virtual Cybernetic Building Testbed: A Building Emulator (OR-10-006)**

Mike Galler, Member, National Institute of Standards and Technology, Gaithersburg, MD

**2. Development and Validation of a Dynamic Air Handling Unit Model, Part 1 (RP-1312)(OR-10-007)**

Jin Wen, Ph.D., Member, Drexel University, Philadelphia, PA

**3. Development and Validation of a Dynamic Air Handling Unit Model, Part 2 (RP-1312)(OR-10-008)**

Jin Wen, Ph.D., Member, Drexel University, Philadelphia, PA

**SEMINAR 8 (BASIC)**

**Centrifugal Chiller Maintenance for Sustainability**

Track: Green Buildings/Sustainability

**Room: Panzacola H1/2**

**Sponsor:** 8.2 Centrifugal Machines

**Chair:** Saunders Smith, Member, AHRI, Arlington, VA

In keeping with the ASHRAE Theme for the 2010 Orlando conference “Humidity and Sustainable Indoor Environment,” case studies of centrifugal chiller maintenance improvements for higher-performing chillers are presented.

**1. Improve Performance of Chilled Water System: A Case Study**

V. P. Gupta, Member, 3M Company, Saint Paul, MN

**2. Case Study**

Forrest S. Yount, Member, Carrier, Charlotte, NC

**3. Chiller Maintenance for Sustainability**

John Vucci, Member, University of Maryland, College Park, MD

**SEMINAR 9 (INTERMEDIATE)**

**Energy and Environmental Implications of Water to Water Heat Pumps in Commercial and Industrial Applications, Part 2**

Track: Energy Conservation and Alternative Energy Sources/Solutions

**Room: Panzacola H3/4**

**Sponsor:** 9.4 Applied Heat Pump/Heat Recovery Systems, 6.8 Geothermal Energy Utilization

**Chair:** Jeff Smith, Member, Georgia Power Company, McDonough, GA

This seminar addresses the direct financial impacts of water to water heat pumps; the emerging value of tax credits, carbon footprint reductions and consideration as a renewable energy source. Speakers identify where energy and environmental benefits exist and how they are calculated.

**1. A Commercial Application of Water to Water Heat Pumps**

Scott Hutto, Member, Gulf Power Company, Pensacola, FL

**2. An Industrial Application of Water to Water Heat Pumps**

Frank Pucciano, Member, Capture Energy Solutions, Lilburn, GA

**3. Applying for and Selling of Environmental Attributes from Water to Water Heat Pumps**

Alden Hathaway, Member, Sterling Planet, Norcross, GA

**SEMINAR 10 (BASIC)**

**Noise and the Mechanical System Design Process**

Track: IAQ/Comfort

**Room: Panzacola G1**

**Sponsor:** 2.6 Sound and Vibration Control

**Chair:** Robert Lilkendey, Associate Member, Siebein Associates, Inc., Gainesville, FL

Noise from mechanical systems can be a major source of complaints in buildings of all types. Many of the noise problems that arise in buildings can be avoided by following well established acoustical design principles and guidelines. This seminar is intended to assist the mechanical engineer in understanding where to access valuable acoustical design information and ways to avoid common noise problems in system design. A case study of how these principles were successfully employed on a very noise sensitive NICU project is presented.

**1. The ASHRAE HVAC Applications Handbook: What Building Owners and Engineers Should Know About Noise and Vibration**

Steve Wise, Associate Member, Wise Associates, Madison, WI

**2. Common Acoustical Pitfalls, Misconceptions and Problems in Mechanical System Design**

Neil Moiseev, Member, Shen Milsom & Wilke, LLC, New York, NY

**3. Case Study: HVAC System Design Concept for a Hospital Neonatal Intensive Care Unit (NICU) Addition**



Rolando Alvarez, M. Skene, Associate Member; Smith Seckman Reid, Inc., Sarasota, FL and Robert Lilkendey, Associate Member; Siebein Associates, Inc., Gainesville, FL

**SEMINAR 11 (BASIC)** 

**Background on Load Calculations Methodologies (Past and Present); Current ASHRAE Information (Handbook and Publications)**

Track: Load Calculations

**Room: Panzacola F3**

**Sponsor:** 4.1 Load Calculation Data and Procedures, 4.2 Climatic Information

**Chair:** Glenn Friedman, P.E., Member, Taylor Engineering, Alameda, CA

Loads are the fundamental foundation of HVAC design. The load calculations chapters of the *ASHRAE Handbook—Fundamentals* volume, have been updated and improved. This seminar covers some of these load calculations improvements.

**1. New Data on Radiant/Convective Splits**

Jeffrey D. Spitzer, Ph.D., P.E., Fellow ASHRAE, Oklahoma State University, Stillwater, OK

**2. Applying Revised Climatic Design Data to Load Calculations**

Charles Barnaby, Member, Wrightsoft Corporation, Lexington, MA

**3. Updated Office Equipment Heat Gain Data from Research Project RP-1482**

Mohammad Hosni, Ph.D., Fellow ASHRAE, Kansas State University, Manhattan, KS

**SEMINAR 12 (INTERMEDIATE)** 

**Writing and Executing Functional Performance Tests**

Track: Commissioning

**Room: Panzacola G2**

**Sponsor:** 7.9 Building Commissioning

**Chair:** Mike Eardley, P.E., Member, Cannon Design, Boston, MA

Functional performance testing is a major activity of the commissioning process and is required to ensure that high performance design leads to a high performance building. Commissioning and functional testing typically focuses on the HVAC system because this system is one of the most complex and highest energy using in the building, often requires fine tuning to achieve the objectives of the designer, and the sequences or intent is often misunderstood by the installer or operator. Functional performance testing begins by ensuring that the equipment, components, and accessories specified and submitted for a project are installed in a building and operating correctly. Seemingly straightforward concepts such as heating, cooling, and air-side economizer can have a series of associated complex tests to verify the system reacts in the correct manner and with the proper sequence of events to achieve the intended energy efficient operation.

**1. Functional Performance Testing for Energy Efficiency**

Mike Eardley, P.E., Member; Cannon Design, Boston, MA

**2. Functional Testing: From Basics to Critical Facilities**

Reinhard Seidl, P.E., Member; Taylor Engineering, Alameda, CA

**SEMINAR 13 (BASIC)**

**Using the Web to Improve Learning and Working for Building Professionals**

Track: Fundamentals

**Room: Panzacola F1**

**Sponsor:** TC 1.5, Computer Applications

**Chair:** Tim Dwyer, Fellow ASHRAE, London South Bank University, London, United Kingdom

The need for properly educated HVAC&R professionals has never been greater at the same time as the tools to share information virtually over the Internet have become more accessible. The demands of a low carbon future requires building professionals to be able to access and share information so that they can not only improve skills but communicate and swap ideas. Internet and web based technologies can achieve this. This seminar provides real world examples of how this is practically being done—methods that can be used to address a global need for HVAC&R education and communication whilst limiting environmental cost as well as saving time and money.

**1. Practical Lessons Learnt from Setting Up and Using Web Meetings for Business Advantage**

Benjamin Skelton, P.E., Member, WMA Consulting Engineers, Chicago, IL

**2. The Virtual Professor: Converting Traditional Courses to eLearning**

Richard Hayter, Ph.D., P.E., Presidential Fellow Member, Kansas State University, Manhattan, KS

**3. Web-Enabled HVAC Systems for Collaborative Teaching and Research**

William Hutzell, Member, P.E., Purdue University, West Lafayette, IN

**1:30 P.M.–3:00 P.M.**

**TRANSACTIONS 4 (INTERMEDIATE)**   

**Cleanroom Airflow Rate Modeling, Humidity and Airborne Contamination Controls**

Track: Energy Conservation and Alternative Energy Sources/Solutions

**Room: Panzacola G1**

**Sponsor:** 9.11 Clean Spaces

**Chair:** Wei Sun, Ph.D., P.E., Member, Engsysco Inc., Ann Arbor, MI

For decades the required airflow rate in cleanroom has been often determined by experience instead of calculation, this existing approach could cause significant energy waste as widely reported. Latest modeling approach has well correlated with field measurements by utilizing the improved

sensing technologies, a CEC-funded research report will be presented. Modern operating rooms are increasingly turning to contamination control by cleanroom technologies for the infectious control. Strategic approaches for a selected full-scale hospital operating room will be presented which resulted in improved airflow distribution and contamination control performance with less cost. Comparison between field measurement data (particle and microbial counts) and CFD simulations will also be provided. Performance of various direct and indirect humidification approaches in a large-scale cleanroom in hot and humid climates has been studied in terms of relative humidity distribution, range of RH variations and energy consumptions under various outdoor air intake conditions.

**1. Performance Investigation for the Cleanroom Contamination Control Strategy in an Operating Room (OR-10-009)**

*Wang Fu-Jen, P.E., Ph.D., National Chin-Yi University of Technology, Taichung, Taiwan*

**2. Cleanroom Exhaust Energy Recovery Optimization Design (OR-10-010)**

*Shih-Cheng Hu, P.E., Ph.D., National Taipei University of Technology, Taipei, Taiwan*

**3. Development of Cleanroom Required Airflow Rate Model Based on Establishment of Theoretical Basis and Lab Validation (OR-10-011)**

*Wei Sun, P.E., Ph.D., Member, Engsysco Inc., Ann Arbor, MI*

**SEMINAR 14 (ADVANCED)**

**Advancements in AC&R Sustainability in Building Applications**

Track: Green Buildings/Sustainability

Room: Panzacola H1/2

**Sponsor:** Refrigeration Committee, 3.1 Refrigerants and Secondary Coolants, 8.1 Positive Displacement Compressors, 10.7 Commercial Food and Beverage Cooling Display and Storage

**Chair:** *Georgi S. Kazachki, Ph.D., Fellow ASHRAE, CRYOTHERM/DRS-SSI, Atlanta, GA*

A substantial portion of commercial building sustainability is the development and operation of sustainable air-conditioning and refrigerating equipment inclusive of the refrigerant selection and their efficient operation. The presentations address these important aspects of building sustainability with state-of-the art information on the sustainable use of natural refrigerants.

**1. Back to the Future? Environmental Impact of Retrofitting CO<sub>2</sub> Refrigeration for Heating and Cooling of Existing Buildings and Applications to New Buildings**

*Klaas Visser, P.E., Member, KAV Consulting Pty Ltd, Kangaroo Flat, VIC, Australia*

**2. Sustainable Use of Refrigerants in Supermarket Applications**

*Rainer Grosse-Kracht, P.E., Member, Bitzer Kuehlmaschinenbau GmbH, Rottenburg-Ergenzingen, GERMANY*

**3. R718-Water as Refrigerant**

*Norbert Müller, Dr. Ing., Member, Michigan State University, East Lansing, MI*

**4. Low-GWP Refrigerants in Secondary-Loop Systems**

*Yunho Hwang, Member, Ph.D., University of Maryland, College Park, MD*

**SEMINAR 15 (INTERMEDIATE)**



**What Does A Large Building Operator Need to Know about the SmartGrid while the Grid Is Still in School?**

Track: Energy Conservation and Alternative Energy Sources/Solutions

Room: Panzacola H3/4

**Sponsor:** 1.9 Electrical Systems

**Chair:** *Lawrence Markel, Fellow ASHRAE, Sentech, Inc., Knoxville, TN*

There has been much talk about the SmartGrid and its interaction with buildings, especially net zero energy buildings. This seminar introduces the ASHRAE membership to the functions the SmartGrid is expected to have, how they matter to building operators and building control designers, and what you can do right away to take advantage of the “moderately intelligent grid” to reduce your energy costs.

**1. What Is the SmartGrid? What Functions Will Help A Building Operator? What Could Hurt?**

*Lawrence C. Markel, Fellow ASHRAE, Sentech, Inc., Knoxville, TN*

**2. Nationwide, Some Grids Are Smarter than Others: Status of SmartGrid Initiatives and Federal Policies**

*Steve Rosenstock, Member, Edison Electric Institute, Washington, DC*

**3. What Your Building can Learn from the Grid Now: Using a Utility Web Based Energy Management System To Control Your Energy Purchases and Energy Use**

*Steven Faulkner, Member, Georgia Power Company, Atlanta, GA*

**4. How Energy Use Data Available Right Now can Make Your Building More Efficient**

*Frank Pucciano, Member, Capture Energy Solutions, Atlanta, GA*

**SEMINAR 16 (BASIC)**

**Implementing and Assessing Your Wireless Sensing and Control Network**

Track: Fundamentals

Room: Panzacola G2

**Sponsor:** 7.5 Smart Building Systems


**Chair:** *William Healy, Ph.D., Member, NIST, Gaithersburg, MD*

Wireless networks promise to ease the installation of sensors and actuators in a building by eliminating wiring costs and allowing for a larger number of sensing and actuating points. Despite the promise of wireless networks, there use

# 2010 ASHRAE Winter Conference - January 23-27 - Orlando, FL

Program Tracks	SUNDAY JANUARY 24th	MONDAY JANUARY 25th	TUESDAY JANUARY 26th	WEDNESDAY JANUARY 27th
<b>ASHRAE Standards</b>	<b>Seminar 3</b> Commercial Benchmark Buildings for Research and Standards Development Rm Panzocola G2 8:00am-9:30am	<b>Seminar 22</b> Standard 189.1P Overview - Part 1 Rm Panzocola G2 8:00am-9:30am   <b>B</b> <sup>NY PDH</sup> <b>Seminar 30</b> Standard 189.1P Overview - Part 2 Rm Panzocola G2 9:45am-10:45am   <b>B</b> <sup>NY PDH</sup> <b>Forum 5</b> Refrigerant Safety Classification 2L: What Do We Do with It? Rm Panzocola G2 11:00am-12:00pm   <b>A</b>	<b>Forum 8</b> Cleanroom Should Gas-Phase Filtration be a Typical Application in Standard 62? Rm Panzocola G2 9:45am-10:45am	<b>Program Session Ratings</b> <b>A</b> =Advanced <b>B</b> =Basic <b>I</b> =Intermediate <b>NY PDH</b> = Approved for NY PDHs and AIA LUs
<b>Building Information Modeling</b>	<b>Seminar 7</b> Don't Let your BIM Go 'BOOM!': Dealing with the Liability Issues of BIM Rm Panzocola G1 8:00am-9:30am   <b>I</b> <sup>NY PDH</sup>	<b>Seminar 24</b> BIM to SIM - Technology Update Rm Panzocola G1 8:00am-9:30am   <b>I</b> <sup>NY PDH</sup>	<b>Seminar 36</b> Which BIM Interoperability Schemas Are Most Appropriate for Different Types of Building Energy Design Rm Panzocola H1/2 8:00am-9:30am   <b>I</b> <sup>NY PDH</sup>	<b>Seminar 73</b> BIM Beyond Design and Construction Rm Panzocola F4 11:00am-12:30pm   <b>I</b> <sup>NY PDH</sup>
<b>Commissioning</b>	<b>Seminar 12</b> Writing and Executing Functional Performance Tests Rm Panzocola G2 11:00am-12:30pm   <b>I</b> <sup>NY PDH</sup>	<b>Forum 4</b> Systems Manuals: What should be included in Guideline 1.4 on Developing Systems Manuals for the Commissioning Process Rm Panzocola G1 11:00am-12:00pm	<b>Workshop</b> Construction Management Rm S310E 2:00pm-3:00pm	<b>Seminar 44</b> Commissioning for Refrigeration Systems: The Possibilities Rm Panzocola F3 9:45am-10:45am   <b>B</b> <sup>NY PDH</sup>
<b>Energy Conservation and Alternative Energy Sources/Solutions</b>	<b>Seminar 2</b> Radiant Cooling Projects for 30% Better than 90.1 2004 Energy Use Rm Panzocola H3/4 8:00am-9:30am   <b>Seminar 6</b> Energy Conservation Impact of Common Maintenance Strategies for Packaged Rooftop Units Rm Panzocola F1 8:00am-9:30am   <b>I</b> <sup>NY PDH</sup> <b>Transactions 2</b> High Density Cooling Issues Update Use Rm Panzocola F4 11:00am-12:30pm   <b>Transactions 3</b> Simulation Tools for Evaluating Control Algorithms and Diagnostic Methods for Air-handling Units Rm Panzocola F2 11:00am-12:30pm	<b>Seminar 9</b> Energy and Environmental Implications of Water to Water Heat Pumps in Commercial and Industrial Applications, Part 2 Rm Panzocola H3/4 11:00am-12:30pm   <b>Transactions 4</b> Cleanroom Airflow Rate Modeling, Humidity and Airborne Contamination Controls Rm Panzocola G1 1:30pm-3:00pm   <b>Seminar 15</b> What Does A Large Building Operator Need to Know about the SmartGrid while the Grid Is Still in School? Rm Panzocola H3/4 1:30pm-3:00pm   <b>I</b> <sup>NY PDH</sup>	<b>Transactions 5</b> Climate Impact on Data Center Energy Efficiency Rm Panzocola H1/2 8:00am-9:30am   <b>Seminar 27</b> Advance Energy Design Guide - Small Hospitals and Health Care Facilities Rm Panzocola F4 8:00am-9:30am   <b>I</b> <sup>NY PDH</sup> <b>Seminar 29</b> Effective Design and Operation of Thermal Energy Storage Systems in Hot and Humid Climates Rm Panzocola F3 9:45am-10:45am   <b>B</b>	<b>Seminar 32</b> Recent Developments of the European Energy Regulations and Standards, Part 1 Rm Panzocola H3/4 9:45am-10:45am   <b>A</b> <b>Transactions 6</b> Recent Advances in Thermal Storage Rm Panzocola F4 11:00am-12:00pm   <b>Seminar 35</b> Recent Developments of the European Energy Regulations and Standards, Part 2 Rm Panzocola H3/4 11:00am-12:00pm   <b>A</b>
<b>Fundamentals</b>	<b>Seminar 13</b> Using the Web to Improve Learning and Working for Building Professionals Rm Panzocola F1 11:00am-12:30pm   <b>B</b> <b>Seminar 16</b> Implementing and Assessing Your Wireless Sensing and Control Network Rm Panzocola G2 1:30pm-3:00pm   <b>B</b>	<b>Seminar 18</b> First Time at an ASHRAE Conference? Rm Panzocola F4 1:30pm-3:00pm   <b>B</b>	<b>Seminar 31</b> Sustaining the Building Envelope During High Wind Events Rm Panzocola G1 9:45am-10:45am   <b>I</b> <b>Forum 2</b> Research Strategic Plan 2010-2015: Does this Draft Meet Our Needs? Rm Panzocola F1 9:45am-10:45am   <b>B</b>	<b>Seminar 40</b> HVAC&R Research Journal, Part 1: Fluid Flow Challenges Rm Panzocola F4 8:00am-9:30am   <b>A</b> <b>Seminar 45</b> HVAC&R Research Journal, Part 2: Thermodynamic Properties Rm Panzocola F4 9:45am-10:45am   <b>A</b> <b>Workshop</b> Cost/Benefit Analysis Methodology and Tools Needed by Owners Rm S310E 2:00pm-3:00pm
<b>Green Buildings/Sustainability</b>	<b>Transactions 1</b> Natural Ventilation Applications and Principles in Transit Systems Rm Panzocola F4 8:00am-9:30am   <b>Seminar 1</b> Acoustics in High Performance Buildings Rm Panzocola H1/2 8:00am-9:30am   <b>I</b> <sup>NY PDH</sup>	<b>Seminar 8</b> Centrifugal Chiller Maintenance for Sustainability Rm Panzocola H1/2 11:00am-12:30pm   <b>B</b> <b>Seminar 14</b> Advancements in AC&R Sustainability in Building Applications Rm Panzocola H1/2 1:30pm-3:00pm   <b>A</b>	<b>Seminar 21</b> Sustainability Case Studies in Hospitality and Foodservice Facilities Rm Panzocola H3/4 8:00am-9:30am   <b>Forum 3</b> The Path to Zero-Net Energy Supermarkets Rm Panzocola H1/2 9:45am-10:45am   <b>Forum 6</b> Solving Moisture Problems Created by Energy Retrofits Rm Panzocola H1/2 11:00am-12:00pm	<b>Seminar 42</b> Climate Change: Implications for ASHRAE Engineers Rm Panzocola H3/4 8:00am-9:30am   <b>Seminar 43</b> How to Assess the Performance of Sustainable Buildings Rm Panzocola H1/2 9:45am-10:45am   <b>I</b> <sup>NY PDH</sup> <b>Seminar 41</b> Measuring Humidity: Does Accuracy Matter? Rm Panzocola F2 8:00am-9:30am   <b>Transactions 8</b> Achieving Required Humidity for Preservation Environments Rm Panzocola F2 9:45am-10:45am   <b>I</b> <sup>NY PDH</sup>
<b>Humidity Control</b>	<b>Seminar 4</b> Ensuring the Performance of Your UFAD System: TAB, Return Air and Humidity Control Best Practices Rm Panzocola F2 8:00am-9:30am   <b>I</b> <sup>NY PDH</sup>	<b>Seminar 17</b> Case Studies of Florida Labs: Designing and Building in a Humid Environment Rm Panzocola F2 1:30pm-3:00pm   <b>I</b> <sup>NY PDH</sup>	<b>Seminar 23</b> Humidity Control using Heat Pipes for Commercial Applications Rm Panzocola F2 8:00am-9:30am   <b>Seminar 34</b> Enhanced Dehumidification Strategies with Energy Recovery in Hot Humid Climates Rm Panzocola F2 11:00am-12:00pm   <b>I</b> <sup>NY PDH</sup> <b>Seminar 28</b> Operating Cost Implications In Humid Environments Rm Panzocola F2 9:45am-10:45am   <b>I</b> <sup>NY PDH</sup>	<b>Seminar 50</b> Humidity Control Issues and Solutions for High Performing Buildings Rm Panzocola F2 11:00am-12:30pm   <b>I</b> <sup>NY PDH</sup> <b>Seminar 58</b> Crawlspace Humidity and Moisture Performance in Hot-Humid and Mixed Climates Rm Panzocola F2 8:00am-9:30am   <b>I</b> <sup>NY PDH</sup> <b>Seminar 72</b> Lessons from the School of Hard Knocks: The Revised ASHRAE Guide for Buildings in Hot & Humid Climates Rm Panzocola F2 11:00am-12:30pm   <b>I</b> <sup>NY PDH</sup>
<b>IAQ/Comfort</b>	<b>Technical Plenary H1N1</b> -- What Can Ventilation Do? Rm Panzocola G1 9:45am-10:45am   <b>B</b>	<b>Seminar 10</b> Noise and the Mechanical System Design Process Rm Panzocola G1 11:00am-12:30pm   <b>B</b>	<b>Seminar 38</b> Modeling of Particle Transport in Indoor Environments Rm Panzocola G1 9:45am-10:45am   <b>B</b> <b>Seminar 39</b> Defining the Contribution of Fans in Achieving the Goals of ASHRAE Std 90.1 Rm Carroll Ford 9:45am-10:45am   <b>Transactions 9</b> Contamination Issues in Datacom Environments Rm Panzocola G1 11:00am-12:30pm	<b>Seminar 59</b> Humidity and Air Quality in Specialist Museums and Galleries Rm Panzocola G1 8:00am-9:30am   <b>A</b> <sup>NY PDH</sup> <b>Seminar 61</b> What's New About the New Indoor Air Quality Guide? Rm Panzocola G2 8:00am-9:30am   <b>I</b> <sup>NY PDH</sup> <b>Seminar 77</b> Impact of Ventilation Air Strategies on Ground Source Heat Pump Systems
<b>Load Calculations</b>	<b>Seminar 11</b> Background on Load Calculations Methodologies (Past and Present); Current ASHRAE Information (Handbook and Publications) Rm Panzocola F3 11:00am-12:30pm   <b>B</b> <sup>NY PDH</sup>	<b>Seminar 19</b> Following Latent Loads through the Cold Chain Rm Panzocola F3 1:30pm-3:00pm   <b>B</b>	<b>Seminar 33</b> Recent ASHRAE Research on Load Calculations: Cooling Load Methodologies for Under Floor Air Distribution Equipment Rm Panzocola F3 11:00am-12:00pm   <b>I</b> <sup>NY PDH</sup>	<b>Poster Session</b> Rm Gaitlin D 11:00am-1:00pm
<b>Professional Skills</b>	<b>Seminar 20</b> Selling Yourself In Interviews and Presentations Rm Panzocola F1 1:30pm-3:00pm   <b>B</b>	<b>Seminar 26</b> Increase the Impact of Your ASHRAE Presentation Rm Panzocola F1 8:00am-9:30am	<b>Seminar 38</b> Design For Hazardous Exhaust Conditions Rm Jones 9:45am-10:45am   <b>Seminar 39</b> Defining the Contribution of Fans in Achieving the Goals of ASHRAE Std 90.1 Rm Carroll Ford 9:45am-10:45am   <b>Seminar 46</b> ASHRAE Member's Survival Guide: Billing and Collection Practices To Insure You Get What You Deserve, Part 1 Rm Panzocola F1 9:45am-10:45am   <b>A</b> <b>Seminar 53</b> ASHRAE Member's Survival Guide: Billing and Collection Practices To Insure You Get What You Deserve, Part 2 Rm Panzocola F1 11:00am-12:30pm   <b>B</b>	<b>Seminar 68</b> Best Practices Toolkit for MEP Professionals Rm Panzocola F1 9:45am-10:45am
<b>Refrigeration</b>	<b>Seminar 5</b> Sustainability Enhancements for Commercial Refrigeration Equipment Rm Panzocola F3 8:00am-9:30am	<b>Seminar 25</b> Energy, Water and Sound: Improvements in Cooling Tower Design to Optimize Equipment Efficiencies Rm Panzocola F3 8:00am-9:30am   <b>I</b> <sup>NY PDH</sup>	<b>Seminar 39</b> Comparing Refrigeration Loads: Peak Calculations, Hourly Simulation and Actual Operation Rm Panzocola F3 8:00am-9:30am   <b>B</b> <sup>NY PDH</sup> <b>Seminar 51</b> Modeling and Characterization of Transport Refrigeration Unit Rm Panzocola F3 11:00am-12:30pm	<b>Seminar 60</b> Advances in Refrigerants and Secondary Coolants Rm Panzocola F3 8:00am-9:30am   <b>Seminar 75</b> Recent Advances in Heat Transfer and Fluid Flow Rm Panzocola F3 11:00am-12:30pm   <b>A</b>

**ASHRAE Learning Institute Courses**



Register for courses individually; they are not included with the conference registration. All courses are approved for NY PDHs and AIA LUs and CEUs.

**Saturday, January 23rd**  
Rosen Shingle Creek Hotel 8am-3pm

- Complying with ASHRAE Std 62.1-07
- Energy Mgt in New & Existing Bldgs: A Sustainable Activity NEW
- Complying with ANSI/ASHRAE/IESNA Std 90.1-07
- Data Center Energy Efficiency
- The Commissioning Process in New & Existing Bldgs.

**Sunday, January 24th**  
Orange County Convention Center 2:00pm-5:00pm

- The Basics of Panel Heating & Cooling
- Using Std 90.1 to Meet LEED Requirements
- Engineering for Sustainability: Understanding Air-to-Air Energy Recovery Technologies & Applications NEW
- Chilled Beam Technology for Excellent Indoor Climate in an Energy-Efficient Manner

**Monday, January 25th**  
Orange County Convention Center 2:30pm-5:30pm

- Successful Solar Applications
- District Cooling & Heating Systems: Central Plants NEW
- Grooved Mechanical Piping System Technology & Design NEW
- Introduction to BACnet
- The Basics of a Proposed Standard on High Performance Green Bldgs. (Std 189.1)

**Tuesday, January 26th**  
Orange County Convention Center

- Healthcare Facilities: Best Practice HVAC Design, Construction & Criteria 8am-12pm
- Determining Energy Savings from Energy Efficiency Projects: Applying IPMVP & Guideline 14 to Performance Contracting & LEED 9am-12pm
- The Commissioning Process & Guideline 0 9am-12pm
- Introduction to Cleanrooms NEW 9am-12pm
- Healthcare Facilities: Best Practice Applications of HVAC Systems 1pm-5pm
- Understanding & Designing Dedicated Outside Air Systems (DOAS) 2pm-5pm
- Designing Toward Net Zero Energy Commercial Bldgs NEW 2pm-5pm
- IEQ & Productivity: How to Maximize Investments in Indoor Climate NEW 2pm-5pm



and application are still new to many in the building field. This seminar presents some application examples of the use of wireless networks, including those based on the ZigBee protocol, and provides some guidance for implementing such a network and checking to see whether it is working as expected.

**1. Improving Network Performance of Wireless HVAC Controllers**

*Pornsak Songkakul, Dr.Eng., Member, Siemens Building Technologies, Buffalo Grove, IL*

**2. Removing the Mystery From BAS Wireless System Installation**

*Patrick Harder, Johnson Controls, Milwaukee, WI*

**3. Tips for Successful Deployment of Wireless Networks**

*Pete Secor, Associate Member, Evergreen Telemetry, Phoenix, AZ*

**SEMINAR 17 (INTERMEDIATE)** 

**Case Studies of Florida Labs: Designing and Building in a Humid Environment**

Track: Humidity Control

Room: Panzacola F2

Sponsor: 9.10 Laboratory Systems

Chair: Wade Conlan, P.E., Member, X-nth, Inc., Maitland, FL

Laboratory buildings constantly struggle to balance the concern of occupant safety versus energy consumption regardless of the location of the facility. Adding the component of “humid environment” creates a potential imbalance in the energy vs. safety struggle that must be addressed properly in the design, construction and commissioning process to successfully provide a safe and energy efficient indoor environment. Key decisions made in any one portion of the design could dampen the project success. Centered on accommodating the humid outdoor environment and avoiding common “pitfalls”—the three phases will provide actual examples of successes and failures for laboratories designed and constructed in Florida.

**1. HVAC Systems and the Implications of Florida’s Environment**

*Wade Conlan, P.E., Member, X-nth, Inc., Maitland, FL*

**2. HVAC Issues Related to Constructing a Biomedical Research Facility in Florida’s Hot/Humid Climate**

*Rick Conklin, P.E., Member, Mechanical Services of Central Florida, Inc., Orlando, FL*

**3. Humid Climates: One More Reason to Commission**

*Bill McGuire, P.E., Member, X-nth, Inc., Maitland, FL*

**SEMINAR 18 (BASIC)**

**First Time at an ASHRAE Conference?**

Track: Fundamentals

Room: Panzacola F4

Sponsor: Conferences and Expositions Committee

Chair: William Dietrich, Member, Baltimore Aircoil Company, Baltimore, MD

OPEN SESSION: no badge required.

This seminar familiarizes first-time Conference attendees with the committee structure of ASHRAE, networking opportunities within the Society and ways to get the most out of ASHRAE Conferences.

**1. Technical Committees, Standing Committees and Programs**

*William Dietrich, Member, Baltimore Aircoil Company, Baltimore, MD*

**2. How to Get the Most (Fun) Out of ASHRAE**

*Monte Troutman, P.E., Member, BC Engineering Inc., Evansville, IN*

**3. Young Engineers in ASHRAE**

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

**SEMINAR 19 (BASIC)**

**Following Latent Loads through the Cold Chain**

Track: Load Calculations

Room: Panzacola F3

Sponsor: 10.8 Refrigeration Load Calculations, 10.9 Refrigeration Application for Foods and Beverages

Chair: Daniel Dettmers, Member, IRC, U.W. Madison, Madison, WI

The latent heat component of internal load in refrigerated facilities and display cases is usually very small compared to the total refrigeration load, especially at very low temperatures. It is often simply regarded as part of the sensible heat in the total load summary. But in many cases the latent heat components should be calculated. Such cases include supermarket display cases with heavy foot traffic, refrigerated warehouses with insufficient dock protection and blast freezers. In all of these cases, understanding the latent load can help optimize defrost times, keep product free of frost and keep floors clear of ice. This seminar runs through three examples of calculating the latent loads found in three critical parts of the cold chain: blast freezers, refrigerated warehouses and supermarket display cases.

**1. Latent Loads in Blast Freezing Operations**

*Todd Jekel, Ph.D., P.E., Member, IRC, U.W. Madison, Madison, WI*

**2. Latent Loads in Refrigerated Warehouses**

*Don Cleland, Dr.Eng., Member, Massey University, Palmerston North, New Zealand*

**3. Latent Loads in Supermarket Display Cases**

*Brian Fricke, Dr.Eng., Member, and Bryan R. Becker, Ph.D., P.E., Fellow ASHRAE, University of Missouri-Kansas City, Overland Park, KS*

**SEMINAR 20 (BASIC)**

**Selling Yourself In Interviews and Presentations**

Track: Professional Skills

Room: Panzacola F1

Sponsor: 1.7 Business, Management & General Legal Education

Chair: Alan Veeck, Member, MVA Inc., Virginia Beach, VA

One of the most difficult presentations is one in which you are selling yourself. Whether in a job interview, doing a big engineering presentation to a prospective client, or presenting in front of a group, establishing credibility and trust is a vital component to one's success. This seminar will concentrate on what it takes to gain credibility, trust and respect quickly during a presentation.

**1. Building Trust and Credibility**

*Alan C. Veeck, Member, MVA Inc., Virginia Beach, VA*

**2. Selling Yourself**

*Ken Roberts, Dale Carnegie Training, Orlando, FL.*

**ASHRAE Foundation – Endowing the Future**

**Room: Panzicola F4**

*Sponsor: ASHRAE Foundation*

*Chair: Foundation Officer*

OPEN ADMISSION: no badge required.

An informational overview of the benefits of a properly prepared estate plan is presented. This session also discusses the current and upcoming programs sponsored by the Foundation in direct benefit to Members. This is for educational purposes only and is not a solicitation.

# Monday, January 25

All sessions for Monday are hosted at Rosen Shingle Creek *except* for the 2:00 P.M. session.

8 :00 A.M.–9:30 A.M.

## TRANSACTIONS 5 (INTERMEDIATE)

### Climate Impact on Data Center Efficiency

Track: Energy Conservation and Alternative Energy Sources/Solutions

Room: Panzacola H1/2

Sponsor: 9.9 Mission Critical Facilities, Technology Spaces and Electronic Equipment

Chair: Terry Rodgers, Member, Syska Hennessy Group, Concord, NC

Methodologies for evaluating PUE, DCiE, Mechanical and electrical PUEs are presented based on field knowledge from 30+ data center energy audits. Instantaneous power measurements lead only to instantaneous efficiency metrics since IT load and cooling loads vary from day to night and from one season to another. In order to generate an average metrics over the time period of interest, either extensive measurements over a period of time or a combination of instantaneous measurements and energy model are required. In addition, analyses of utility bills and BMS historical trending data are essential components as well. Case studies are presented to show how one can utilize existing data center information and retrieved data to generate a comprehensive energy assessment of the data center and hence average efficiency metrics.

#### 1. Design Consideration of Applying Airside and Waterside Economizer to Data Centers (OR-10-012)

Yury Lui, Member, EYP Mission Critical Facilities, Chicago, IL

#### 2. Data Center Energy Auditing and Benchmarking: Progress Update (OR-10-013)

Munther Salim, Member, EYP Mission Critical Facilities, Chicago, IL

#### 3. Numeric Analysis of Telco and Data Center Cooling and Humidification Options (OR-10-014)

Bruce Hellmer, P.E., Member, Tier IV Consulting Group, Lee's Summit, MO

## SEMINAR 21 (INTERMEDIATE)

### Sustainability Case Studies in Hospitality and Foodservice Facilities

Track: Green Buildings/Sustainability

Room: Panzacola H3/4

Sponsor: 5.10 Kitchen Ventilation

Chair: Douglas J. Horton, D. J. HORTON and Associates, Inc., Batavia, IL

Four presentations highlight case studies of results of sustainable design solutions in several international hospitality and foodservice chains. Several sustainable design solutions are described, with a focus on commercial kitchen ventilation and indoor environment solutions.

#### 1. Changing the HVAC Strategy in Florida Restaurant Design

Mark Finck, Burger King Corporation, Miami, FL

#### 2. Comparative Analysis of HVAC and Exhaust Systems in LEED Gold Experimental and Standard Restaurants

Adam P. Jarboe, Member, YUM! Global Engineering, Louisville, KY

#### 3. Humidity and Hospitality Foodservice Don't Mix

Anthony J. Spata, P.E., Member, Hyatt Hotels Corporation, Chicago, IL

#### 4. Comparative Analysis of Energy and Water Consumption in Operation of Restaurants Utilizing High Efficiency Designs

Brad Davis, Independent Purchasing Cooperative, Miami, FL

## SEMINAR 22 (BASIC)

### Standard 189.1P Overview: Part 1

Track: ASHRAE Standards

Room: Panzacola G2

Sponsor: 2.8 Building Environmental Impacts and Sustainability

Chair: Katherine Hammack, Member, Ernst & Young LLP, Phoenix, AZ

ASHRAE has developed a new Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings—Standard 189.1P. The standard is targeted to be published in June of 2010. Following approval, Standard 189.1P will be placed on continuous maintenance, permitting the standard to be updated through the publication of approved addenda to the standard. The planned schedule for republication is anticipated to be every third year with approved addenda and errata. Standard 189.1P is not a rating system, though it could be incorporated as the baseline in a green building rating system. It is also not a design guide. It is written in building code language to simplify adoption by building code authorities. It is intended that this standard be used in conjunction with ASHRAE/IESNA Standard 90.1-2007, and ASHRAE Standards 62.1-2007 & 55-2004. Standard 189.1P addresses site sustainability, water use efficiency, energy efficiency, indoor environmental quality (IEQ) & the building's impact on the atmosphere, materials & resources. These five key subject areas, as well as plans for construction & high-performance operation, are each

addressed in a separate chapter. This seminar covers each section of the new standard & describe the requirements of the section—mandatory, prescriptive and performance, strategies to meet the standard and a short case history highlighting a project that meets the requirements.

**1. Site Sustainability**

*Anthony Floyd, City of Scottsdale, Scottsdale, AZ*

**2. Water Use Efficiency**

*John Koeller, P.E., Alliance for Water Efficiency, Yorba Linda, CA*

**3. Environment, Materials and Resources**

*Donald Horn, Member, US General Services Administration, Seattle, WA*

**4. Construction and Operation Plans**

*Tom Marsielle, P.E., Member, Stantec Consulting, Seattle, WA*

**SEMINAR 23 (INTERMEDIATE)**

**Humidity Control Using Heat Pipes for Commercial Applications**

Track: Humidity Control

**Room: Panzacola F2**

**Sponsor:** 8.10 Mechanical Dehumidification Equipment and Heat Pipes

**Chair:** Harry Milliken, Member, Desert Aire, Lewiston, ME

One economical solution for meeting the tightened humidity requirements of ASHRAE Std. 62.1-2007 is wrap around heat pipes. They reduce the equipment SHR in chilled water systems, and also reduce the leaving DP in DX systems. This seminar presents the use and selection of heat pipes for enhanced dehumidification, examines their energy ramifications in DOAS units and explores their use in thermal storage applications.

**1. How to Select a Thermosiphon Heat Pipe to Optimize Energy Savings**

*Richard Trent, Member, Carolina Heat Pipe Inc, Charleston, SC*

**2. Wrap Around Heat Pipes in DOAS Units**

*Tom Brooke, P.E., Member, Heat Pipe Technology, Ocala, FL*

**3. Heat Pipes and Thermal Storage**

*Samuel Sami, Ph.D., P.Eng., Fellow ASHRAE, San Diego State University, Carlsbad, CA*

**SEMINAR 24 (INTERMEDIATE)**

**BIM to SIM: Technology Update**

Track: Building Information Modeling

**Room: Panzacola G1**

**Sponsor:** 1.5 Computer Applications, 7.1 Integrated Building Design

**Chair:** Krishnan Gowri, Ph.D., Member, Pacific Northwest National Lab., Richland, WA

BIM has the promise of solving the data import of geometry and building data required for energy simulation during early stages of design. However, ASHRAE members and industry

practitioners often are not well informed of the potential benefits and limitations. This seminar brings together three speakers involved in early adoption and model development to help ASHRAE members understand the challenges and opportunities of using BIM tools for energy simulation.

**1. BIM to SIM in the Real World: A Consulting Engineer's Perspective**

*Raj Setty, P.E., Member, Setty and Associates, Washington, DC*

**2. Challenges in Importing BIM Data for Energy Simulation**

*Mike Galler, Member, National Institute of Science and Technology, Gaithersburg, MD*

**3. Role of Standards in BIM to SIM Data Exchange Process**

*Benjamin Welle, Stanford University, Stanford, CA*

**SEMINAR 25 (INTERMEDIATE)**

**Energy, Water and Sound: Improvements in Cooling Tower Design to Optimize Equipment Efficiencies**

Track: Refrigeration

**Room: Panzacola F3**

**Sponsor:** 8.6 Cooling Towers and Evaporative Condensers

**Chair:** Leon E. Shapiro, Member, VRTX Technologies, Las Vegas, NV

Energy, water and sound are three major issues challenging operators of cooling towers and evaporative condensers. Major improvements have been made in equipment and system design and operation in dealing with these concerns. These improvements can have a significant impact on compliance with ASHRAE Standard 90.1 and assisting in LEED certification. This seminar presents an overview of industry advancements in energy and water conservation and sound attenuation.

**1. Advancements in Energy Conservation in Cooling Tower Design and Operation**

*Daniel S. Kelly, Member, Evapco, Westminster, MD*

**2. Water Conservation for Evaporative Cooling Equipment**

*Greg Hentschel, P.E., Member, SPX Cooling Technologies, Overland Park, KS*

**3. Sound Attenuation for Evaporative Cooling Equipment: Less Is More**

*Stephen G. Kline, P.E., Member, Baltimore Air Coil, Jessup, MD*

**SEMINAR 26 (INTERMEDIATE)**

**Increase the Impact of Your ASHRAE Presentation**

Track: Professional Skills

**Room: Panzacola F1**

**Sponsor:** 1.7 Business, Management & General Legal Education

**Chair:** Alan C. Veeck, Member, MVA Inc., Virginia Beach, VA

Speaking to an audience or presenting your ideas to a group can be intimidating; however, it is a skill that can be learned,



practiced and mastered. This working session provides attendees with methods and techniques to more effectively present information, especially of a technical nature to groups. Topics covered include better use of PowerPoint and other visuals along with creative openings, more credible information in the presentation, and a dynamic Q & A and summary. Your audience will thank you for attending this session.

**1. Increase the Impact of Your ASHRAE Presentation**

*Ken Roberts, Dale Carnegie Training, Wilbur by the Sea, FL; Alan Veeck, Member, MVA Inc., Virginia Beach, VA*

**SEMINAR 27 (BASIC)** 

**Advance Energy Design Guide—Small Hospitals and Health Care Facilities**

Track: Energy Conservation and Alternative Energy Sources/Solutions

**Room:** Panzacola F4

**Sponsor:** 9.6 Healthcare Facilities

**Chair:** Michael Meteyer, P.E., Member, Cogdell Spencer ERDMAN, Madison, WI

The Advanced Energy Design Guides (AEDG) are a series of publications designed to provide recommendations for achieving energy savings over the minimum code requirements. The latest AEDG—Small Hospitals and Health Care Facilities is now available. Come hear from the authors what it contains and how to use it.

**1. How to Take Advantage of the New Advanced Energy Design Guide for Small Hospitals and Healthcare Facilities**

*Shanti Pless, Ph.D., P.E., Member, National Renewable Energy Laboratory, Golden, CO*

**2. HVAC “How to Tips” to Help Reduce Energy Use By 30% in Small Hospitals and Healthcare Facilities**

*Dennis J. Wessel, P.E., Member, Karpinski Engineering, Cleveland, OH*

**3. Lighting “How to” Tips: Optimizing the Energy Efficiency of Lighting in Support of an Overall 30% Reduction in Energy Consumption In Hospitals and Health-Care Facilities**

*John W. Gill, P.E., CRS Engineering & Design Consultants, Birmingham, AL*

9:45 A.M.–10:45 A.M.

**SEMINAR 28 (INTERMEDIATE)** 

**Operating Cost Implications In Humid Environments**

Track: Humidity Control

**Room:** Panzacola F2

**Sponsor:** 7.8 Owning and Operating Costs, 1.12 Moisture Management in Buildings

**Chair:** Chuck Dale-Derks, P.E., Member, McClure Engineering, St. Charles, MO

Hot and humid climates definitely have an impact on the operating and maintenance costs of mechanical systems and buildings. Chapter 36 of the 2007 Applications Handbook suggests that the service life of equipment is negatively impacted by being near salt water or by being operated in humid environments. What types of equipment failures and maintenance challenges are seen in the Southeast and what is their impact on owning and operating costs? This seminar identifies unique aspects of maintaining and operating HVAC systems in hot humid environments and their cost impacts. System challenges include maintaining vapor barriers on ducts and pipes, preventing biological growth inside HVAC equipment and ducts, maintaining good indoor environmental quality during periods of wind driven rain, effect of hot and humid on worker productivity while servicing equipment on a hot roof and moisture management in buildings.

**1. Practical Designs to Reduce Operating Costs in Humid Climates**

*Lew Harriman, P.E., Member, Mason-Grant Consulting, Portsmouth, NH*

**2. Effects of Humidity on Owning and Operating Costs**

*Jim Earley, P.E., Member, Georgia Power Co., Atlanta, GA*

**3. Cost Experiences of HVAC Systems in the South: Southern Belle or S.O.B.**

*Michael Dillard, P.E., Member, Mechanical Services, Inc., Orlando, FL*

**SEMINAR 29 (BASIC)**

**Effective Design and Operation of Thermal Energy Storage Systems in Hot and Humid Climates**

Track: Energy Conservation and Alternative Energy Sources/Solutions

**Room:** Panzacola F3

**Sponsor:** 6.9 Thermal Storage

**Chair:** Guy Frankenfield, P.E., Member, Natgun Corporation, Grand Prairie, TX

Thermal energy storage (TES) systems have been used effectively for the over three decades. This seminar highlights the two most common TES systems (chilled water and ice) with case studies of systems in Florida. The case studies include how TES systems provide value in a hot and humid climate.

**1. District Cooling Systems with Chilled Water TES in Humid Environments**

*John Andrepont, Member, Cool Solutions, Lisle, IL*

**2. Ice Storage Systems at Schools in Florida**

*Robert Wegmann, Hillsborough County Schools, Tampa, FL*

**SEMINAR 30 (Basic)** 

**Standard 189.1P Overview: Part 2**

Track: ASHRAE Standards

**Room:** Panzacola G2

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

**Chair:** Katherine Hammack, Member, Ernst & Young LLP, Phoenix, AZ



ASHRAE has developed a new Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings—Standard 189.1P. This standard is targeted to be published in June of 2010. Following approval, Standard 189.1P will be placed on continuous maintenance, permitting the standard to be updated through the publication of approved addenda to the standard. The planned schedule for republication is anticipated to be every third year with approved addenda and errata. Standard 189.1P is not a rating system, though it could be incorporated as the baseline in a green building rating system. It is also not a design guide. It is written in building code language to simplify adoption by building code authorities. It is intended that this standard be used in conjunction with ASHRAE/IESNA Standard 90.1-2007, and ASHRAE Standards 62.1-2007 and 55-2004. Standard 189.1P addresses site sustainability, water use efficiency, energy efficiency, indoor environmental quality (IEQ) and the building's impact on the atmosphere, materials and resources. These five key subject areas, as well as plans for construction and high-performance operation, are each addressed in a separate chapter. This seminar covers each section of the new standard and describes the requirements of the section—mandatory, prescriptive and performance, strategies to meet the standard and a short case history highlighting a project that meets the requirements.

**1. Energy Efficiency**

*Stephen D. Kennedy, Member, Georgia Power Company, Atlanta, GA*

**2. Energy Modeling Results for ASHRAE Standard 189.1 in Comparison with Standard 90.1-2007**

*Drury Crawley, Ph.D., Member, DOE, Washington, DC*

**3. Indoor Environmental Quality**

*Molly McGuire, P.E., Associate Member, Taylor Engineering, Alameda, CA*

**SEMINAR 31 (INTERMEDIATE)**

**Sustaining the Building Envelope During High Wind Events**

Track: Fundamentals

Room: Panzacola G1

*Sponsor: 2.7 Seismic and Wind Restraint Design*

*Chair: Richard Sherren, PE, Member, Kinetics Noise Control, Dublin, OH*

Extreme wind events have resulted in billions of dollars in building damage caused by failure of the building envelope in repelling water. HVAC systems have components that are part of the building envelope. HVAC specifications remain inadequate to protect buildings from moisture penetration during these wind events. This seminar covers the code requirements for preventing the HVAC system from becoming a source of water penetration and details steps manufacturers take to ensure that equipment complies with these code requirements.

**1. Design Wind Loads for Exposed Roof-Mounted HVAC Components**

*Tim Reinhold, PE, Institute of Business and Home Safety, Tampa, FL*

**2. Specifying Florida Building Code Compliant HVAC Components**

*Daniel Rau, PE, Member, Ruskin Company, Grandview, MO*

**SEMINAR 32 (ADVANCED)**

**Recent Developments of the European Energy Regulations and Standards, Part 1**

Track: Energy Conservation and Alternative Energy Sources/Solutions

Room: Panzacola H3/4

*Sponsor: REHVA, Technical Activities Committee*

*Chair: Olli A. Seppanen, Dr.Eng., Fellow Life ASHRAE, REHVA, Brussels, Belgium*

The seminar offers updates of new and proposed EU regulations on Energy Efficiency of Buildings (EPBD), Revision of building energy related European standards, National implementation of European directives and achievements in energy efficiency improvements and related information campaigns like BUILD UP- portal. The seminar is organised by Federation of European HVAC-Associations (REHVA).

**1. European Policy, Directives and Regulation to Improve Energy Efficiency of Buildings**

*Francis Allard, Dr.Eng., P.Eng., Member, ISSO, Rotterdam, Netherlands*

**2. European Directive on Energy Performance of Buildings in the Member Countries**

*Martin Elsberger, Dr.Eng., European Commission, Schaarbeek, Belgium*

**3. BUILD UP Platform: An Open Platform to Disseminate Energy Efficiency Related Information**

*Olli A. Seppanen, Dr.Eng., Fellow Life ASHRAE, REHVA, Brussels, Belgium*

**FORUM 1 (BASIC)**

**What Does Exergy Mean to You in Hot and Humid Climates?**

Track: Green Buildings/Sustainability

Room: Panzacola F4

*Sponsor: TGI Exergy Analysis for Sustainable Buildings (EXER)*

*Chair: Birol Kilkis, Ph.D., Fellow ASHRAE, Mechanical Eng., Baskent University, Ankara, Turkey*

For the development of optimally balanced comfort systems in high-performance, green and sustainable buildings, it is important to consider the connected exergy processes within the human body, buildings, and in the built environment at fundamental and applied levels. This connection becomes especially important in hot and humid climates and the basics must be well understood for an environmentally and economically optimized green building design and operation. This forum focuses on fundamental and practical issues on how to metricate and solve the rather complex nature of the exergy based connection among human body, the building,

and the built environment for achieving the right balance among them for sustainable comfort, environment and economy.

**FORUM 2 (BASIC)**

**Research Strategic Plan 2010-2015: Does this Draft Meet Our Needs?**

Track: Fundamentals

**Room: Panzacola F1**

**Sponsor:** Research Advisory Panel, Tech. Council, Technical Activities Committee

**Chair:** Jeffery Spittle, Ph.D., P.E., Fellow ASHRAE, Oklahoma State University, Stillwater, OK

This forum presents the first draft of the Society’s 2010–2015 Research Strategic Plan. This draft has been two and a half years in the making and has had substantial input from TCs, TGs, SSPCs and other ASHRAE members. This forum seeks input on the first draft.

**FORUM 3 (INTERMEDIATE)**

**The Path to Zero-Net Energy Supermarkets**

Track: Green Buildings/Sustainability

**Room: Panzacola H1/2**

**Sponsor:** 10.7 Commercial Food and Beverage Cooling Display and Storage

**Chair:** Devin Rauss, Member, Southern California Edison, Irwindale, CA

In the spirit of the ASHRAE Vision 2020, this forum provides a venue for open discussion on the steps needed for achieving zero-net energy supermarkets. Attendees will have the opportunity to discuss obstacles and solutions on the path to zero net energy for these energy intensive buildings.

11:00 A.M.–12:00 NOON

**TRANSACTIONS 6 (INTERMEDIATE)**   

**Recent Advances in Thermal Storage**

Track: Energy Conservation and Alternative Energy Sources/Solutions

**Room: Panzacola F4**

**Sponsor:** 6.9 Thermal Storage

**Chair:** John Nix, Member, Florida Power and Light Co., Miami, FL

This transaction session will present recent findings of TES system advances in two areas:

1. the creation of optimal control strategies for shifting peak cooling loads and reducing building energy costs through the utilization of both the passive and active thermal energy storage systems.
2. the use of a refrigerant based air conditioning (DX) Thermal Storage system rather than the traditional DX air conditioners to increase site energy efficiency.

**1. Field Testing of Optimal Controls of Passive and Active Thermal Storage (OR-10-015)**

*Moncef Krarti, Ph.D., P.E., Member, University of Colorado, Boulder, CO*

**2. Energy Efficient TES Designs for Commercial DX Systems (OR-10-016)**

*Robert Willis, Member, Ice Energy, Fort Collins, CO*

**SEMINAR 33 (INTERMEDIATE)** 

**Recent ASHRAE Research on Load Calculations: Cooling Load Methodologies for Under Floor Air Distribution Equipment**

Track: Load Calculations

**Room: Panzacola F3**

**Sponsor:** 4.1 Load Calculation Data and Procedures

**Chair:** Glenn Friedman, P.E., Member, Taylor Engineering, Alameda, CA

This seminar explains underfloor air distribution (UFAD) load calculations. Some elements of UFAD are include raised floor plenum, floor outlets, return air path, raised floor configuration, supply and return air paths. This seminar addresses UFAD cooling load calculations methods related to cooling loads for the underfloor air distribution system, the UFAD cooling load at the cooling coil and the UFAD heat transfer paths and heat balance.

**1. Discussion of the Elements of UFAD Systems and their Affect on the Determination of Heating and Cooling Loads**

*Gary Wingfield, P.E., Fellow ASHRAE, Gary Wingfield, Retired, Jacksonville, FL*

**2. Using Fundamental Heat Balance Principles to Determine the Separate Load Components in Spaces with UFAD Systems**

*Curtis O. Pedersen, Ph.D., Fellow Life Member, University of Illinois at Urbana-Champaign, Hastings, MN*

**3. Cooling Airflow Design Sizing and Load Calculations for UFAD Systems**

*Fred Bauman, Member, Center for the Built Environment (CBE), University of California, Berkeley, Berkeley, CA*

**SEMINAR 34 (INTERMEDIATE)** 

**Enhanced Dehumidification Strategies with Energy Recovery in Hot Humid Climates**

Track: Humidity Control

**Room: Panzacola F2**

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

**Chair:** John Dieckmann, Member, TIAX LLC, Cambridge, MA

Energy recovery ventilation saves energy in any climate having significant space heating and/or space cooling loads. In humid climates where the humidity content of ventilation air makes up a large part of the latent cooling load, energy recovery also greatly improves humidity control, by reducing and stabilizing the humidity load that the air conditioning

system must handle. The presentations show how and the extent to which energy recovery improves humidity control and how energy recovery can improve the economics of space conditioning and humidity control in a hot, humid climate.

**1. Using Energy Recovery to Improve Dehumidification Performance and Control**

*Ronnie Moffitt, Member, Trane Co., Lexington, KY*

**2. Economics of Energy Recovery in a Hot Humid Climate**

*Gregory Dobbs, Member, United Technologies Research Center, East Hartford, CT*

**SEMINAR 35 (ADVANCED)**

**Recent Developments of the European Energy Regulations and Standards, Part 2**

Track: Energy Conservation and Alternative Energy Sources/Solutions

Room: Panzacola H3/4

Sponsor: REHVA

Chair: Chair: Francis Allard, Dr Sc., Member, REHVA, University of La Rochelle, France

This seminar offers updates of new and proposed EU regulations on energy efficiency of buildings (EPBD), revision of building energy related European standards, national implementation of European directives and achievements in energy efficiency improvements and related information campaigns like BUILD UP- portal and CENSE. The seminar is organized by Federation of European HVAC-Associations (REHVA).

**1. National Implementation and Revision of European CEN-standards to Improve Energy Efficiency of Buildings**

*Jaap Hogeling, Member, ISSO, Rotterdam, Netherlands*

**2. Application of European CEN-standards to Evaluate Indoor Environmental Quality and Energy Performance of Heating Systems**

*Bjarne Olesen, PhD, Fellow ASHRAE, Technical University of Denmark, Denmark*

**FORUM 4 (INTERMEDIATE)**

**Systems Manuals: What should be included in ASHRAE Guideline 1.4 on Developing Systems Manuals for the Commissioning Process**

Track: Commissioning

Room: Panzacola G1

Sponsor: GPC 1.4

Chair: Gerald J. Kettler, P.E., Life Member, AIR Engineering and Testing, Dallas, TX

ASHRAE Guidelines 0-2005 and 1.1-2007 require the preparation of a systems manual during the commissioning process. An outline of the systems manual process is included in each publication but few details. This forum is intended to gather information for the development of a guideline on Systems Manuals to strengthen the Commissioning documentation process and information transfer to the operation and maintenance staff.

**FORUM 5 (ADVANCED)**

**Refrigerant Safety Classification 2L: What Do We Do with It?**

Track: ASHRAE Standards

Room: Panzacola G2

Sponsor: 3.1 Refrigerants and Secondary Coolants

Chair: William Walter, Member, Carrier Corporation, Syracuse, NY

SSPC 34 has proposed a new flammability classification of 2L. This would be an optional classification for moderately flammable refrigerants (Class 2) that have a burning velocity less than 10 cm/sec. In order to be of any use, this must be incorporated into Standard 15 and the codes. This forum seeks information on how 2L refrigerants could be applied differently than the class 2 refrigerants in air conditioning and refrigeration systems.

**FORUM 6 (INTERMEDIATE)**

**Solving Moisture Problems Created By Energy Retrofits**

Track: Green Buildings/Sustainability

Room: Panzacola H1/2

Sponsor: 1.12 Moisture Management in Buildings, 4.4 Building Materials and Building Envelope Performance, 9.1 Large Building Air-Conditioning Systems

Chair: Alex McGowan, P.Eng., Member, Levelton Consultants Ltd., Victoria, BC, Canada

Increasing insulation levels, setting back thermostats, reducing air leakage, modifying ventilation strategies and controls—all common activities in energy retrofits, and all lead to various problems in moisture control. This forum discusses ways to solve the energy-retrofit challenge without creating problems that reduce the durability of the building envelope or overwork the mechanical equipment.

**FORUM 7 (INTERMEDIATE)**

**Multiple Plenum Fans in an Array: What Are the Advantages and Disadvantages?**

Track: Fundamentals

Room: Panzacola F1

Sponsor: 5.1 Fans, 2.6 Sound and Vibration Control, 5.9 Enclosed Vehicular Facilities

Chair: Rad Ganesh, P.E., Member, Twin City Fan Companies, Plymouth, MN

Open Session: no badge required.

Multiple fans in an array have been applied for years but there has been recent resurgence of interest in using small plenum fans at high speeds for this type of application. Efficiency, sound, vibration and cost implication of this type of arrangement compared to conventional single or dual fan system will be discussed in this forum.

**AHR Expo—Orange County  
Convention Center**

**2 P.M.–3 P.M.**

**Construction Management**

**Room:** S310 E

**Sponsor:** TG3, HVAC&R Contractors and Design Build Firms

**Chair:** George W. (Billy) Austin, Jr., PE, Member, Shultz Engineering Group, P.C., Charlotte, NC

**1. Will Systems Commissioning Improve the Contractor’s Ability to Perform Well?**

*David Underwood, P.E., Fellow Life ASHRAE, Isotherm Engineering, Mississauga, Ontario, CANADA*

**Open session: no badge required.**

This presentation covers the aspects of systems commissioning that are intended to improve and enhance contractor performance for the benefit of the contractor and the construction manager. These benefits accrue to not only the construction manager but all participants in the construction process. With LEED now including commissioning as one of the criteria for certification of a building there will be more commercial buildings requiring commissioning. In the construction manager’s traditional role they often have felt that they were able to effectively commission a project. We believe technical skill for the building elements being commissioned require familiarity with the construction of these elements. Commissioning has

many different definitions and as the practice is relatively new to our industry there are many varied approaches to its implementation, and it can be beneficial to the commissioning manager, contractor, designers and the building owner/operator.

**2. Preconstruction Management Basics for the Mechanical Engineer and Contractor on Design-Build/Design-Assist Projects**

*Mike McLaughlin, P.E., Associate Member, Southland Industries, Dulles, VA*

This presentation highlights the mutually beneficial interaction that can occur between a mechanical contractor and the mechanical engineer during the preconstruction stage for a project. This interaction occurs on projects using the design-build or design-assist procurement method where the mechanical contractor is engaged early in the project and works closely with the engineer throughout the design phase. With the continued growth in design-build and design-assist projects, understanding the engineering process and basics of construction management by both parties will enable the team work together effectively and achieve both their individual goals and the overall goals of the project. The presentation will include an overview of the engineering and construction management process with the intent to understand the goals and priorities of each team member. These processes will then be overlapped in the preconstruction stage to identify when, where and how each team member can provide information and support that is mutually beneficial for all team members.



# Tuesday, January 26

All sessions for Tuesday are hosted at Rosen Shingle Creek *except* for the 2:00 P.M. session.

8:00 A.M.–9:30 A.M.

## TRANSACTIONS 7 (ADVANCED)

### ASHRAE Standard 90.1 Metal Building U-factors

Track: Energy Conservation and Alternative Energy Sources/Solutions

Room: Panzacola G2

Sponsor: SSPC 90.1

Chair: Michael Waite, Associate Member, Simpson Gumpertz & Heger, Inc., New York, NY

ASHRAE Standard 90.1 contains appendices listing the installed U-factors for insulated metal building roof and wall assemblies. These U-factors were originally developed through finite element analysis models validated against calibrated hot box measurements. Each U-factor was based on many assumptions that were considered to be typical or representative values at that time. However, the fundamental question of whether the insulation drupe was representative of typical field installations has generated considerable debate. This session examines recent efforts in support of ASHRAE SSPC 90.1 to identify current typical fiberglass installations in metal building roof assemblies, to develop analytical methods to predict the U-factor of those assemblies and to apply the calculation methods to typical installed profiles.

#### 1. Mathematical Modeling and Validation by Calibrated Hot Box (OR-10-017)

Manoj K. Choudhary, P.E., Owens Corning Center of Science and Technology, Granville, OH; Chris Kasprzak, Associate Member, Owens Corning, Toledo, OH; Reed H. Larson, Johns Manville Technical Center, Littleton, CO; Raj Venuturumilli, Ph.D., ANSYS, Inc., Evanston, IL

#### 2. Predicting the Thermal Performance of Single Layer Fiberglass Batt Insulation Assemblies (OR-10-018)

Chris Kasprzak, Associate Member, Owens Corning, Toledo, OH; Manoj K. Choudhary, P.E., Owens Corning Center of Science and Technology, Granville, OH

#### 3. Equations for Double Layers of Fiberglass Batt Insulation in Roof and Wall Assemblies (OR-10-019)

Merle F. McBride, Ph.D., P.E., Member; Patrick M. Gavin, Ph.D., Owens Corning Center of Science and Technology, Granville, OH

#### 4. Development of U-Factors for Walls and Roofs Based on Experimental Measurements (OR-10-020)

Leslie Christianson, Ph.D., University of Illinois at Urbana-Champaign, Urbana-Champaign, IL

## SEMINAR 36 (INTERMEDIATE)

### Which BIM Interoperability Schemas Are Most Appropriate for Different Types of Building Energy Design

Track: Building Information Modeling

Room: Panzacola H1/2

Sponsor: 1.5 Computer Applications

Chair: Stephen Roth, P.E., Member, Carmel Software, San Rafael, CA

There is confusion in the architectural/engineering world about existing interoperability schemas and standards that allow various software tools such as building information modeling (BIM) authoring software (aka - 3D-CAD) and building analysis software to communicate with one another. The question that many of these stakeholders have is when to use one schema over the other and which ones are the most appropriate for different types of building analysis. This seminar presents three views on this type of interop, including discussions about Green Building XML (gbXML) and Industry Foundation Classes (iFCs).

#### 1. Discussion of Green Building XML (gbXML)

John Kennedy, Member, Autodesk, Santa Rosa, CA

#### 2. Discussion of Industry Foundation Classes (IFC)

Francois Grobler, US Army Engineer Research and Development Center, Champaign, IL; Vladimir Bazjanac, Lawrence Berkeley National Laboratory, Berkeley, CA

#### 3. Case Study Usage of gbXML and IFCs

Charles Eastman, Georgia Institute of Technology, Atlanta, GA

## SEMINAR 37 (INTERMEDIATE)

### Web-based Programs for Calculating Energy Code Compliance

Track: Energy Conservation and Alternative Energy Sources/Solutions

Room: Panzacola F1

Sponsor: 4.7 Energy Calculations

Chair: Larry Degelman, P.E., Life Member, Texas A&M University, College Station, TX

A minimum requirement on the route to maximizing energy conservation and use of alternative energy sources is the compliance with latest versions of energy codes. Given the rapidly changing requirements in energy codes, users are finding that web-based access to code software is a practical way to keep updated with the most current versions without the need to download software and install it permanently on their own computers. Also, in an ever-increasing mobile society, people are beginning to prefer “computing on the fly”. This seminar aims to inform Society members of some



available code compliance tools that are available on the web, but do not require downloading.

**1. COMcheck-Web/REScheck-Web: Paperless Energy Code Compliance for Multiple Codes**

*Eric Richman, Member, Pacific Northwest National Laboratory, Richland, WA*

**2. Development of a Web-Based, Code-compliant Residential Simulator for Texas**

*Jeff Haberl, Ph.D., P.E., Fellow ASHRAE, Texas A&M University, College Station, TX*

**3. Energy Code Compliance as a Web Service: Challenges and Opportunities**

*Krishnan Gowri, Ph.D., Member, Pacific Northwest National Laboratory, Richland, WA*

**SEMINAR 38 (INTERMEDIATE)** 

**Modeling of Particle Transport in Indoor Environment for Air Quality Analyses**

Track: IAQ/Comfort

**Room: Panzacola G1**

**Sponsor:** 4.10 Indoor Environmental Modeling

**Chair:** Atila Novoselac, Ph.D., Associate Member, CAEE, University of Texas at Austin, Austin, TX

Recent advancements in the application of computational fluid dynamics (CFD) for indoor environment modeling have made possible the accurate air flow field calculation needed for particle dynamics simulations. Particle dynamics analyses, based on Lagrangian and Eulerian particle modeling methods, can be successfully used for aerosols studies in both small domains such as a vicinity of a floor surface and large spaces such as a room or a house. The seminar shows examples of particle modeling applied at different scales of indoor environments utilized to solve problems related to human exposure. The overall goal of this seminar is to demonstrate the state-of-the-art particle modeling techniques and show how these techniques can be used for achieving optimal air quality in the indoor environment.

**1. Fast Predictions of Particles with Small Stokes Number in a Ventilated Room**

*Wangda Zuo, Ph.D., Student Member, Purdue University, West Lafayette, IN*

**2. Prediction of Particle Deposition onto Indoor Surfaces by CFD with a Modified Lagrangian Method**

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

**3. Aerodynamic Resuspension of Dust Due to Falling Flat Objects**

*Ezzat H. Khalifa, Ph.D., Member, Syracuse University, Syracuse, NY*

**4. Simulating Particle Transport for Analysis of Portable Air Cleaning Devices**

*Jeffrey A. Siegel, Member, CAEE, University of Texas at Austin, Austin, TX*

**SEMINAR 39 (BASIC)** 

**Comparing Refrigeration Loads: Peak Calculations, Hourly Simulation and Actual Operation**

Track: Refrigeration

**Room: Panzacola F3**

**Sponsor:** 10.8 Refrigeration Load Calculations, 10.5 Refrigerated Distribution and Storage Facilities

**Chair:** Daniel Dettmers, Member, IRC, U.W. Madison, Madison, WI

While performing load calculations for the commercial and residential building sector has entered the computer age, many designers of refrigerated facilities/processing plants still rely on fairly simple hand calculations as presented in the ASHRAE Refrigeration Handbook. This is partly due to a lack of sophistication and reliability in modeling software currently available and partly due to a general reluctance by the industrial refrigeration community to give up their tried and true methods. This seminar aims to provide insight by examining a single refrigerated facility by comparing refrigeration loads determined by “hand” calculations and generated by an hourly modern simulation program. Then they are compared with actual operating data from the same facility.

**1. Load Calculation Using the ASHRAE Refrigeration Handbook**

*Donald Fenton, Dr.Eng., Member, Kansas State University, Manhattan, KS*

**2. Load Calculation Using DOE 2.2R (E-Quest)**

*Doug Scott, Member, VaCom Technologies, La Verne, CA*

**3. Comparison of the Previous Results to Actual Data from the Example Facility**

*Ryan Hoest, Member, VaCom Technologies, La Verne, CA*

**SEMINAR 40 (ADVANCED)**

**HVAC&R Research Journal, Part 1: Fluid Flow Challenges**

Track: Fundamentals

**Room: Panzacola F4**

**Sponsor:** HVAC&R Research

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

This session presents highlights of papers that were recently published in ASHRAE’s premier research journal: HVAC&R Research.

**1. Analysis of Expansion Waves Appearing in the Outlets of Two-Phase Flow Nozzles**

*Atsushi Harada, Student Member, Toyohashi University of Technology, Toyohashi City, Japan*

**2. Shock Waves in Supersonic Two-Phase Flow of CO<sub>2</sub> in Converging-Diverging Nozzles**

*Menadro Berana, Student Member, Toyohashi University of Technology, Toyohashi City, Japan*

### 3. Introduction of Cooling Fan Efficiency Index

*Stefano Schiavon, Ph.D., Member, University of California, Berkeley, CA*

### 4. Transient Flow of Air through Rectangular Vents in Horizontal Partition

*Ahmad Sleti, Member, University of North Carolina, Charlotte, NC*

## SEMINAR 41 (INTERMEDIATE)

### Measuring Humidity: Does Accuracy Matter?

Track: Humidity Control

Room: Panzacola F2

**Sponsor:** 1.4 Control Theory and Application

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

Humidity sensors are commonly used in HVAC control systems to control outdoor air economizers and humidification and dehumidification systems. But these sensors are known to have problems in the field delivering their specified performance, particularly over the long term. This seminar addresses the accuracy and reliability of humidity measuring devices based on laboratory tests and the impact of sensor accuracy on HVAC system energy usage.

#### 1. Performance Evaluation of Relative Humidity Sensors for HVAC Applications

*Curtis J. Klaassen, P.E., Member, Iowa Energy Center, Energy Resource Station, Ankeny, IA*

#### 2. Performance Evaluation of Economizer Enthalpy Sensors

*Xiaohui Zhou, Member, Iowa Energy Center, Energy Resource Station, Ankeny, IA*

#### 3. Impact of Humidity and Enthalpy Sensor Error on Economizer Performance

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

## SEMINAR 42 (INTERMEDIATE)

### Climate Change: Implications for ASHRAE Engineers

Track: Green Buildings/Sustainability

Room: Panzacola H3/4

**Sponsor:** Environmental Health Committee (EHC)

**Chair:** Hal Levin, Fellow ASHRAE, Building Ecology Research Group, Santa Cruz, CA

Greenhouse gas emissions (GHG) have become a driving force for most ASHRAE activities and those of its members. Emissions from buildings are a major contributor to total GHG emissions and, thus, to climate change. The program addresses the context of buildings and their energy consumption as a major factor in total global GHG emissions. The reduction of energy use in buildings and associated GHG emissions, the role designers and operators can play, and the tools to assess building's GHG emissions are the focus of the session providing members with a focused discussion of the implications of climate change.

### 1. How Do Buildings Fit into Total Societal GHG Emissions?

*Micahel Deru, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO*

### 2. What Are the Implications of Coming Constraints on Greenhouse Gas Emissions for ASHRAE Engineers?

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

### 3. What Are the Tools Available for Calculating GHG Emissions from Buildings?

*Hal Levin, Fellow ASHRAE, Building Ecology Research Group, Santa Cruz, CA*

9:45 A.M.–10:45 A.M.

## TRANSACTIONS 8 (INTERMEDIATE)

### Achieving Required Humidity for Preservation Environments

Track: Humidity Control

Room: Panzacola F2

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

**Chair:** Cecily M. Grzywacz, Member, Getty Conservation Institute, Los Angeles, CA

HVAC systems for museums, galleries, archives and libraries are designed to preserve collections of objects and artifacts and not necessary human comfort. These environments require different design criteria for temperature, humidity as well as IAQ. Previously accepted set points are being reconsidered with respect to energy efficiency and the revitalized trend of sustainability. Papers will address humidity control to balance preservation requirements, alternative climate control in historic buildings, and energy efficient humidity control in archives.

#### 1. Alternative Climate Control for Collections in Historic Structures Using Sustainable Technologies (OR-10-021)

*Shin Maekawa, Ph.D., Associate Member, Getty Conservation Institute, Los Angeles, CA*

#### 2. Energy Efficient Humidity Control for Archives: New Design Standards for Building Archival Facilities from the Society of American Archivists (SAA) (OR-10-022)

*Ernest Conrad, P.E., Member, Landmark Facilities Group, Inc., Norwalk, CT*

## TRANSACTIONS 9 (BASIC)

### Contamination Issues in Datacom Environments

Track: IAQ/Comfort

Room: Panzacola G1

**Sponsor:** 9.9 Mission Critical Facilities, Technology Spaces and Electronic Equipment

**Chair:** Joe Prisco, P.E., Member, IBM, Rochester, MN

This transactions session will cover on a variety of issues that are pertinent to particulate and gaseous contamination in data centers, telecommunications facilities, and combinations thereof. Issues of recent concern include the use of air-side

economizers, filtration, control and prevention, geographical considerations, susceptible areas of datacom equipment, hardening of datacom equipment, and the impact of RoHS legislation.

**1. What's Creeping Around in Your Data Center? (OR-10-023)**

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

**2. Contamination in the Data Center the Impact of CRAC Belt Dust (OR-10-024)**

*J. Stack, Member, and Daniel Fannin, Emerson Network Power, Columbus, OH*

**SEMINAR 43 (INTERMEDIATE)**

**How to Assess the Performance of Sustainable Buildings**

Track: Green Buildings/Sustainability

Room: Panzocola H1/2

Sponsor: 4.7 Energy Calculations

Chair: Moncef Krarti, P.E., Member, University of Colorado, Boulder, CO

Buildings are typically rated as sustainable during the design phase. However, once built, performance differs from expectations. Since buildings are not commonly built with the intention of readily being able to monitor building performance, and building automation systems have not traditionally been capable of providing the energy performance feedback, energy performance tracking has been difficult. This seminar presents recommended M&V approaches to assess the performance of sustainable buildings. Moreover, a case study is presented to evaluate and compare the actual performance of a sustainable building against predictions. These are much more easily implemented than more complex detailed diagnostics, and hence can be applicable to buildings of all sizes.

**1. Metrics and Graphs: Tracking Building Energy Performance for Sustainability**

*William E. Koran, P.E., Member, QuEST, West Linn, OR*

**2. Performance of a Sustainable Building: Case Study**

*David E. Claridge, P.E., Member, Texas A&M, College Station, TX*

**SEMINAR 44 (BASIC)** 

**Commissioning for Refrigeration Systems: The Possibilities**

Track: Commissioning

Room: Panzocola F3

Sponsor: 10.1 Custom Engineered Refrigeration Systems, 10.5 Refrigerated Distribution and Storage Facilities

Chair: Daniel Dettmers, Member, IRC, U.W. Madison, Madison, WI

To aid in the proper construction of commercial buildings, ASHRAE has developed Guideline 0-2005, The Commissioning Process. Following the commissioning process as laid out in the guideline verifies that a facility and

its systems meet the Owner's Project Requirements Guideline without regard to specific elements, assemblies, or systems. This process has become standard in the construction of most new commercial buildings. This seminar explores the possibility of creating or adapting Guideline 0 to refrigeration systems and refrigerated facilities. Most commercial and industrial refrigeration systems are not currently commissioned to the same level as outlined in Guideline 0. The presenters provide an outline of the commissioning process along with the benefits and roadblocks that exist when applying it to refrigeration systems.

**1. Overview of the Commissioning Process**

*Jim Bochat, Member, Commissioning Concepts, Phoenix, AZ*

**2. Benefits and Roadblocks to the Commissioning of Refrigeration Systems**

*Douglas Reindl, Dr.Eng., P.Eng., Fellow ASHRAE, IRC, U.W. Madison, Madison, WI*

**SEMINAR 45 (ADVANCED)**

**HVAC&R Research Journal, Part 2: Thermodynamic Properties**

Track: Fundamentals

Room: Panzocola F4

Sponsor: HVAC&R Research

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

This session highlights recently published papers in HVAC&R Research.

**1. Thermodynamic Properties of Real Moist Air, Dry Air, Steam, Water and Ice**

*Sebastian Herrmann, Student Member, Zittau/Goerlitz University of Applied Sciences, Zittau, Germany*

**2. Extension of the Implicit Curve-Fitting Method for Fast Calculation of Thermodynamic Properties of Subcooled Refrigerants**

*Gou-liang Ding, Member, Shanghai Jiao Tong University, Shanghai, China*

**SEMINAR 46 (ADVANCED)**

**ASHRAE Member's Survival Guide: Billing and Collection Practices to Insure You Get What You Deserve, Part 1**

Track: Professional Skills

Room: Panzocola F1

Sponsor: 1.7 Business, Management & General Legal Education

Chair: Leon E. Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV

ASHRAE members face a multitude of business problems even in the best of times. In these difficult times, some of these issues—billing, delinquent accounts and collections—become critical to your survival. This seminar and ensuing panel discussion presents ideas on how to improve billing practices, and will explore the legal and practical aspects of



collections including: strategies to identify problem accounts; technology to optimize billing; use of outside collection and/or law firms; collection negotiation skills; litigation strategies and procedures and bankruptcy issues.

**1. Don't Work for Free: Collection Strategies from A to Z**  
*Robert L. Saldutti, Esq., Saldutti Law LLC, Cherry Hill, NJ.*

#### FORUM 8 (INTERMEDIATE)

##### Should Gas-Phase Filtration be a Typical Application in Standard 62?

Track: ASHRAE Standards

**Room: Panzacola G2**

**Sponsor:** Standard 62.1

**Chair:** William P. Lull, Member, Garrison/Lull Inc., Princeton Jct, NJ

ASHRAE Standard 62.1 includes many requirements related to ventilation for acceptable indoor air quality, but it makes little reference to gaseous contamination. Section 4 requires the user to assess and document both regional and local outside air quality. Section 6.1 specifically requires air cleaning to remove outdoor ozone, but only in locations with very high regional ozone levels. Section 6.3 (the IAQ Procedure) requires identification of contaminants of concern, which almost certainly includes gaseous contaminants, but specific contaminants and/or air cleaning requirements are not addressed directly. Should gas-phase filtration requirements be a more prominent in the standard? What gases should be filtered? What are the gaseous air cleaning opportunities for net-zero energy and low-impact buildings?

#### FORUM 9 (ADVANCED)

##### Will Equipment Protection Requirements for Large Buildings Change as NZEB with PV Increase?

Track: Energy Conservation and Alternative Energy Sources/Solutions

**Room: Panzacola H3/4**

**Sponsor:** 1.9 Electrical Systems

**Chair:** John Nix, Member, Florida Power & Light company, Miami, FL

As photovoltaic installations on the distribution system increase, utilities expect to relax the frequency threshold for inverters to drop out, to prevent sudden loss of PV during a minor disturbance, which could cause system instability when the power from the PV is most needed. Will large building HVAC&R equipment see more voltage sags as a result? Is it necessary for an owner of a high-performance or NZEB building who installs PV to increase the protection on HVAC equipment and controls?

11:00 A.M.–12:30 P.M.

#### SEMINAR 47 (ADVANCED)

##### High Performance HVAC System in LEED Platinum Projects: A Selected Showcase

Track: Green Buildings/Sustainability

**Room: Panzacola H1/2**

**Sponsor:** Commissioning, TRG4 Sustainable Building Guidance and Metrics (SBGM)

**Chair:** Paul Tseng, P.E., Associate Member, Advanced Building Performance, Inc., Potomac, MD

The seminar showcases a short list of selected LEED Platinum projects and highlights the high performance design features, especially energy efficient HVAC designs, building envelope enclosure features, ventilation strategies, indoor environmental quality attributes and actual energy performance index, if available.

##### 1.High Performance HVAC Systems in LEED Platinum Projects: Overview of Projects

*David Thibodeau, E.K. Fox & Associates, Ltd., Fairfax, VA*

##### 2.HVAC System Performance for the New U.S. Green Building Council's Headquarters: A LEED-2009 Platinum Project

*Paul O'Brien and Patrick Kunze, GHT Limited, Arlington, VA*

##### 3.Commissioning High Performance HVAC Systems in LEED Platinum Projects: An Experienced Review

*Doug Menchhofer and Jeremy Shinko, Girard Engineering, PC, Falls Church, VA*

#### SEMINAR 48 (INTERMEDIATE)

##### Economics, Energy and CO<sub>2</sub> Savings of CHP Systems and the Future of Opportunity Fuels as an Energy Source

Track: Energy Conservation and Alternative Energy Sources/Solutions

**Room: Panzacola H3/4**

**Sponsor:** 1.10 Cogeneration Systems, 7.7 Testing and Balancing

**Chair:** Riyaz Papar, P.E., Member, Hudson Technologies, The Woodlands, TX

Combined heat and power (CHP) systems are being applied where energy cost provides a reasonable ROI. Equipment load factor, electric rate, fuel pricing are the dominant drivers for CHP system success today. CHP viability is increasing as public policy shifts toward sustainability and opportunity fuels. This seminar provides essential insight about performance through two case studies and a presentation on the use of opportunity fuels in CHP systems.

##### 1. Case Study of a CHP Plant Serving an Office, Research and Data Center Campus in San Diego

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

**2. Case Study of a Microturbine-based CHP System at a New York City Hotel**

*Timothy Wagner, Ph.D., Member, UTC Power Program Office at United Technologies Research Center, Hartford, CT*

**3. Future of Opportunity Fuels for CHP Systems and their CO2 Impact**

*Bruce Hedman, Ph.D., ICF International Company, Arlington, VA*

**SEMINAR 49 (INTERMEDIATE)** 

**On the Front-line of Comfort: Working with Building Operators for Sustainable Comfort**

Track: IAQ/Comfort

Room: Panzacola G1

**Sponsor:** TRG7 Tools for Sustainable Building Operations, Maintenance and Cost Analysis (SBOMC)

**Chair:** Michael Bobker, Member, Building Performance Lab, City University of NY, New York, NY

Building systems' ability to deliver comfort is directly perceived by operators; failures go first to them for resolution. How they respond can determine energy performance. This seminar reports on TRG-7 findings about comfort, energy performance and how ASHRAE can work with operators to improve outcomes.

**1. Findings from TRG-7: Towards Sustainable Operations**  
*Adam Hinge, Member, Sustainable Energy Partnerships, Tarrytown, NY*

**2. Web-based Outreach and Education**

*Janice Peterson, Member, Northwest Energy Efficiency Alliance, Seattle, WA*

**3. The View from the Service Contract**

*Matthew Mullen, Member, NEMSI-EMCOR, Hartford, CT; Jeff Traylor, Member, EMCOR Government Services, Washington, DC*

**4. Changing Operator Perceptions about Comfort Complaints**

*Michael Bobker, Member, Building Performance Lab, City University of NY, New York, NY*

**SEMINAR 50 (INTERMEDIATE)** 

**Humidity Control Issues and Solutions for High Performing Buildings**

Track: Humidity Control

Room: Panzacola F2

**Sponsor:** 4.3 Ventilation Requirements and Infiltration

**Chair:** Ray Sinclair, Ph.D., Member, RWDI, Guelph, ON, Canada

Three presentations cover a broad range of humidity control issues affected by the integration of architectural and mechanical engineering design. Real world examples of problems and solutions clarify practices which influence design of buildings in the health care, science and technology, higher education and commercial sectors. Attendees will take away practical tips for their next projects.

**1. Innovative Humidity Control for Energy Efficient Sustainable Buildings**

*John Straube, Ph.D., P.Eng., Member, Building Science Corp., Boston, MA*

**2. Unique Design and Construction Conditions in a Humid Subtropical Environment**

*Brian Lomel, P.E., Member, TLC Engineering for Architecture, Deerfield Beach, FL*

**3. Modeling to Avoid Transient Condensation in Burn Operating Rooms**

*Glenn Schuyler, P.Eng., Member, RWDI, Guelph, Ontario, CANADA*

**SEMINAR 51 (INTERMEDIATE)**

**Modeling and Characterization of Transport Refrigeration Unit**

Track: Refrigeration

Room: Panzacola F3

**Sponsor:** 10.6 Transport Refrigeration

**Chair:** Bill Mohs, Member, Ingersoll Rand–Climate Control Technologies, Minneapolis, MN. *Jeff Berge, P.E., Member, Ingersoll Rand–Climate Control Technologies, Minneapolis, MN*

Today, most perishable commodities are transported via transport refrigeration units (TRU). TRU's typically consists of a vapor compression refrigeration system driven by a small diesel engine. While this type of system has dominated the market, it has a number of drawbacks: low thermal efficiency, and high emission of air pollutants. The rise in fuel prices, and a better awareness of the effects of airborne pollutants, is driving a change in the market to improve the efficiency of these systems. A number of recent studies have expanded the understanding of the transient behavior of TRU, with the goal of providing the design engineer with information and tools to develop more efficient systems.

**1. Transient Modeling and Validation of a TRU**

*Neera Jain; Andrew Alleyne, Ph.D., University of Illinois at Urbana-Champaign, Champaign, IL*

**2. Dynamic Model of a TRU with Compressor OFF/ON Cycling**

*Bin Li; Andrew Alleyne, Ph.D., University of Illinois at Urbana-Champaign, Champaign, IL*

**3. Field Operational Profiles of TRU**

*Brad Pierskalla, Ingersoll Rand–Climate Control Technologies, Minneapolis, MN*

**SEMINAR 52 (BASIC)**

**Issues Update: Climate Change Legislation and International Policy**

Track: Green Buildings/Sustainability

Room: Panzacola G2

**Sponsor:** Advocacy Committee; TC 2.5, Global Climate Change

**Chair:** Ryan M. Colker, J.D., Associate Member, ASHRAE, Washington, DC



Legislation aimed at the reduction of greenhouse gas emissions and mitigating the impacts of global warming is making its way through the U.S. Congress. International efforts also are underway. This session provides an update on the current status of these activities, opportunities within the building community, and the potential impact on the economy, consumers and building professionals.

**1. Cap-and-Trade Legislation: Where are We?**

*David Doniger, Natural Resources Defense Council, Washington, DC*

**2. The International Policy Response**

*Tom Werkema, Member, Arkema, Philadelphia, PA*

**3. Impacts of Climate Change Policy on Buildings**

*Jason Hartke, U.S. Green Building Council, Washington, DC*

**SEMINAR 53 (BASIC)**

**ASHRAE Member's Survival Guide: Billing and Collection Practices to Insure You Get What You Deserve, Part 2**

Track: Professional Skills

Room: Panzacola F1

**Sponsor:** 1.7 Business, Management & General Legal Education

**Chair:** *Leon Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV*

ASHRAE members face a multitude of business problems even in the best of times. In these difficult times, some of these issues—billing, delinquent accounts and collections—become critical to your survival. This seminar and ensuing panel discussion presents ideas on how to improve billing practices, and will explore the legal and practical aspects of collections including: strategies to identify problem accounts; technology to optimize billing; use of outside collection and/or law firms; collection negotiation skills; litigation strategies and procedures and bankruptcy issues.

**1. Good Billing Practices Can Keep the Cash Flowing in the Right Direction**

*Leon E. Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV*

**2. Making It Clear: Invoicing, Billing and Scoping for Clarity**

*E. Mitchell Swann, P.E., Member, MDC Systems, Paoli, PA*

**3. Panel Discussion**

*Robert L. Saldutti, Esq., Saldutti Law LLC, Cherry Hill, NJ; Leon E. Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV; E. Mitchell Swann, P.E., Member, MDC Systems, Paoli, PA*

**SEMINAR 54 (INTERMEDIATE)**

**Energy Needs Concerning Daylighting, Electrical, Lighting and Cooling Load in Green-Designed Buildings, Part 1**

Track: Energy Conservation and Alternative Energy Sources/Solutions

Room: Panzacola F4

**Sponsor:** ASHRAE Associate Society Alliance

**Chair:** *Branko Todorovic, Fellow ASHRAE, University of Belgrade, Belgrade, Serbia*

Building designs reflect the confluence of a wide range of issues and trends. These include not only the technical constraints of available technologies but also the economic, trends where energy comes these days as most important economic and environmental factor. Glass is a key element in the architectural expression of the building and also provides occupants with a visual connection with the outdoors and provides daylight indoors to enhance the quality of the interior environment. The building skin serves a crucial functional role to help maintain proper interior environments under extremes of external environmental conditions. The primary technical challenges of environmental control include heating, cooling and lighting and the final design impacts not only the owner who pays for the energy use but society at large due to resource depletion, carbon emissions, and other related regional and global environmental impacts. This seminar presents discussion of newest Buildings with the optimization concerning three greatest energy consumers, heating and cooling load and electrical and daylighting. Discussions about these influencing factors, energy needs, comfort and indoor air quality on examples in different countries is the main topic of this international seminar with the authors from USA, UK, Serbia, China, India, Finland, Turkey and France.

**1. Tuning Control of Buildings Glazing's Transmittance Dependence on the Solar Radiation Wavelength to Optimize Daylighting and Building's Energy Efficiency via Co-simulation**

*Marija Todorovic, Ph.D., Fellow ASHRAE, and Olivera Djuric Ecim, University of Belgrade, Belgrade, Serbia*

**2. New Example of High Performance Building in Turkey: Natural Lighting and Optimum Combination with Local Power**

*Birrol Kilkis, Ph.D., Fellow ASHRAE, Baskent University, Ankara, Turkey*

**3. Optimization of Cooling System in a View of Energy Saving and Indoor Environment Quality**

*Maria Virta, Member, Harri Itkonen, Panu Mustakallio and Risto Kosonen, Halton, Kausala, Finland; Jyrki Jokisalo, Helsinki University of Technology, Finland*

11:00 A.M.–1:00 P.M.

POSTER SESSION   

Room: Gatlin D

**3.5 MW Seawater Heat Pump Assisted Multipurpose Solar System's 25 Years of Operation (OR-10-025)**

*Marija S. Todorovic, Ph.D., P.E., Member, University of Belgrade, Belgrade, Serbia; Slobodan PejkoVIC, P.E., Filterfrigo Ltd., Belgrade, Serbia; Vido Zenovic, P.E., Touristic Ltd., Budva, Montenegro*

This paper describes a Slovenian Beach system constructed in Budva at the Adriatic coast 26 years ago. The 3.5 MW multipurpose solar system combined with a seawater heat pump is providing the complex of hotel buildings with sanitary and swimming pool water heating, hotel rooms space heating and air conditioning. The system in Slovenian Beach has total power of 3,5 MW and includes a 2.500 m<sup>2</sup> flat plate solar collectors field and three heat pumps of total 930 kW heating and of 720 kW cooling capacities. Sea water is used as heat source and heat sink for heat pump operation.

**A New Design Concept in Refrigerator Reversed Cycle Defrosting (OR-10-026)**

*Chin-Ting Yang, Ph.D.; V. C. Mei, Ph.D., P.E., St. John's University Taiwan, Taipei, Taiwan, China; W. R. Chang, Ph.D.; J. Y. Lin, Ph.D., Industrial Technology Research Institute, Chutung Hsinchu, Taiwan, China*

Refrigerators have been becoming more energy efficient in recent years. However, there is little research work on refrigerator defrosting. Refrigerators generally still use electrical resistance heating elements for defrost. In Asia, particularly in Japan and Taiwan, a lot of refrigerator condensers are attached to the refrigerator side panels, with heat dissipation through the panels. This design saves refrigerator space, but is not very energy efficient. Applying a typical heat pump type cycle reversal for defrosting would cause the condenser panels to become cold, and moisture might condense on the surface of the side panels and run down to the floor. A novel reverse cycle system was designed to completely by-pass the condenser, thus avoiding moisture condensation on the side panels.

**A Simulation Study of Anticipatory Control Strategies in a Net-Zero Energy Solar House (OR-10-027)**

*José A. Candanedo, P.Eng.; Andreas K. Athienitis, Ph.D., P.Eng., Building, Civil and Environmental Engineering, Concordia University, Montréal, QC, Canada*

This paper investigates anticipatory control strategies in a house designed to have approximately net zero average annual energy consumption. These strategies are particularly useful in the case of optimized solar buildings, which include one or more of the following features: (a) passive solar design; (b) active systems for collection and control of solar energy (BIPV or BIPV/T systems, solar thermal collectors, motorized blinds); and (c) thermal energy storage systems (water tanks, phase change material containers). This paper presents results of simulations which model the performance of a net-zero energy solar demonstration house using anticipatory control techniques. A relatively simple thermal network model is used throughout the building's design and in the development of the control strategies.

**An Experimental Evaluation of HVAC-Grade Carbon-Dioxide Sensors: Part 2, Performance Test Results (OR-10-028)**

*Som S. Shrestha, Ph.D., Oak Ridge National Laboratory, Oak Ridge, TN; Gregory M. Maxwell, Ph.D., Iowa State University, Ames, IA*

This is the second paper in a four-part series reporting on the test and evaluation of typical carbon-dioxide sensors used in building HVAC applications. Fifteen models of NDIR HVAC-grade CO<sub>2</sub> sensors were tested and evaluated to determine the accuracy, linearity, repeatability, and hysteresis of each sensor. This paper describes the performance of the sensors and provides a comparison with the manufacturers' specifications. The test results showed a wide variation in sensor performance among the various manufacturers and in some cases a wide variation among sensors of the same model. In all, 45 sensors were evaluated: three from each of the 15 models. Among the 15 models tested, eight models have a single-lamp, single-wavelength configuration, four models have a dual-lamp, single-wavelength configuration, and three models have a single-lamp, dual-wavelength configuration.

**An Experimental Evaluation of HVAC-Grade Carbon-Dioxide Sensors: Part 3, Humidity, Temperature, and Pressure Sensitivity Test Results (OR-10-029)**

*Som S. Shrestha, Ph.D., Oak Ridge National Laboratory, Oak Ridge, TN; Gregory M. Maxwell, Ph.D., Iowa State University, Ames, IA*

This is the third paper in a four-part series reporting on the test and evaluation of typical carbon-dioxide sensors used in building HVAC applications. Fifteen models of NDIR HVAC-grade CO<sub>2</sub> sensors were tested and evaluated to determine the humidity, temperature, and pressure sensitivity of the sensors. This paper reports the performance of the sensors at various relative humidity, temperature, and pressure levels common to building HVAC applications and provides a comparison with manufacturer specifications. The test result showed a wide variation in humidity, temperature, and pressure sensitivity of CO<sub>2</sub> sensors among manufacturers. In some cases, significant variations in sensor performance exist between sensors of the same model.

**An Experimental Study of the Thermal Environment Around a Strong Heat Source Under Single-Sided Natural Ventilation (OR-10-030)**

*Dong Liu, Ph.D.; Siwei Li, P.E.; Qing Miao, P.E., Tongji University, Shanghai, China*

A test model has been built in order to analyze how a strong heat source (SHS) influences its surrounding thermal environment with single-sided natural ventilation. Through a study about how the air temperature distributes around the heat source, particularly when the heat source was located in three locations in the center of the test model room, near the inlet and comparatively far away from the inlet, a conclusion

can be drawn that three factors, heat release rate of the SHS, air distribution with single-sided natural ventilation and the location of the heat source, have a great impact on the surrounding thermal environment.

#### **An Innovative Ventilation System for Cleanrooms with High Cooling Loads (OR-10-031)**

*Ti Lin, P.E.; Shih-Cheng Hu, Ph.D.; Andy Chang, P.E., Dept of Energy and Refrigerating Air-Conditioning Eng., Taipei University of Technology, Taipei, Taiwan; James Hwang, Ph.D., Taiwan Semiconductor Manufacturing Company, Hinchu, Taiwan*

This study proposes a unique local air exhaust system that can significantly improve the air cleanliness level and remove heat loads efficiently simultaneously. The main component is a Fan Dry Coil Unit (FDCU) installed on the ceiling above the process tool in order to extract heat and particles released from the tool. An experimental study was conducted in a full-scale cleanroom with real process tools to compare the performance of both systems. Results show that more than 50% of particles were eliminated by the proposed FDCU system as compared to that of the conventional wall return system.

#### **CFD Study of Human Respiratory Exposure to Indoor Particular Contaminants (OR-10-032)**

*Lin Tian, Ph.D., State University of New York, Canton, NY; Goodarz Ahmadi, Ph.D. and Philip K. Hopke, Ph.D., Clarkson University, Potsdam, NY; Yung-Sung Cheng, Ph.D., Lovelace Respiratory Research Institute, Albuquerque, NM*

Human respiratory exposure to indoor airborne contaminants is of great concern as humans spend most of their time indoors. To evaluate the risk of such exposure, computer simulations examined the transport of inhaled particles. The human upper respiratory system containing the trachea and the main bronchi is modeled. The effects of the breathing pattern, particle to flow density ratio, human airway geometry toward particle motion and particle fate in the upper respiratory tree are evaluated. It is found that the airflow patterns in the selected domain are more affected by the geometry than the breathing intensity. Particle dispersion, deposition pattern and penetration rates are calculated.

#### **Compensation of Manual Reset to Offset Thermal Loads Change for PID Controller (OR-10-033)**

*Yuji Yamakawa, Ph.D., University of Tokyo, Bunkyo-ku, Japan; Takanori Yamazaki, P.E., Oyama National College of Technology, Oyama, Tochigi, Japan; Kazuyuki Kamimura, P.E., Yamatake Co., Ltd., Tokyo, Ota-ku, Japan; Shigeru Kurosu, P.E., Crotech, Ibaraki, Chikusei, Japan*

Proportional-plus-integral (simply, PI) controllers have been by far the most widely used and this situation has not yet changed greatly. With a simple Proportional (P) controller, there would be an offset, which the operator could eliminate by the manual reset to compensate for thermal loads change. The automatic reset with an Integral (I) controller is absolutely necessary to make the control output be returned to the

setpoint automatically. PI controller, however, often leads to a poorly damped response. Proportional-plus-integral-plus-derivative (PID) controllers have been more desirable than PI controllers due to the stabilizing effect of a Derivative (D) action. The thrust of this paper is to offset thermal loads before they affect the control output and to confirm the effectiveness of compensation of the manual reset.

#### **Demonstration of the Use of Multimedia Electronic Information Enhancements for a Chapter Handbook CD-ROM (RP-1017): 3D Modeling and Animation (OR-10-034)**

*Jeff Haberl, Fellow, Ph.D., P.E. and Ergun Akleman, Ph.D., Texas A&M University, College Station, TX*

Earlier we demonstrated the effectiveness of multimedia and advanced presentation techniques such as 3D computer graphics, visualization and animation techniques (Akleman 02). The previous paper was intended to serve as a model and guide for the broad use of these techniques in other ASHRAE publications. However, the 3D models and animations that were developed for ASHRAE publications has a unique set of problems that are different from classical 3D modeling and animation problems. Our experience with this project convinced us that these models and animations cannot be created without close collaboration between ASHRAE engineers and animation specialists. Therefore, in this paper, we expand the discussion initiated in the first paper by presenting some of the unique sets of difficulties we have faced during the process using two case studies, modeling and animation, of: (1) Rolling Piston, and (2) Twin Screw Compressors.

#### **Development and Validation of a Fan Performance Model for Typical Packaged HVAC Systems (OR-10-035)**

*Zheng Keke, P.E.; Haorong Li, Ph.D., University of Nebraska-Lincoln, Omaha, NE*

Existing methods for fan performance model are mostly based on fan static pressure and fan airflow. However, for typical packaged HVAC units, a non-ideal airflow pattern arises due to the compact arrangement of interior components, thus resulting in both the fluctuation of the field fan static pressure and the difficulties of the pressure sensors installation. This paper describes the development of the fan performance grey-box model, which relates fan power consumption to fan speed and airflow both of which are much easier to measure. Several practical field measuring or prediction methods of blower speed for the model implement and validation are proposed.

#### **Development of a High-Efficiency Air Cooled Packaged Air-Conditioner for Data Centers (OR-10-036)**

*Keisuke Sekiguchi, Dr.Eng. and Shisei Waragai, Dr.Eng., NTT Facilities, Inc., Tokyo, Japan; Tsuneo Uekusa, Dr.Eng., Nippon Telegraph and Telephone West Corp., Osaka, Japan; Kenji Yamasaki, Hitachi Appliances, Inc., Shizuoka, Japan*



The authors have developed technologies that will contribute to saving energy in air-cooling package air conditioners and have developed an air conditioner for data centers that incorporates these technologies. In the development of constituent technologies, based on the unique characteristics of year-round cooling operations in data centers, the authors endeavored to increase the efficiency of compressors in outdoor conditions at medium and low temperatures, and to expand the scope of low pressure ratio operations. Air conditioners that incorporate these saving energy technologies reduce annual power consumption by about 40% under Tokyo meteorological conditions compared to conventional computer room air conditioners.

**Effect of Dents in Condenser Fins on Air-Conditioner Performance (OR-10-037)**

*Frank Lu, P.E., University of Texas at Arlington, Arlington, TX; Matthew Sitzmann, P.E.; Steve R. Smith, P.E., Haag Engineering, Co., Irving, TX*

Experiments demonstrated performance degradation in air-conditioning systems resulting from dents in the fins of their condensers and the extent to which conventional fin repair methods restore performance. Two different, commercially available residential-type air-conditioner condensing units were tested. Flattening substantial areas of the fins caused a reduction in capacity and efficiency of the cooling systems tested. Performance dropped appreciably after 60% of the fin areas were pressed flat. With 100% of the fin area flattened, system capacity decreased by 27% and system SEER by 34% for one of the systems. Combing the dented fins after the extreme case where all fins were flattened restored capacity to within 1% and SEER to within 6% of the undented condition.

**Energy Implications of Filtration in Residential and Light-Commercial Buildings (RP-1299) (OR-10-038)**

**Sponsor:** *TC 2.4 Particulate Air Contaminants and Particulate Contaminant Removal Equipment*

*Brent Stephens, P.E.; Jeffrey A. Siegel, Ph.D.; Atila Novoselac, Ph.D., Civil, Architectural and Environmental Engineering, The University of Texas at Austin, Austin, TX*

Higher-efficiency HVAC filters generally have a higher pressure drop and are widely assumed to increase energy consumption in smaller air conditioning systems. To explore the effects of filters in real buildings, we monitored 17 residential and light-commercial forced air cooling systems in Austin, Texas. Measurements were made once per month for one year at each site with filters from three different MERV range categories. The median energy consequence of higher-efficiency filtration in the test systems was estimated as a decrease of approximately 16 kWh per ton of nominal capacity (4.6 kWh per kW) per month of cooling season operation, albeit with large variation. These results suggest that the link between higher-efficiency filters and energy use in smaller residential and light-commercial systems is weak and that other factors should govern filter selection.

**Energy Systems Management and Greenhouse Gas Reduction (OR-10-039)**

*Stephen Treado, Ph.D., P.E., Pennsylvania State University, State College, PA; David Holmberg, Ph.D., National Institute of Standards and Technology, Gaithersburg, MD*

The efficient use of energy reduces both energy costs and greenhouse gas (GHG) emissions, and the mix of energy sources can also affect GHG emissions. In the United States, the building sector comprises about one third of GHG emissions, presenting an attractive opportunity for utilizing advanced design, operation and control strategies to minimize energy consumption and emissions while optimizing overall system performance through the implementation of cogeneration, heat recovery, adaptive controls and other advanced techniques. This paper presents an approach for controlling GHG emissions and energy consumption through improved communication between energy consumers and suppliers, and advanced energy management systems. A specific example involving cogeneration is detailed to demonstrate the concept.

**Evaluating the Ability of Unitary Equipment to Maintain Adequate Space Humidity Levels (RP-1254) (OR-10-040)**

**Sponsor:** *TC 8.11 Unitary and Room Air Conditioners and Heat Pumps*

*Michael J. Witte, Ph.D., P.E.; Robert H. Henninger, P.E., GARD Analytics, Inc., Arlington Heights, IL*

This paper provides an overview of the results of ASHRAE Research Project RP-1254, Evaluating the Ability of Unitary Equipment to Maintain Adequate Space Humidity Levels; Phase II: Simulations, Summary and Development of Guidelines. Whole-building energy simulations were used to perform a parametric analysis of eighteen HVAC system types in seven commercial building types (small office, large retail, 9 month classroom, 12 month classroom, restaurant dining area, small hotel/motel guest room, and theater) using two sets of ventilation rates (ASHRAE Standards 62-2001 and 62.1-2004) in 10 locations. The systems are also compared for life cycle costs using approximate installed equipment costs and HVAC annual energy costs.

**Experimental and Numerical Investigation of a Mechanically Ventilated, Double Glazing Facade with Between-the-Panes Venetian Blinds (OR-10-041)**

*Omid Nemati, P.E.; Michael R. Collins, Ph.D., University of Waterloo, Waterloo, ON, Canada; Luis M. Candanedo, P.E.; Andreas Athienitis, Ph.D., P.E., Concordia University, Montreal, QC, Canada*

This paper examines a building integrated photovoltaic/thermal (BIPV/T) system consisting of a mechanically ventilated, multi-skin façade, a between-the-panes venetian blind layer, and a between-the-panes photovoltaic (PV) panel. The paper will thus contribute to the need to understand, design, and optimize BIPV/T systems. The combined photovoltaic and shading arrangement produces electricity and thermal



energy in the form of preheated fresh air, and allows for adjustable daylighting. The velocity and temperature fields around the blind slats were experimentally and numerically studied. Experimental observations and numerical models are essential in understanding the complex fluid dynamical and thermal system. Two important experimental techniques were Particle Image Velocimetry (PIV) and temperature measurements that were taken inside the ventilated façade.

#### **Feasibility Study of Hybrid Wheel Desiccant Dehumidification Cooling Systems in Malaysia (OR-10-042)**

*Salman Khosravi, Ph.D.; T.M. Indra Mahlia, Ph.D.; Yau Yat Huang, Ph.D., University of Malaya, Malaya, Malaysia*

HVAC with wheel desiccant dehumidification (WDD) with a low ambient impact is more efficient system compare to the traditional systems. Hybrid desiccant cooling systems (HDCS) can be used to control indoor air quality (temperature and humidity) in commercial and industrial buildings. Results increasingly show stringent guidelines for outdoor ventilation rate. Application of these systems depends on site-specific conditions and the loading rate, while; a high percentage of a building load can be latent. This study presents important variables analysis for different areas in Malaysia. The correlation shows that a high potentiality exists for using hybrid desiccant systems in all areas of Malaysia. Moreover the corresponding electricity saving would be considerable.

#### **For Designing a Compact Absorber with Membrane Contractor at Liquid Vapor Interface: Influence of Membrane Properties on Water Vapor Transfer (OR-10-043)**

*Ahmed Hamza H. Ali, Ph.D., Assiut University, Assiut, Egypt; Peter Schwerdt, P.Eng., Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT, Oberhausen, Germany*

Designing a compact cooling system for specialty applications, like person-designing a compact cooling system for specialty applications, like person-portable biological suits, requires novel approaches. Absorption chiller technology has long been considered an ideal candidate for portable applications and designing a compact absorber for a new type chiller has merit. This study aims at investigating experimentally and analytically, under vacuum operating conditions, the influence of membrane properties on the water vapor transfer flux into a lithium bromide-water solution through a hydrophobic microporous membrane contactor at a liquid/vapor interface forming a confined narrow channel.

#### **High Solar Combi Systems in Europe (OR-10-044)**

*Constantinos A. Balaras, Ph.D., P.E., National Observatory of Athens, Athens, Greece*

This paper reviews the various options for exploiting solar thermal systems for sanitary hot water and space heating (solar combi systems), solar cooling, and combined solar space heating-cooling and sanitary hot water) systems (combi-plus) in Europe, summarizing their main design,

operational and performance characteristics, in order to derive some practical guidelines. The paper also includes an overview of high combi-plus solar systems that aim to develop solar thermal heating and cooling systems with high solar fraction, combining different technologies and components to optimize performance, as a result of an ongoing European research and demonstration project.

#### **Impact of Typical Weather Selection Approaches on Energy Analysis of Buildings (RP-1477) (OR-10-045)**

**Sponsor:** TC 4.2 Climatic Information

*Donghyun Seo, P.E., University of Colorado, Boulder, CO; Joe Huang, P.E., White Box Technologies Inc., Moraga, CA; Moncef Krarti, Ph.D., P.E., University of Colorado, Boulder, CO*

The paper summarizes the results of a series of analyses to assess the impact of the selection procedure used to generate of typical year weather on annual building energy use. The building energy analysis is carried out using detailed whole building simulation tool that utilizes hourly typical year weather files. Annual energy use for prototypical office buildings are obtained for 10 sites representing a wide range of climatic conditions in the US. In particular, the analyses presented in this paper evaluate the impacts of weighting factors for various weather variables and of the length of historical data used on predicting the energy use of building systems.

#### **Impacts of Static Pressure Reset on VAV System Air Leakage, Fan Power, and Thermal Energy (OR-10-046)**

*Jingjuan Feng, Ph.D., University of California Berkeley, Berkeley, CA; Mingsheng Liu, Ph.D., P.E.; Zhan Wang, Ph.D.; Lixia Wu, Ph.D.; Keke Zheng, Ph.D., University of Nebraska Lincoln, Omaha, NE; Xiufeng Pang, Ph.D., Lawrence Berkeley National Laboratory, Berkeley, CA*

As for a variable air volume (VAV) system, the supply fan speed typically modulate to maintain a duct static pressure setpoint. Traditionally, this setpoint is a constant based on system characteristics at design condition and the pressure sensor location. Under partial load conditions, the pressure loss in the duct is much less than the design value due to reduced air flow. Thus, the static pressure set point can be reset lower. This can reduce fan power, avoid noise at terminal box dampers and prevent box damper malfunction due to excessive pressure. This paper develops theoretical models to demonstrate the impacts of static pressure reset on air leakage, fan power and thermal energy for both pressure independent and pressure dependent terminal boxes.

#### **Infiltration Investigation of a Radiantly Heated and Cooled Office (OR-10-047)**

*Xiangyang Gong, P.E.; David E. Claridge, Ph.D., P.E., Texas A&M University, College Station, TX; David H. Archer, Ph.D., Carnegie Mellon University, Pittsburgh, PA*

Air infiltration has a significant impact on the heating and cooling loads of small office and residential buildings. In a radiantly heated and cooled office, air infiltration normally determines whether this type of system can operate without condensation on the radiant cooling surface in summer in mild and humid climatic conditions, because infiltration may bring considerable moisture into the space. The office studied experiences infiltration that seriously limits the effectiveness of the radiant cooling system and active desiccant dehumidification system. This paper reports the results of infiltration levels determined from blower door measurements and logged humidity data from the ventilation unit as well as a reanalysis of the CO<sub>2</sub> data.

### **Influence of Long-term Trends and Period of Record Selection on the Calculation of Climatic Design Conditions and Degree-Days (RP-1453) (OR-10-048)**

*Sponsor: TC 4.2 Climatic Information*

*Didier Thevenard, Ph.D., P.Eng., Numerical Logics Inc., Waterloo, ON, Canada*

Calculation of climatic design conditions and cooling and heating degree days using data from different decades for 1274 stations worldwide reveals long-term trends. Over the last three decades, climatic design conditions have increased at an average rate of 0.76°C/decade (1.37°F/decade) for the 99.6% heating dry bulb temperature, 0.38°C/decade (0.68°F/decade) for the 0.4% cooling design temperature, and 0.28°C/decade (0.50°F/decade) for the 0.4% dehumidification dew point temperature. Annual heating degree-days have decreased on average by 118°C-day/decade (212°F-day/decade) while annual cooling degree days have increased by 68°C-day/decade (122°F-day/decade). The paper also studies the appropriate period of record to use for the calculation of climatic design conditions and degree-days.

### **Integrated Design for Perimeter Zones with Glass Facades (OR-10-049)**

*Athanassios Tzempelikos, Ph.D., Purdue University, West Lafayette, IN; Andreas K. Athienitis, Ph.D., P.E., Concordia University, Montreal, QC, Canada; Atonis Nazos, P.E., Technological Education Institute of Piraeus, Athens, Greece*

A general simulation design methodology for integrated daylighting and thermal analysis of perimeter spaces of buildings is presented in this paper. The objective is to provide guidelines on how to select glass ratio of the façade, shading device properties and control from the early design stage. The simulation-based approach followed is to create generalized performance indices (at a systems level) as parametric functions of key design parameters (at a component level, such as the glazing area) and then provide the designer with useful information for making decisions based on the integrated analysis results. The methodology is general and applies to perimeter spaces of commercial and institutional buildings (particularly offices) for any location, orientation, glazing and shading type.

### **Metastable Flow Inside Capillary Tubes: A Critical Review (OR-10-050)**

*Mohd. Kaleem Khan, Ph.D., Indian Institute of Technology Patna, Patliputra Colony, Patna, India*

In this paper, an attempt has been made to document the literature on metastability, a phenomenon associated with boiling of liquids. The available correlations for the prediction of metastability have been presented and their range of applications has also been discussed. In a capillary tube, the metastability significantly influences the refrigerant mass flow rate. A comparison of Heurta et al. (2007) and Li et al. (1990) studies on the metastable flow in adiabatic capillary tubes has been made. However, the only study on the metastable flow through diabatic capillary tubes was conducted by Chen and Lin (2001). In the end, a simplified mathematical model based on the previous works has also been presented to give the readers an insight into the numerical design of adiabatic capillary tubes, considering the phenomenon of metastability.

### **Method to Specify and Empirically Develop Air Conditioning Components and System Leak Tightness for In-line Leak Testing (OR-10-051)**

*Ranjit Ghosh, P.E.; Hemi Sagi, Ph.D., Advanced Test Concepts, Inc., Indianapolis, IN*

Air-conditioning components and systems leak tightness is defined by numerous specifications/standards in terms of g/yr of refrigerant loss. Implementation of these standards to a production leak tightness specification has been based on theoretical models that have resulted in potentially biased specifications that do not consider all micro-fluidic phenomena that can cause a given micro leak-path to be self-plugged. A generic method for leak tightness specifications known as equivalent micro-geometry (EMG) is presented. The EMG is the maximum size of a micro-channel or pin-hole that will likely self plug during normal operation and therefore meets current environmental and functional specifications.

### **Methodology to Evaluate End Use Options to Reduce CO<sub>2</sub> Emissions from Buildings (OR-10-052)**

*Neil P. Leslie, P.E.; M. Czachorski, P.E.; Yanjie Yang, P.E.; Ron Edelstein, P.E., Gas Technology Institute, Des Plaines, IL*

This paper provides a methodology to evaluate end use options to reduce primary energy consumption and CO<sub>2</sub> emissions associated with buildings. First, the paper discusses alternative energy efficiency metrics, their uses, and limitations. In particular, limitations of site energy and cost as meaningful societal metrics are reviewed, along with the challenges associated with alternative metrics such as full fuel cycle energy efficiency and CO<sub>2</sub> emissions. In addition, the paper provides a methodology and example calculations for evaluating the site energy, full fuel cycle energy, and CO<sub>2</sub> emissions of targeted direct use options. Results of the sample calculations show that natural gas water heaters can reduce primary energy consumption and CO<sub>2</sub> emissions significantly compared to equivalent electric resistance water heaters.

### Moving Ducts into Conditioned Space: Getting to Code in the Pacific Northwest (OR-10-053)

David Hales, P.E., Washington State University Extension Energy Program, Spokane, WA; David Baylon, P.E., Ecotope, Seattle, WA

Changes in building practices in the Pacific Northwest have led to the installation of most components of central forced air heating systems outside of the conditioned envelope resulting in an overall degradation of distribution efficiency. Increases in fuel costs and efforts to reduce environmental impacts have resulted in an effort to encourage builders to place duct work within the conditioned envelope and regain lost distribution efficiency. Modeling with SEEM software indicates substantial savings for the region across climate zones and system fuel types ranging from 9.0% to 28.4% system savings in heating and 7.7% to 17.0% savings in cooling.

### Optimization of the Ground Thermal Response in Hybrid Geothermal Heat Pump Systems (OR-10-054)

Andrew D. Chiasson, Ph.D., P.E., University of Dayton, Dayton, OH; Cenk C. Yavuzturk, Ph.D., University of Hartford, West Hartford, CT; Drew W. Johnson, Ph.D., P.E., University of Texas, San Antonio, San Antonio, TX; Thomas P. Filburn, Ph.D., University of Hartford, West Hartford, CT

A study for the optimization of the ground thermal response in hybrid geothermal heat pump systems is presented. The design difficulty with hybrid geothermal heat pump systems is inherently an optimization problem that is best solved with a short time-step system simulation method. Many parameters can be optimized, and there is no unique expression of the optimization objective function. In this study, the optimization problem is defined as balancing the annual thermal loads on the ground by minimizing the borehole heat exchanger length and supplemental equipment size. The supplemental equipment examined in this research work has been limited to flat plate solar thermal collectors for heating-dominated applications and direct-contact evaporative cooling towers in cooling-dominated applications.

### Organic Rankine Cycle Working Fluid Considerations for Waste Heat to Power Applications (OR-10-055)

David J. Schroeder, Ph.D., Northern Illinois University, DeKalb, IL; Neil Leslie, P.E., Member, Gas Technology Institute, Des Plaines, IL

This paper describes the results of an analysis of the opportunity for industrial waste heat to power in the United States using the organic Rankine cycle. The EPA National Emissions Inventory databases are used to quantify the available heat content and temperature of the sources. By frequency, the majority of waste heat sources are at temperatures below 450°F (232°C) however, more than half of the total opportunity for waste heat to power comes from sources with exhaust gas temperature between 500°F (260°C) and 1000°F (538°C). While these temperatures are

not high enough to make steam based generation attractive they are high enough that working fluid decomposition must be considered in the opportunity analysis. For sources under 1000°F (538°C) including the limitations of working fluid decomposition brings the technically recoverable power from 44 to 32 GW. Total opportunity, including all sources over 300°F (149°C) is estimated to be 51 GW. In addition to opportunity analysis the kinetics of working fluid decomposition are discussed and calculated for several widely used fluids as a function of temperature.

### Performance of a Transcritical CO<sub>2</sub> Heat Pump for Simultaneous Water Cooling and Heating (OR-10-056)

J. Sarkar, P.E., Institute of Technology-BHU, Varnasi, India; Souvik Bhattacharyya, Ph.D., P.E.; M. Ram Gopal, P.E., Indian Institute of Technology, Kharagpur, India

This paper presents the experimental as well as the simulated performance studies on the transcritical CO<sub>2</sub> heat pump for simultaneous water cooling and heating; effects of water mass flow rates and water inlet temperatures of both evaporator and gas cooler on the cooling and heating capacities, system COP and water outlets temperatures are investigated. Study shows that both the water mass flow rate and inlet temperature have significant effect on system performances. Test results show that the effect of evaporator water mass flow rate on the system performances and water outlet temperatures is more pronounced compared to the gas cooler water mass flow rate and the effect of gas cooler water inlet temperature is more significant compared to the evaporator water inlet temperature.

### Refinements and Improvements to the Radiant Time Series Method (RP-1326) (OR-10-057)

**Sponsor:** TC 4.1 Load Calculation Data and Procedures  
Jeffrey D. Spitzer, Ph.D., P.E., Oklahoma State University, Stillwater, OK; Bereket A. Nigusse, Ph.D., ICF International, Arlington, VA

This paper provides an overview of recent refinements and improvements to the Radiant Time Series Method (RTSM) as part of 1326-RP. These refinements and improvements include updating the fenestration model to be consistent with currently available manufacturers data, development of a correction for heat losses that can be significant in buildings with high percentages of single pane glazing on the façade, and development of compact procedures for computing radiant time factors (RTF) and conduction time series factors (CTSF). In addition, verification of the RTSM against the Heat Balance Method (HBM) with a large parametric study is also summarized.

### Relationship between HVAC Noise Levels and Air-flow Rates, and Noise Control, in a Mechanically-ventilated University Building (OR-10-058)

Murray R. Hodgson, Ph.D., SOEH-MECH, UBC, Vancouver, BC, Canada

An investigation was conducted into HVAC-related noise levels and air-flow rates in five classrooms in a mechanically-



ventilated building at the University of British Columbia (UBC), the relationship between them, and how to control the noise. The results suggest that achieving both acceptable noise and ventilation can be a challenge; they also demonstrate that environmental factors are not independent, and must be optimized from a multi-disciplinary perspective if high-quality environments are to be achieved for the building occupants.

#### **Solution of a Regenerator Periodic Problem: Case for Air Conditioning (OR-10-059)**

*A. A. Rabah, P.E., University of Khartoum, Khartoum, Sudan; S. Kabelac, P.E., University of Helmut-Schmidt, Hamburg, Germany*

This work presents analytical solution for the periodic problem of regenerators used in air conditioning which are operating at low regeneration temperatures and mass flow rates. These types of regenerators are characterized with  $NTU/Cr^* < 1$ . The partial differential equations for the hot and cold airflows as well as the regenerator matrix were solved using ‘successive transformation of variables’. They were reduced to ordinary Bessel differential equation of the type. The conventional initial and reversal boundary conditions were used in this work. The solution produced a correlation for the prediction of regenerator effectiveness. Besides the effectiveness, the solution facilitates the calculation of the matrix temperature distribution and exit airflow temperatures.

#### **The Influence of HVAC Systems on Indoor Secondary Organic Aerosol Formation (OR-10-060)**

*Michael Waring, Ph.D., Drexel University, Philadelphia, PA; Jeffrey Siegel, Ph.D., University of Texas at Austin, Austin, TX*

Chemical reactions between ozone and terpenoids can yield secondary organic aerosol (SOA), which are potentially a large source of indoor particles that are harmful to human health. The mass of SOA formed in a building is influenced by the operation of the heating, ventilation, and air-conditioning (HVAC) system. This investigation models the influence of HVAC systems on SOA concentrations in residential and commercial buildings. A parametric analysis explores the role of ventilation and recirculation rates, filtration efficiency and loading, and the operation of heat exchangers. The results presented herein can be used to estimate the effects of altering HVAC system components and operation strategies on indoor SOA concentrations and subsequent exposure.

#### **The Nature, Significance and Control of Solar Driven Diffusion in Wall Systems: Synthesis of RP-1235 (RP-1235) (OR-10-061)**

**Sponsor:** *TC 4.4 Building Materials and Building Envelope Performance*

*Dominique Derome, Ph.D., EMPA, Dübendorf, Switzerland; Achilles Karagiozis, Ph.D., Oak Ridge National Laboratory, Oak Ridge, TN; Jan Carmeliet, Ph.D., EMPA, Dübendorf, Switzerland*

A project initiated by TC 4.4 looked at the nature, significance and control of solar-driven diffusion in wall

systems. The project combined experimental and simulation work to provide an in-depth characterization of the phenomena occurring during inwards vapor diffusion in insulated wall assemblies. Small- and large-scale laboratory tests provided data under controlled conditions, indicating that porous claddings that absorb rain become the source of moisture when subjected to solar radiation. The vapor permeance of the interior finish layer is a key parameter leading to moisture accumulation in the gypsum board. Field studies were performed over a period of 2 years and occurrence of solar driven diffusion was documented for different wall assemblies. Once the capacity of computer models to reproduce the observed behavior was verified, a parametric study was performed for 18 different wall assemblies in seven locations in USA.

#### **The Novel Use of Piezoelectric Transducers in the Implementation of Reliable Self-Contained Range Hoods (OR-10-062)**

*Tang-Jen Liu, Ph.D., Far East University, Taiwan, China; I-Cheng Shen, Ph.D., National Cheng Kung University, Taiwan, China*

Although the use of a piezoelectric transducer has transformed a traditional range hood to a self-contained one and give it real-time performance on the detection of cooking fumes that is never achieved by the temperature and the optic sensors commonly used for continuous ventilation in the kitchen, the exhaust flow rate controlled precisely without unnecessary running noise and power consumption on the basis of reliable estimation of the amount of plume-like cooking fumes is still desired. With the implementation in this study, cooking fumes can be detected immediately and estimated properly within four sampling periods that is about 23.8 ms. Then the self-contained range hood removes the cooking fumes with proper exhaust flow rates instead of the full one. As a result, the noise reduction or the energy saving can be reached up to 39.53%.

#### **Thermal Environment and Productivity in Factory (OR-10-063)**

*Xiaojiang Ye, Ph.D.; Huanxin Chen, Ph.D., Huazhong University of Science and Technology, Wuhan, China; Zhiwei Lian, Ph.D., Zhongyuan University of Technology, Henan, China*

Field investigations of two different factories were carried out in Zhenjiang and Shanghai in cool season to analyze the relation among indoor environment, humans and productivity. This study examined the effect of working environment and other factors on thermal comfort and productivity in factories. In this study, mean thermal neutral temperature was 19.0 °C in the factory in cool season. The results show that productivity (103.2% in Zhenjiang and 100.6% in Shanghai) does not reach the highest when occupants thermal sensation vote (TSV) are neutral or comfort. The highest productivity (105.1% in Zhenjiang and 104.7% in Shanghai) occurs when TSV of subjects are slightly cool. The productivity in slightly warm state is 104.5% in Zhenjiang (103.4% in Shanghai) which is also higher than that in neutral state.



**Transient and Steady State Models for Open-Loop Air-Based BIPV/T Systems (OR-10-064)**

*Luis M. Candanedo, P.E.; Andreas K. Athienitis, Ph.D., P.Eng.; Jose A. Candanedo, P.E.; William O'Brien, P.E.; Yu-Xiang Chen, P.E., Concordia University, Montreal, QC, Canada*

Open-loop building-integrated photovoltaic/thermal (BIPV/T) systems with air as the heat transfer fluid can supply a substantial portion of the space heating and hot water needs of residential and commercial buildings in cold climates. Over the last few years, several customized mathematical models for these systems have been developed. This paper presents a more general model useful for design or control purposes which allows for steady-state or transient analysis. Steady state models provide a quick evaluation of the energy balance and system performance useful for design. Transient models provide more insight valuable for development of control algorithms and system design optimization. .

**AHR Expo—Orange County Convention Center**

**2 P.M.–3 P.M.**

**Cost/Benefit Analysis Methodology and Tools Needed by Owners**

**Room: S310 E**

**Sponsor:** *TG3, HVAC&R Contractors and Design Build Firms*

**Chair:** *George W. (Billy) Austin, Jr., PE, Member, Shultz Engineering Group, P.C., Charlotte, NC*

**Presenter:** *Paul Shahriari, Founder, GreenMind, North Fort Myers, FL*

The focus throughout the business world has turned to a longer-term view of decision-making. Sustainability has its foundation built upon the triple bottom line. This presentation will provide an understanding of High Performance Green Building Cost Benefit Analysis with a focus on the LEED Rating System. Real project example reviews of how they tackled options and impacts are presented. How these decisions made greener, over an entire portfolio of buildings and facilities can provide tremendous impact on a economic, environmental and social scales.†

# Wednesday, January 27

All sessions for Wednesday are hosted at Rosen Shingle Creek.

8:00 A.M.–9:30 A.M.

## SEMINAR 55 (INTERMEDIATE)

### Energy Needs Concerning Daylighting, Electrical, Lighting and Cooling Load in Green-Designed Buildings, Part 2

Track: Energy Conservation and Alternative Energy Sources/Solutions

Room: Panzacola F4

Sponsor: ASHRAE Associate Society Alliance

Chair: Kent Peterson, P.E., Presidential Fellow Member, P2S Engineering Inc., Long Beach, CA

Building designs reflect the confluence of a wide range of issues and trends. These include not only the technical constraints of available technologies but also the economic, trends where energy comes these days as most important economic and environmental factor. Glass is a key element in the architectural expression of the building and also provides occupants with a visual connection with the outdoors and provides daylight indoors to enhance the quality of the interior environment. The building skin serves a crucial functional role to help maintain proper interior environments under extremes of external environmental conditions. The primary technical challenges of environmental control include heating, cooling and lighting and the final design impacts not only the owner who pays for the energy use but society at large due to resource depletion, carbon emissions, and other related regional and global environmental impacts. This seminar presents discussion of newest Buildings with the optimization concerning three greatest energy consumers, heating and cooling load and electrical and daylighting. Discussions about these influencing factors, energy needs, comfort and indoor air quality on examples in different countries is the main topic of this international seminar with the authors from USA, UK, Serbia, China, India, Finland, Turkey and France.

#### 1. Analysis for Optimization of Primary Energy Consumption between Heating, Cooling and Lighting in High Performance Commercial Buildings

Frank Hovorka, ICADE, Paris, France

#### 2. Dynamic Building Façades for Zero Energy Buildings

Steve Selkowitz, Member; Eleanor Lee, Marc LaFrance, Lawrence Berkeley National Laboratory, Berkeley, CA

#### 3. Demystifying Green Buildings and Case Study

Ashish Rakheja, Member; Spectral Services Consultants, Noida, India

## SEMINAR 56 (INTERMEDIATE)

### Integration of Server and Facilities Controls in Data Centers for Lower Costs and Higher Efficiency

Track: Green Buildings/Sustainability

Room: Panzacola H1/2

Sponsor: 9.9 Mission Critical Facilities, Technology Spaces and Electronic Equipment

Chair: Michael K. Patterson, Ph.D., P.E., Member, Intel, Hillsboro, OR

Energy efficiency and cost savings in data centers are a key factor in their success. Recent advances in server technology, manageability, and software has allowed the server temperatures to be used to control the data center cooling systems. This seminar details the demonstration of this application in a case-study format, as well as looking at what this new capability can mean for the future efficiency improvements in data centers.

#### 1. Server Data for the Facility; the Holy Grail

Michael K. Patterson, Ph.D., P.E., Member, Intel, Hillsboro, OR; Prasad Pusuluri, Intel, Santa Clara, CA

#### 2. Connectivity and Control for Servers and the Building Management System

Dennis A. Nasont, Intel, Santa Clara, CA; Bill Storey, Wunderlich-Malec, Pleasanton, CA

#### 3. Designing Efficient Sustainable Data Centers with Enhanced Visibility to the Server Status

Vali Sorell, P.E., Member, Syska Hennessy, Charlotte, NC; Michael K. Patterson, Ph.D., P.E., Member, Intel, Hillsboro, OR

## SEMINAR 57 (INTERMEDIATE)

### Smart Systems for Sustainable Buildings, Part 1

Track: Energy Conservation and Alternative Energy Sources/Solutions

Room: Panzacola H3/4

Sponsor: 7.5 Smart Building Systems

Chair: Michael R. Brambley, Ph.D., Member, Pacific Northwest National Laboratory, Richland, WA

The pursuit of increasingly sustainable buildings will create new demands for achieving and maintaining highly energy-efficient operations while continuing to meet occupant needs. Smart building systems will contribute by continually optimizing operations, ensuring that faults are corrected in a timely manner and helping manage complex interactions between on-site renewable generation and the electric power grid, while efficiently meeting building energy demands. Part 1 of this seminar will start with

an introduction to smart building systems, then continue with presentations providing insight into the potential role of ubiquitous sensing, how fault detection and diagnostics will help ensure high operating efficiencies, and the role of smart human-machine interfaces in sustainable buildings.

**1. Smart Building Systems and Sustainability**

*Michael R. Brambley, Ph.D., Member, Pacific Northwest National Laboratory, Richland, WA*

**2. Understanding Building Performance through Ubiquitous Sensing**

*William Healy, Ph.D., Member, National Institute of Standards and Technology, Gaithersburg, MD*

**3. Maintain to Sustain with Fault Detection and Diagnostics**

*John M. House, Ph.D., Member, Johnson Controls, Inc., Saint-Leonard, QC, Canada*

**4. Human-Machine Conjoint Systems: Why Smart, Sustainable Buildings Should Communicate Effectively with their Operators**

*Michael Bobker, Member, City University of New York, New York, NY*

**SEMINAR 58 (INTERMEDIATE)** 

**Crawlspace Humidity and Moisture Performance in Hot-Humid and Mixed Climates**

Track: Humidity Control

**Room: Panzacola F2**

**Sponsor:** 4.4 Building Materials and Building Envelope Performance

**Chair:** Paul Shipp, Ph.D., P.E., Member, Corporate Innovation Center, USG Corporation, Libertyville, IL

Crawl spaces present unique challenges to building moisture management. Long accepted venting practices are being challenged as research into crawlspace moisture behavior identifies impediments to durability and energy efficiency. This seminar examines the results of three research programs that studied crawlspace behavior in hot-humid and mixed climates.

**1. Moisture Performance of Insulated Raised Floors in Southern Louisiana**

*Samuel V. Glass, Ph.D., Member, U.S. Forest Products Laboratory, Madison, WI*

**2. Crawlspace Humidity and Ventilation Studies in a Hot-Humid Climate**

*Maria Mauceri, Advanced Energy, Raleigh, NC*

**3. Crawlspace Hygrothermal Performance in Mixed Climates**

*Achilles Karagiozis, Ph.D., Member, Oak Ridge National Laboratory, Oak Ridge, TN*

**SEMINAR 59 (ADVANCED)** 

**Humidity and Air Quality in Specialist Museums and Galleries**

Track: IAQ/Comfort

**Room: Panzacola G1**

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

**Chair:** Frank Mills, P.Eng., Member, SKM, Manchester, United Kingdom

Museums and art galleries which house antiquities and precious collections require environmental control of humidity and air quality to reduce deterioration of the displays within. Energy efficiency and sustainable design requires that this be achieved with minimum use of energy and materials lest the very act of creating conservation facilities causes their demise. This seminar provides technical guidance on acceptable environments and their design and gives case study examples of good practice.

**1. Ventilation of Tombs of Valley of Kings, Luxor, Egypt**

*Essam Khalil, Ph.D., P.Eng., Member, Cairo University, Cairo, Egypt*

**2. Humidity and Air Quality Standards for Museums and Art Galleries to Protect Collections**

*Cecily Grzywacz, Member, Getty Institute, Los Angeles, CA and Stefan Michalski, Member, Canadian Conservation Institute, Ottawa, Ontario, Canada*

**3. Conditions for Collections in Historic Buildings and Castles**

*Frank A. Mills, P.Eng., Member, SKM, Manchester, United Kingdom*

**SEMINAR 60 (INTERMEDIATE)**

**Advances in Refrigerants and Secondary Coolants**

Track: Refrigeration

**Room: Panzacola F3**

**Sponsor:** 3.1 Refrigerants and Secondary Coolants, TGI Exergy Analysis for Sustainable Buildings (EXER)

**Chair:** Samuel Sami, Ph.D., P.E., Fellow ASHRAE, TransPacific Energy Inc., Carlsbad, CA

The session presents and discusses new trends in refrigeration and secondary coolants and in particular alternatives to HCFC-22 and current technology in supermarket refrigeration.

**1. R-427A: The Logical R-22 Alternative**

*Stephen Spletzer, Member, Arkema Inc., King of Prussia, PA*

**2. Energy and Performance of Secondary Coolant Low-Temperature Refrigeration Systems**

*Joseph Roland, P.E., Member, Purdue University, West Lafayette, IN*

**3. Propylene Glycol as a Secondary Coolant for Medium Temperature Refrigeration Systems**

*Kevin Connor, Member, Dow Chemical, Midland, MO*

**SEMINAR 61 (INTERMEDIATE)** 

**What's New About the New Indoor Air Quality Guide?**

Track: IAQ/Comfort

**Room: Panzacola G2**

**Sponsor:** Indoor Air Quality Guide Steering Committee, 4.3 Ventilation Requirements and Infiltration

**Chair:** Andrew Persily, Fellow ASHRAE, NIST, Gaithersburg, MD

This fall ASHRAE—in collaboration with AIA, BOMA, EPA, SMACNA and USGBC—will publish its new Indoor Air Quality Guide, Best Practices for Design, Construction, and Commissioning. The Guide is a comprehensive, practical resource aimed at helping project teams consistently achieve better IAQ in commercial and institutional buildings. Why do practitioners need another IAQ document? Where does the Guide fit in the decades-long efforts to address IAQ within ASHRAE? How does it relate to Standard 62.1, Ventilation for Acceptable Indoor Air Quality, and what challenges and opportunities does it create for practitioners seeking to meet the standard of care? How does it relate to the IAQ prerequisites and credits of the USGBC LEED program and other green and sustainable building programs? Is this the last word in IAQ? This seminar addresses these and other questions.

**1. How the New IAQ Guide “Advances the Ball” on IAQ for ASHRAE**

*Barney Burroughs, Presidential Fellow Life Member, Building Wellness Consultancy, Inc., Atlanta, GA*

**2. Standard 62.1 and the New IAQ Guide: Confusion or Complement?**

*Dennis Stanke, Fellow ASHRAE, The Trane Company, La Crosse, WI*

**3. IAQ Design Guide and LEED**

*Jude Anders, Member, Shoreline Concepts, LLC, Glendale, WI*

**4. What’s Still Missing?**

*Hal Levin, Fellow ASHRAE, Building Ecology Research Group, Santa Cruz, CA*

**SEMINAR 62 (BASIC)**

**New Information on Service Hot Water Systems: Not Your Grandfather’s Way Anymore!**

Track: Energy Conservation and Alternative Energy Sources/Solutions

**Room:** Panzacola F1

**Sponsor:** 6.6 Service Water Heating Systems

**Chair:** Carl C. Hiller, Ph.D., P.E., Fellow ASHRAE, Applied Energy Technology Co., Davis, CA

Service water heating systems represent the second largest energy use in residences, and in an increasing number of locations are becoming the largest as space conditioning loads are reduced with improved building designs, practices and equipment. Water heating is also one of the largest energy users in many commercial buildings. Improved water heating systems reduce both water and energy waste, and can have a beneficial effect on reducing indoor humidity through the use of more efficient shower heads, distribution systems, venting systems and more. This seminar presents new information on how hot water is used, as well as on old and new distribution systems and water heaters, and provides new insights for total hot water system optimization.

**1. Real Hot Water Use and Its Effect on Water Heating Efficiency**

*Martin Thomas, Member, CANMET Energy Technology Centre, Ottawa, ON, Canada*

**2. ENERGY STAR Advanced Water Heater Energy Efficiency Programs**

*Richard Karney, Member, Department of Energy, Washington, DC*

**3. Residential Hot Water Use: Looking at Recent Studies**

*James Lutz, P.E., Member, Lawrence Berkeley National Laboratory, Berkeley, CA*

**4. Energy and Water Waste Implications of Hot Water Distribution System Design and Use Patterns**

*David Springer, Member, Davis Energy Group, Davis, CA*

9:45 A.M.–10:45 A.M.

**SEMINAR 63 (BASIC)**

**Existing Buildings Survival Strategies**

Track: Green Buildings/Sustainability

**Room:** Panzacola H1/2

**Chair:** Fiona Cousins, P.E., Member, Arup, New York, NY

A six step survival strategy for refreshing tired building assets is covered in this seminar. First, the challenges existing buildings and their owners and occupiers face are explained in simple, clear language, as are the wide range of opportunities that can be built into a building renovation—one that adds value to a property portfolio, increases rental income, reduces building energy usage, or brings an existing building into code compliance. Tools to quickly assess your building and look at your current facility operations are presented. Almost 200 initiatives in 20 focus areas are reviewed. A selection of case studies demonstrate some of these successful initiatives in action.

**1. Existing Buildings Survival Strategies: A Six Step Process for Renewing Tired Assets**

*Fiona Cousins, P.E., Member, Arup, New York, NY*

**SEMINAR 64 (INTERMEDIATE)** 

**Smart Systems for Sustainable Buildings, Part 2**

Track: Energy Conservation and Alternative Energy Sources/Solutions

**Room:** Panzacola H3/4

**Sponsor:** 7.5 Smart Building Systems

**Chair:** Michael R. Brambley, Ph.D., Member, Pacific Northwest National Laboratory, Richland, WA

The pursuit of increasingly sustainable buildings will create new demands for achieving and maintaining highly energy-efficient operations while continuing to meet occupant needs. Smart building systems will contribute by continually optimizing operations, ensuring that faults are corrected in a timely manner and helping manage complex interactions between on-site renewable generation and the electric power grid, while efficiently meeting building energy demands. Part



2 of the seminar will focus on two topics: 1) how smart systems can be used to ensure that a building operates sustainably and 2) the role of smart systems in enabling sustainable buildings to interact effectively with a dynamic electric power grid.

**1. Ensuring Sustainable Operations with Smart Building Solutions**

*Haorong Li, Ph.D., Member, University of Nebraska-Lincoln, Omaha, NE*

**2. Smart Buildings Can Help Achieve a Smart Electric Power Grid and Increase Energy Efficiency**

*Srinivas Katipamula, Ph.D., Member, Pacific Northwest National Laboratory, Richland, WA*

**3. Smart Building Systems for Demand Responsive and Optimized Control of Buildings with Thermal Mass in California**

*Peng Xu, Ph.D., P.E., Member, Lawrence Berkeley National Laboratory, Berkeley, CA*

**SEMINAR 65 (ADVANCED)**

**Integrated Approaches to Eliminating Air Bypass in HVAC Equipment**

Track: Green Buildings/Sustainability

Room: Panzacola F2

*Chair: Ian Shapiro, P.E., Member, Taitem Engineering, Ithaca, NY*

Vertical stack water source heat pumps are increasingly popular, especially in high-rise hotels and apartments. They allow a small footprint, and serviceability through slide-out access. However, anecdotal problems with units included freezeup during cooling mode. This led to a project to examine air bypass, due to the critical junction of the slideout chassis and the heat pump cabinet, and also because the fan section is typically separate from the indoor heat exchanger (“coil”) which is frequently part of the slideout chassis. Five installations were examined in different buildings. Air bypass was identified on several of the units, resulting in increased risk of freezeup, and lower operating efficiency. Common bypass sites were identified, air bypass quantities measured, and impact on efficiency measured.

**1. Integrated Approaches to Eliminating Air Bypass in HVAC Equipment**

*Yossi Bronsnick; Kapil Varshney, Ph.D.; Jim Holahan, Taitem Engineering, Ithaca, NY*

**SEMINAR 66 (INTERMEDIATE)**

**LEED Pre-requisite vs. LEED Enhanced: Is it Really Enough?**

Track: Commissioning

Room: Panzacola G2

*Sponsor: 7.9 Building Commissioning*

*Chair: Sarah E. Maston, P.E., Member, RDK Engineers, Andover, MA*

Different case studies that utilized both LEED Pre-requisite and LEED Enhanced processes are presented.

**1. LEED Pre-Requisite vs. Enhanced Cx: Is this Really Enough? Library Case Studies**

*Raj Setty, P.E., Member, Setty and Associates International, Washington, DC*

**2. Differences between Fundamental and Enhanced Commissioning**

*Harry J. Enck, Member, Commissioning & Green Building Solutions, Buford, GA*

**SEMINAR 67 (INTERMEDIATE)**



**Load Calculations Methodologies for Unique Construction Types**

Track: Load Calculations

Room: Panzacola F4

*Sponsor: 4.1 Load Calculation Data and Procedures*

*Chair: Glenn Friedman, P.E., Member, Taylor Engineering, Alameda, CA*

This session introduces the engineering and research community with critical design parameters in the form of improved convection calculation methods for rooms with ceiling slot diffusers and evaluate effects that window blinds have on convective heat transport at windows and external walls.

**1. Convective Heat Transfer in Rooms with Ceiling Slot Diffusers**

*Kate Goldstein, Student Member, University of Texas at Austin, Austin, TX*

**2. Influence of Venetian Blinds on Convection Heat Transfer at Window Surfaces**

*Atila Novoselac, Ph.D., Member, University of Texas at Austin, Austin, TX*

**SEMINAR 68 (INTERMEDIATE)**

**Best Practices Toolkit for MEP Professionals**

Track: Professional Skills

Room: Panzacola F1

*Chair: David C. Bixby, Associate Member, Coalitions, ACEC, Washington, DC*

The Council of American Mechanical and Electrical Engineers (CAMEE) is developing new tools to help MEP firms improve their businesses, increase profitability and reduce risk. This session reviews the existing CAMEE tools, comprised of a planning guide and a fee calculation spreadsheet, and the newest tools for client evaluation and project status reports.

**1. Best Practices Toolkit for MEP Professionals**

*Doug Post, P.E., Associate Member, Coalitions, ACEC, Washington, DC*

**SEMINAR 69 (INTERMEDIATE)**

**Chilled Water Plant Retrofits for Optimization and Reduction in Energy**

Track: Energy Conservation and Alternative Energy Sources/Solutions

**Room: Panzacola G1**

**Sponsor:** 6.1 Hydronic and Steam Equipment and Systems  
**Chair:** Steve M. Tredinnick, P.E., Member, Syska Hennessy Group, Madison, WI

With the uncertain future of electrical prices (higher) and the push for increased energy efficiency, this seminar highlights two approaches of getting more capacity out of an existing chilled water system and increasing the chiller efficiency to reduce energy costs.

**1. Expanding the Capacity of an Existing Central Chilled Water Plant by Increasing the Design Temperature Differential**

*Evans Lizardos, P.E., Member, Lizardos Mechanical and Electrical Engineering, Mineola, NY*

**2. Retrofitting Light Tonnage Chillers for 30% Energy Savings**

*John Kuempel, P.E., Member, DeBra-Kuempel, Cincinnati, OH*

**FORUM 10 (INTERMEDIATE)**

**Micro and Nano Systems and their Future Potential in HVAC and Energy Systems**

Track: Energy Conservation and Alternative Energy Sources/Solutions

**Room: Panzacola F3**

**Sponsor:** 1.3 Heat Transfer and Fluid Flow, 8.4 Air-to-Refrigerant Heat Transfer Equipment, 10.4 Ultra-Low Temperature Systems and Cryogenics

**Chair:** Michael M. Ohadi, Ph.D., Fellow ASHRAE, Petroleum Institute/University of Maryland, College Park, MD

Microelectromechanical systems (MEMS) refer to devices that have characteristic length of less than 1 mm but more than 1 micron, that combine electrical and mechanical components. Nanoelectromechanical systems (NEMS) are MEMS scaled to sub-micrometer dimensions, to exploit the mechanical degree of freedom on the nanometer scale. MEMS/NEMS are emerging in a variety of industrial and medical fields with potential worldwide markets in automotive, energy (micro-heat exchangers, micro channels), aeronautics, military, computer devices, manufacturing and fabrication, microfluidics, sensors, micro-solid oxide fuel cells (power source for electronics), nano polymers for enhanced fluidics and/or flow control, etc. This forum discusses the recent progress and to the degree that HVAC and Energy systems have benefited. Future perspectives and growth potential for the micro and nano systems in general and applications in energy and HVAC systems in particular are discussed.

11:00 A.M.–12:30 P.M.

**SEMINAR 70 (INTERMEDIATE)** 

**How to Achieve the Optimum Balance Between Water and Energy Savings and Minimize the Effect on the Carbon Footprint**

Track: Green Buildings/Sustainability

**Room: Panzacola H1/2**

**Sponsor:** SPC 191 Water Conservation, 3.6 Water Treatment, 8.6 Cooling Towers and Evaporative Condensers  
**Chair:** Scott Mayes, Member, LAKOS, Olathe, KS

To achieve the optimal use of natural resources it is important to consider all aspects of water and energy savings. This seminar presents the impact of water use in generating electricity how to achieve the best balance for water and energy savings. The “source” cost of energy and water is addressed to determine what factors must be included in achieving optimal water and energy savings while having the least impact on the carbon footprint and natural resources.

**1.A Holistic Comparison of Air and Water Cooled Chillers Including Site and Source Perspectives**

*Mark Hydeman, P.E., Fellow ASHRAE, Taylor Engineering, Alameda, CA*

**2. Life Cycle Cost Analysis and Beyond**

*Bill Hoffman, P.E., Member, Water Management Inc, Austin, TX*

**3. Water Heating, Hot Water Distribution and Water Conservation**

*Gary Klein, Member, Affiliated International Management, LLC, Elk Grove, CA*

**4. The Energy-Water Nexus and its Impacts on America’s Future**

*Michael Webber, Ph.D., Member, University of Texas, Austin, TX*

**SEMINAR 71 (ADVANCED)** 

**Evaporative Cooling Down South? You’ve Got To Be Kidding!**

Track: Energy Conservation and Alternative Energy Sources/Solutions

**Room: Panzacola H3/4**

**Sponsor:** 5.7 Evaporative Cooling

**Chair:** Leon E. Shapiro, Member, VRTX Technologies, Las Vegas, NV

Evaporative cooling was perhaps the earliest form of air conditioning, and has always been one of the most energy efficient means of providing cooling for indoor spaces. Conventional wisdom holds that while evaporative cooling is highly effective in dry climates, it is not very useful in humid environments. However, advances in technology (especially in the use of indirect evaporative cooling) have shown that evaporative cooling can be an efficient and effective means of cooling in hot/humid climates. Moreover, its efficiencies allow for the use of 100% outdoor air systems, which can have a significant impact on improving indoor air quality. This program highlights system designs and case studies of the effective use of direct and indirect evaporative cooling in industrial and commercial applications in humid climates.

**1. Spot Cooling Within the Industrial Environment**

*Carl Brown, Member, Air Concepts, Inc., Tucson, AZ*

**2. Direct Evaporative Cooling in High Humidity Areas**

*Harry Gaffney, Member, AQUACOOOL, Dallas, TX*

### 3. Indirect Evaporative Cooling... More Than a Dry Climate Cooler

Nicholas Des Champs, Ph.D., P.E., Fellow ASHRAE, Munters, Buena Vista, VA

#### SEMINAR 72 (INTERMEDIATE)

### Lessons from the School of Hard Knocks: The Revised ASHRAE Guide for Buildings in Hot & Humid Climates

Track: Humidity Control

Room: Panzacola F2

**Sponsor:** 1.12 Moisture Management in Buildings

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

The revised and expanded ASHRAE Guide for Buildings in Hot & Humid Climates was created in response to energy and mold problems with modern buildings in the humid regions of North America and the Caribbean, South Asia and the Middle East. This seminar summarizes key aspects of the new ASHRAE guidance. The co-authors of the new book provide examples of best practices for energy reduction, comfort and mold avoidance in the design of building enclosures and HVAC systems.

#### 1. Secret Guide to Serving a Worldwide Need: How the New ASHRAE Guide Was Born

Ray Patenaude, P.E., Member, The Holmes Agency, St. Petersburg, FL

#### 2. Straight Talk with Your Architect: Buildings That Won't Rot or Be Energy Pigs in Hot and Humid Climates

Joe Lstiburek, Ph.D., P.Eng., Fellow ASHRAE, Building Science Corporation, Westford, MA

#### 3. HVAC Problems and Solutions from the ASHRAE Guide for Hot & Humid Climates

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

#### SEMINAR 73 (INTERMEDIATE)

### BIM Beyond Design and Construction

Track: Building Information Modeling

Room: Panzacola F4

**Sponsor:** 7.1 Integrated Building Design, 1.5 Computer Applications

**Chair:** Dennis Knight, P.E., Member, Liollo Architects, Charleston, SC

This presentation provides analysis and case studies related to BIM applications beyond traditional design and construction.

#### 1. Enhancing Cx with BIM

Christopher Wilkins, P.E., Member, Hallam-ICS, So. Burlington, VT

#### 2. BIM as a Tool in Asset Management

Reijo Hanninen, Member, Insinoritoimisto Olof Granlund Oy, Helsinki, Finland

#### 3. BIM as a Facility Management Tool

Angela Lewis, Student Member, Cumberland, MD

#### SEMINAR 74 (INTERMEDIATE)

### Selection and Operation of Fan for Different Building Systems in Relation to its Efficiency and ASHRAE 90.1 and Other Standards

Track: ASHRAE Standards

Room: Panzacola G2

**Sponsor:** 5.1 Fans, 5.9 Enclosed Vehicular Facilities

**Chair:** Aresh Raychaudhuri, P.E., Member, US Dept. of Veterans Affairs, Washington, DC

Fan selection and its operating efficiency vary considerably depending on the type of system and their operating modes. Different aspects of fan operating efficiency in relation to ASHRAE standard 90.1 and ISO are discussed in this seminar.

#### 1. Fan Efficiencies, ASHRAE Standard 90.1 and European Union Goals for Different Application

Charles W. Coward, Jr, P.E., Fellow ASHRAE, Waddell Engineering Company, Moorestown, NJ

#### 2. Implications of Fan Efficiency Limits on Fan Selection

Michael Brendel, Ph.D., Member, Lau Industries/Ruskin Company, Dayton, OH

#### 3. Impact of Specifying Minimum Efficiency on Fan Selection

John A. Murphy, Ph.D., Member, Jogram Inc, New Philadelphia, OH

#### 4. Does FEG and Energy Saving Guidelines Endanger Health and Safety?

Brent A. Fullerton, Member, Loren Cook Company, Springfield, MO

#### SEMINAR 75 (ADVANCED)

### Recent Advances in Heat Transfer and Fluid Flow

Track: Refrigeration

Room: Panzacola F3

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

**Chair:** Omar Abdelaziz, Student Member, Mechanical Engineering, University of Maryland, College Park, MD

Experimental and computational techniques are essential for proper understanding of heat transfer and fluid flow physics in complex situations such as multi-phase flow and air flow over enhanced fins. This seminar provides a review of recent advancement in heat transfer and fluid flow for complicated flow conditions.

#### 1. Numerical Modeling of Condensation in Complex Microchannel Geometries

John Thome, Ph.D., Member; Stefano Nebuloni, Ecole Polytechnique Fédérale de Lausanne., Lausanne, Switzerland

#### 2. Surface Tension Shape Effect on Condensation Heat Transfer in a Square Cross Section Minichannel

Alberto Cavallini, P.Eng., Fellow ASHRAE; Davide Del Col; Marko Matkovic; Luisa Rossetto; Daniele Torresin, University of Padova, Padova, Italy

**3. Numerical Investigation of Heat transfer and Pressure Drop in Finned-Tube Heat Exchangers with Different Fin Structure**

*Stanislav Perencevic, Member, Güntner AG & Co. KG, Fürstenfeldbruck, Germany*

**4. Heat Transfer and Pressure Drop Inside Tubes with Different Inlet Geometries in the Transitional Flow Regime**

*Josua Meyer, Ph.D., Member; Leon Liebenberg, Member, University of Pretoria, Pretoria, South Africa; Jonathan Olivier, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland*

**SEMINAR 76 (BASIC)**

**Coil Selection and Control for Hydronic Systems**

Track: Humidity Control

Room: Panzacola F1

**Sponsor:** 6.1 Hydronic and Steam Equipment and Systems, 7.7 Testing and Balancing

**Chair:** Mark Hegberg, Member, Heating, Danfoss, Elmhurst, IL

This session discusses proper selection of chilled water and hot water coils, with an emphasis on de-humidification. Basics of coil selection are discussed, as well as coil characteristic for control and control methodologies and valve application. In addition retrofit of existing coil control applications will be discussed.

**1. Selection of Hydronic System Coils**

*Evans Lizardo, P.E., Life Member, Lizardos Consulting, New York, NY*

**2. A Discussion of Hydronic System Coil Characteristics**

*Mark C. Hegberg, Member, Heating, Danfoss, Elmhurst, IL*

**3. Control Application of Hydronic Coils**

*Mark Hegberg, Member, Heating, Danfoss, Elmhurst, IL*

**SEMINAR 77 (INTERMEDIATE)**

**Impact of Ventilation Air Strategies on Ground Source Heat Pump Systems**

Track: IAQ/Comfort

Room: Panzacola G1

**Sponsor:** 6.8 Geothermal Energy Utilization, 9.4 Applied Heat Pump/Heat Recovery Systems

**Chair:** Donald C. Smith, Member, Sound Geothermal Corporation, Sandy, UT

In order for GSHP systems to achieve peak efficiency, optimize energy savings, and minimize life cycle cost the designer must be attuned to different strategies to manage outside air. This seminar explores several key ventilation related design components for consideration when designing a commercial GSHP system.

**1. Impact of Ventilation Air Strategies on Sizing GSHP**

*Steve Kavanaugh, Ph.D., Fellow ASHRAE, University of Alabama, Tuscaloosa, AL*

**2. Ventilation Strategies to Improve IAQ in Schools Using GSHP**

*Kirk Mescher, Member, CM Engineering, Inc., Columbia, MO*

**3. How Changes in LEED Ventilation Requirements Impact Energy Efficiency of GSHP**

*Xiaobing Liu, Ph.D., Member, Climate Master, Oklahoma City, OK*



## SOCIETY COMMITTEE MEETINGS

(Subcommittees are indented)

All meetings are scheduled in Rosen Shingle Creek. The number in parenthesis following the room name indicates location within the hotel. Please refer to the diagrams of the meeting rooms in this program for assistance in finding your room.

### ALPHABETICAL LISTING

#### ABEL Ad Hoc,

Sun., 1/24, 8:00 a.m.-10:30 a.m., Sebastian L3 (1)

#### Advocacy,

Sun., 1/24, 6:30 a.m.-8:30 a.m., Suwannee 18(2)

#### ASHRAE/AHRI Joint Expo,

Sun., 1/24, 9:00 a.m.-11:00 a.m., Suwannee 13 (2)

#### ASHRAE Foundation,

Mon., 1/25, 8:00 -10:00 a.m., St. John 26 (2)

##### Executive Subcommittee,

Sat., 1/23, 1:30 -3:00 p.m., St. John's 22 (2)

#### ASHRAE Research Canada,

Sun., 1/24, 7:00 -8:30 a.m., Suwannee 11 (2)

#### Associate Society Alliance,

Sun., 1/24, 1:30 p.m.-4:30 p.m., Gatlin E4

Mon., 1/25, 4:15-6:00 p.m., Sebastian I3 (1)

#### Board of Directors,

Sun., 1/24, 1:30 p.m.-5:30 p.m., Sebastian K (1)

Wed., 1/27, 2:00 -6:00 p.m., Sebastian K (1)

#### Board Governance Transition Team,

Sat., 1/23, 1:00 p.m.-3:00 p.m., St. John's 27 (2)

Sun., 1/24, 9:00 a.m.-Noon, St. John's 27 (2)

#### Certification,

Sat., 1/23, 8:00 a.m.-Noon, St. John's 22 (2)

#### Chapter Technology Transfer,

Fri., 1/22, 8:00 a.m.-Noon, Suwannee 17 (2)

Sat., 1/23, 8:00 a.m.-Noon, Suwannee 13 (2)

##### Member Services,

Fri., 1/22, 1:30 p.m.-5:00 p.m., Suwannee 21 (2)

##### Operations,

Fri., 1:30 p.m.-5:00 p.m., Suwannee 17 (2)

##### Executive,

Fri., 5:00 p.m.-6:00 p.m., Suwannee 21 (2)

#### CIBSE/ASHRAE Liaison,

Wed., 1/27, 9:30 a.m.-Noon, Suwannee 18 (2)

#### CLIMA,

Sat., 1/23, 12:30-1:30 p.m., St. John's 29 (2)

#### College of Fellows Board/Advisory,

Sun., 1/24, 8:00 -10:00 a.m., Wekiwa 8 (2)

#### College of Fellows,

Sun., 1/24, 10:00 a.m. -Noon, Wekiwa 8 (2)

#### Conferences and Expositions Committee,

Sat., 1/23, 8:00 a.m.-1:00 p.m., Wekiwa 8 (2)

##### Executive,

Fri., 1/22, 1:00 p.m.-3:00 p.m., St. John's 28 (2)

##### TAC/CEC Executive,

Sat., 1/23, 7:00 a.m.-8:00 a.m., Wekiwa 4 (2)

#### Annual and Winter Meetings,

Fri., 1/22, 3:00 p.m.-6:00 p.m., St. John's 28 (2)

#### Operations,

Friday, 1/22, 3:00 p.m.-6:00 p.m., St. John's 27 (2)

#### Specialty Conferences,

Friday, 1/22, 4:00 p.m.-6:00 p.m., Suwannee 18 (2)

#### Electronic Communication,

Sat., 1/23, 11:00 a.m.-3:00 p.m., Suwannee 21 (2)

#### Environmental Health,

Mon., 1/25, 2:15 p.m. -6:15 p.m., Wekiwa 3 (2)

##### Executive,

Mon., 1/25, 7:00 a.m.-8:00 a.m., Wekiwa 3 (2)

##### Education/Research,

Mon., 1/25, 8:00 a.m.-10:00 a.m., Wekiwa 3 (2)

##### Handbook/Program,

Mon., 1/29, 10:00 a.m.-Noon, Wekiwa 3 (2)

#### Executive,

Sat., 1/23, 8:30 a.m.-1:00 p.m., St. John's 23 (2)

Wed., 1/27, 7:30 a.m.-9:00 a.m., Suwannee 18 (2)

Thurs., 1/28, 7:30 a.m.-11:00 a.m., Suwannee 19 (2)

#### Finance,

Fri., 1/22, 8:00 a.m.-1:00 p.m., St. John's 24 (2)

##### Investment Subcommittee,

Thursday, 1/21, 7:00 p.m.-9:00 p.m., Wekiwa 1 (2)

##### Planning Subcommittee,

Thursday, 1/21, 7:00 p.m.-9:00 p.m., Wekiwa 2 (1)

#### Handbook,

Sun., 1/24, 9:45 a.m.-1:00 p.m., Suwannee 15 (2)

##### Fundamentals Liaisons/TCs,

Sun., 1/24, 7:00 a.m.-8:00 a.m., Suwannee 13 (2)

##### Refrigeration Liaisons/TCs,

Sun., 1/24, 7:00 a.m.-8:00 a.m., Suwannee 14 (2)

##### HVAC Applications Liaisons/TCs,

Sun., 1/24, 7:00 a.m.-8:00 a.m., Suwannee 15 (2)

##### HVAC Systems & Equipment Liaisons/TCs,

Sun., 1/24, 7:00 a.m.-8:00 a.m., Suwannee 16 (2)

##### Volume Subcommittees,

Sun., 1/24, 9:00 a.m.-9:30 a.m., Suwannee 15 (2)

##### SPO/Excom,

Sat., 1/23, Noon-3:00 p.m., St. John's 26 (2)

##### Handbook Training for TC Handbook Chairs,

Sun., 1/24, 8:00 -9:00 a.m., Gatlin E1 (1)

#### Historical,

Sun., 1/24, 8:30 a.m.- Noon, St. John's 25 (2)

#### Honors & Awards,

Sun., 1/24, Noon-5:00 p.m., St. John's 22 (2)

Mon., 1/25, 2:15 p.m.- 5:30 p.m., St. John 28 (2)

#### IAQ 2010 Steering Committee,

Sun., 1/24, 6:30 p.m.-8:30 p.m., St. John's 24 (2)

#### Life Members' Executive Board,

Tues., 1/26, 8:00 a.m.-11:30 a.m., St. John's 23 (2)

#### Members Council,

Mon., 1/25, 8:00 a.m. - Noon, Wekiwa 5 (2)

Tues., 1/26, 8:00 a.m. - Noon, Wekiwa 5 (2)

##### Region Operation,

Sat., 1/23, 8:00 a.m.- 12:30 p.m., St. John's 27 (2)

**Planning,**

Sun., 1/24, 8:00 a.m.- Noon, St. John's 24 (2)

**PAOE,**

Mon., 1/25, 2:30 p.m.-4:00 p.m., St. John's 32 (2)

**Membership Promotion,**

Sat., 1/23, 8:00 a.m.-3:00 p.m., Suwannee 14 (2)

**Membership Promotion Subcommittees,**

Fri., 1/22, 8:00 a.m.- 6:30 p.m., St. John's 26 (2)

**Nominating,**

Sun., 1/24, 7:30a-3:00 p.m., Gatlin A2 (1)

**PEAC,**

Tues., 1/26, Noon-2:00 p.m., St. John's 25 (2)

**Planning,**

Fri., 1/22, 1:00 p.m.-6:00 p.m., St. John's 29 (2)

**Professional Development,**

Mon., 1/25, 8:00 a.m.- Noon, St. John 27 (2)

**Planning,**

Sun., 1/24, 8:00 a.m.-10:00 a.m., Suwannee 19 (2)

**Operations,**

Sun., 10:00 a.m.-Noon, Suwannee 19 (2)

**Publications Committee,**

Sun., 1/24, 8:00 a.m.-Noon, St. John's 30 (2)

**Planning Subcommittee,**

Sat., 1/23, 10:00 a.m.-Noon, St. John's 26 (2)

**Publishing and Education Council,**

Tues., 1/26, 8:00a- Noon, Wekiwa 6 (2)

**E-Learning**

Sat., 1/23, 1:30 pm.-3:00 p.m., St. John's 29 (2)

**Advertising Sales Subcommittee,**

Sun., 1/24, 7:00 a.m.-8:30 a.m., St. John's 22 (2)

**Research Journal,**

Mon., 1/25, 11:00 a.m.- Noon, Suwannee 20 (2)

**Fiscal,**

Mon., 1/25, 2:00 p.m. -3:30 p.m., Boardroom (1)

**Functional,**

Mon., 1/25, 3:30 p.m.- 5:00 p.m., Boardroom (1)

**Refrigeration,**

Sun., 1/24, 8:00 a.m.-Noon, Gatlin E4 (1)

**Region-at-Large Planning,**

Mon., 1/25, 2:15 p.m.-4:15 p.m., St. John 24 (2)

**Research Advisory Panel,**

Mon., 1/25, 6:00 p.m.-8:00 p.m., Sebastian L4 (1)

**Research Administration,**

Sat., 1/23, 8:00 a.m.-3:00 p.m., Wekiwa 7 (2)

Wed., 1/27, 7:00 a.m.-11:00 a.m., Suwannee 13 (2)

**Excom,**

Fri., 1/22, 1:00 p.m.-2:30 p.m., Wekiwa 5 (2)

**RAS/RPS,**

Fri., 1/22, 3:00 p.m.-7:00 p.m., Wekiwa 5 (2)

**Research Subcommittee Chairs,**

Mon., 1/25, 6:30 a.m.-9:00 a.m., Conway (1)

**Research Promotion,**

Sat., 1/23, 8:00 a.m.-11:30 a.m., Wekiwa 9 (2)

Sun., 1/24, 8:15 a.m.-Noon, Wekiwa 5 (2)

**Executive Subcommittee,**

Fri., 1/22, 2:00 p.m.-6:00 p.m., Wekiwa 2 (2)

**Scholarship Trustees,**

Tues., 1/26, 8:00 a.m.- Noon, St. John's 32 (2)

**Society Rules,**

Tues., 1/26, 2:00 p.m.-5:00 p.m., St. John's 22 (2)

**Solar Decathlon Ad Hoc,**

Mon., 1/25, 2:00 p.m.-3:00 p.m., Sebastian I3 (1)

**Standards,**

Sat., 1/23, 8:00 a.m.-3:00 p.m., Wekiwa 6 (2)

Wed., 1/27, 8:00 -10:00 a.m., Sebastian K (1)

**Executive,**

Fri., 1/22, 8:00 a.m.-11:00 a.m., St. John's 25 (2)

**TCLS,**

Fri., 1/22, 11:00 a.m.- Noon, St. John's 25 (2)

Tues., 1/26, 5:00 p.m.-5:30 p.m., St. John's 34 (2)

**PPIS,**

Fri., 1/22, 2:00 p.m.-6:00 p.m., St. John's 25 (2)

Tues, 1/27, 11:00 a.m.-1:00 p.m., St. John's 34 (2)

**ILS/ISAS**

Fri., 1/22, 1:00 p.m.-4:00 p.m., Suwannee 18(2)

**SPLS,**

Fri., 1/22, 2:00 p.m.-6:00 p.m., St John's 24 (2)

Tues., 1/26, 2:00 p.m.-3:00 p.m., St. John's 34 (2)

**SRS,**

Tues., 1/26, 5:00 p.m.-6:00 p.m., St. John's 32 (2)

**Code Interaction,**

Sun., 1/24, 7:00 p.m.-10:00 p.m., St. John's 27 (2)

**PC Chair Breakfast,**

Sun., 1/24, 7:00 -9:00 a.m., Sebastian L1 (1)

**Standards Advisory Committee,**

Tues., 1/26, 2:00 -6:00 p.m., Suwannee 15 (2)

**Student Activities,**

Sat., 1/23, 8:00 a.m.-3:00 p.m., Wekiwa 1 (2)

**Executive,**

Fri., 1/22, 10:00 a.m.-Noon, St. John's 23 (2)

**K-12/STEM,**

Fri., Noon-2:00 p.m. St. John's 23 (2)

**Accreditation,**

Fri., 2:00 p.m.-4:00 p.m., St. John's 22 (2)

**Post High,**

Fri., 2:00 p.m.-4:00 p.m., St. John's 23 (2)

**Grants,**

Fri., 4:00-7:00 p.m., St. John's 22 (2)

**Design Competition,**

Fri., 4:00 p.m.-7:00 p.m., St. John's 23 (2)

**SAC New Member Training,**

Fri., 7:00 p.m.-8:00 p.m., St. John's 23 (2)

**EWEEK,**

Mon., 1/25, 4:15 p.m.-6:15 p.m., Sebastian L3 (1)

**Student Program,**

Sun., 1/24, 7:30 a.m.-11:30 a.m., Gatlin B (1)

**Student Congress,**

Mon., 1/26, 10:00 a.m.-Noon, Suwannee 17 (2)

**Technical Activities,**

Sat., 1/23, 8:00 a.m.-3:00 p.m., Wekiwa 4 (2)

Wed., 1/27, 7:00 a.m.-10:00 a.m., Suwannee 14 (2)

**TAC/CEC Executive,**

Sat., 1/23, 7:00 a.m.-8:00 a.m., Wekiwa 4 (2)

## Society Committee Meetings

### TC/TG Chair's Training Workshop,

Sun., 1/24, 9:45-10:45 a.m., Panzacola F2 (1)

### TAC: TC/TG Section Meetings

Sun., 6:30 a.m.-8:00 a.m.

**Section 1,** Wekiwa 1

**Section 2,** St. John's 32

**Section 3,** St. John's 33

**Section 4,** St. John's 34

**Section 5,** St. John's 31

**Section 6,** St. John's 27

**Section 7,** Wekiwa 2

**Section 8,** St. John's 23

**Section 9,** Wekiwa 3

**Section 10,** Wekiwa 10

### Technology Council,

Tues., 1/26, 8:00 a.m.-Noon, Sebastian L1 (1)

Wed., 1/27, 10:00a.m.-1:00 p.m., Suwannee 15 (2)

#### **Building Information Modeling Steering Committee,**

Sat., 1/23, 1:15 p.m.-3:00 p.m., Wekiwa 8 (2)

#### **Building Performance Metrics Steering Committee,**

Sun., 1/24, 1:00 p.m.-4:00 p.m., Wekiwa 10 (2)

#### **Document Review Committee,**

Mon., 1/25, 7:00 a.m.-9:00 a.m., Boardroom (1)

#### **Operations,**

Mon., 1/25, 8:00 a.m.-Noon, St. John's 33 (2)

#### **Special Projects,**

Mon., 1/25, 8:00 a.m.-Noon, St. John's 31 (2)

#### **Planning,**

Mon., 1/25, 8:00 a.m.-Noon, St. John's 32 (2)

#### **AEDG Steering Committee,**

Mon., 2:15 p.m.-5:00 p.m., St. John 23 (2)

### YEA ,

Mon., 1/25, 7:00 a.m.- Noon, St. John 25 (2)

## CHRONOLOGICAL LISTING

### Friday, January 22

#### **Standards Executive,**

Fri., 8:00 a.m.-11:00 a.m., St. John's 25 (2)

#### **Chapter Technology Transfer,**

Fri., 8:00 a.m.-Noon, Suwannee 17 (2)

#### **Finance,**

Fri., 8:00 a.m.-1:00 p.m., St. John's 24 (2)

#### **Membership Promotion Subcommittees,**

Fri., 8:00 a.m.- 6:30 p.m., St. John's 26 (2)

#### **Student Activities Executive,**

Fri., 10:00 a.m.-Noon, St. John's 23 (2)

#### **Standards TCLS,**

Fri., 11:00 a.m.- Noon, St. John's 25 (2)

#### **Student Activities K-12/STEM,**

Fri., Noon-2:00 p.m. St. John's 23 (2)

#### **RAC Excom,**

Fri., 1:00 p.m.-2:30 p.m., Wekiwa 5 (2)

#### **CEC Executive,**

Fri., 1:00 p.m.-3:00 p.m., St. John's 28 (2)

#### **Standards ILS/ISAS,**

Fri., 1:00 p.m.-4:00 p.m., Suwannee 18(2)

### Planning,

Fri., 1:00 p.m.-6:00 p.m., St. John's 29 (2)

#### **CTTC Member Services,**

Fri., 1:30 p.m.-5:00 p.m., Suwannee 21 (2)

#### **CTTC Operations,**

Fri., 1:30 p.m.-5:00 p.m., Suwannee 17 (2)

#### **Student Activities Accreditation,**

Fri., 2:00 p.m.-4:00 p.m., St. John's 22 (2)

#### **Student Activities Post High,**

Fri., 2:00 p.m.-4:00 p.m., St. John's 23 (2)

#### **Research Promotion Executive,**

Fri., 2:00 p.m.-6:00 p.m., Wekiwa 2 (2)

#### **Standards PPIS,**

Fri., 2:00 p.m.-6:00 p.m., St. John's 25 (2)

#### **Standards SPLS,**

Fri., 2:00 p.m.-6:00 p.m., St John's 24 (2)

#### **CEC Annual and Winter Meetings,**

Fri., 3:00 p.m.-6:00 p.m., St. John's 28 (2)

#### **CEC Operations,**

Fri., 3:00 p.m.-6:00 p.m., St. John's 27 (2)

#### **RAC RAS/RPS,**

Fri., 3:00 p.m.-7:00 p.m., Wekiwa 5 (2)

#### **CEC Specialty Conferences,**

Fri., 4:00 p.m.-6:00 p.m., Suwannee 18 (2)

#### **Student Activities Grants,**

Fri., 4:00-7:00 p.m., St. John's 22 (2)

#### **Student Activities Design Competition,**

Fri., 4:00 p.m.-7:00 p.m., St. John's 23 (2)

#### **CTTC Executive,**

Fri., 5:00 p.m.-6:00 p.m., Suwannee 21 (2)

#### **SAC New Member Training,**

Fri., 7:00 p.m.-8:00 p.m., St. John's 23 (2)

### Saturday, January 23

#### **TAC/CEC Executive,**

Sat., 7:00 a.m.-8:00 a.m., Wekiwa 4 (2)

#### **Handbook Training for TC Handbook Chairs,**

Sun., 8:00 -9:00 a.m., Gatlin E1 (1)

#### **Research Promotion,**

Sat., 8:00 a.m.-11:30 a.m., Wekiwa 9 (2)

#### **Certification,**

Sat., 8:00 a.m.-Noon, St. John's 22 (2)

#### **Chapter Technology Transfer,**

Sat., 8:00 a.m.-Noon, Suwannee 13 (2)

#### **Members Council Region Operation,**

Sat., 8:00 a.m.- 12:30 p.m., St. John's 27 (2)

#### **Conferences and Expositions Committee,**

Sat., 8:00 a.m.-1:00 p.m., Wekiwa 8 (2)

#### **Membership Promotion,**

Sat., 8:00 a.m.-3:00 p.m., Suwannee 14 (2)

#### **Research Administration,**

Sat., 8:00 a.m.-3:00 p.m., Wekiwa 7 (2)

#### **Standards,**

Sat., 8:00 a.m.-3:00 p.m., Wekiwa 6 (2)

#### **Student Activities,**

Sat., 8:00 a.m.-3:00 p.m., Wekiwa 1 (2)

**Technical Activities,**

Sat., 8:00 a.m.-3:00 p.m., Wekiwa 4 (2)

**Executive,**

Sat., 8:30 a.m.-1:00 p.m., St. John's 23 (2)

**Publications Planning Subcommittee,**

Sat., 10:00 a.m.-Noon, St. John's 26 (2)

**Electronic Communication,**

Sat., 11:00 a.m.-3:00 p.m., Suwannee 21 (2)

**Handbook SPO/Excom,**

Sat., Noon-3:00 p.m., St. John's 26 (2)

**CLIMA,**

Sat., 12:30-1:30 p.m., St. John's 29 (2)

**Board Governance Transition Team,**

Sat., 1:00 p.m.-3:00 p.m., St. John's 27 (2)

**Technology Council Building Information Modeling Steering Committee,**

Sat., 1:15 p.m.-3:00 p.m., Wekiwa 8 (2)

**ASHRAE Foundation Executive Subcommittee,**

Sat., 1:30 -3:00 p.m., St. John's 22 (2)

**Publishing and Education Council E-Learning**

Sat., 1:30 pm.-3:00 p.m., St. John's 29 (2)

**Sunday, January 24****TAC: TC/TG Section Meetings**

Sun., 6:30 a.m.-8:00 a.m.

**Section 1,** Wekiwa 1**Section 2,** St. John's 32**Section 3,** St. John's 33**Section 4,** St. John's 34**Section 5,** St. John's 31**Section 6,** St. John's 27**Section 7,** Wekiwa 2**Section 8,** St. John's 23**Section 9,** Wekiwa 3**Section 10,** Wekiwa 10**Advocacy,**

Sun., 6:30 a.m.-8:30 a.m., Suwannee 18(2)

**Handbook Fundamentals Liaisons/TCs,**

Sun., 7:00 a.m.-8:00 a.m., Suwannee 13 (2)

**Handbook Refrigeration Liaisons/TCs,**

Sun., 7:00 a.m.-8:00 a.m., Suwannee 14 (2)

**Handbook HVAC Applications Liaisons/TCs,**

Sun., 7:00 a.m.-8:00 a.m., Suwannee 15 (2)

**Handbook HVAC Systems & Equipment Liaisons/TCs,**

Sun., 7:00 a.m.-8:00 a.m., Suwannee 16 (2)

**ASHRAE Research Canada,**

Sun., 7:00 -8:30 a.m., Suwannee 11 (2)

**Publishing and Education Council Advertising Sales Subcommittee,**

Sun., 7:00 a.m.-8:30 a.m., St. John's 22 (2)

**Standards PC Chair Breakfast,**

Sun., 7:00 -9:00 a.m., Sebastian L1 (1)

**Student Program,**

Sun., 7:30 a.m.-11:30 a.m., Gatlin B (1)

**Nominating,**

Sun., 7:30a-3:00 p.m., Gatlin A2 (1)

**College of Fellows Board/Advisory,**

Sun., 8:00 -10:00 a.m., Wekiwa 8 (2)

**Professional Development Planning,**

Sun., 8:00 a.m.-10:00 a.m., Suwannee 19 (2)

**ABEL Ad Hoc,**

Sun., 8:00 a.m.-10:30 a.m., Sebastian L3 (1)

**Members Council Planning,**

Sun., 8:00 a.m.- Noon, St. John's 24 (2)

**Publications Committee,**

Sun., 8:00 a.m.-Noon, St. John's 30 (2)

**Refrigeration,**

Sun., 8:00 a.m.-Noon, Gatlin E4 (1)

**Research Promotion,**

Sun., 8:15 a.m.-Noon, Wekiwa 5 (2)

**Historical,**

Sun., 8:30 a.m.- Noon, St. John's 25 (2)

**Handbook Volume Subcommittees,**

Sun., 9:00 a.m.-9:30 a.m., Suwannee 15 (2)

**ASHRAE/AHRI Joint Expo,**

Sun., 9:00 a.m.-11:00 a.m., Suwannee 13 (2)

**Board Governance Transition Team,**

Sun., 9:00 a.m.-Noon, St. John's 27 (2)

**TC/TG Chair's Training Workshop,**

Sun., 9:45-10:45 a.m., Panzacola F2 (1)

**Handbook,**

Sun., 9:45 a.m.-1:00 p.m., Suwannee 15 (2)

**College of Fellows,****Sun., 10:00 a.m. -Noon, Wekiwa 8 (2)****Professional Development Operations,**

Sun., 10:00 a.m.-Noon, Suwannee 19 (2)

**Honors & Awards,**

Sun., Noon-5:00 p.m., St. John's 22 (2)

**Technology Council Building Performance Metrics Steering Committee,**

Sun., 1:00 p.m.-4:00 p.m., Wekiwa 10 (2)

**Associate Society Alliance,**

Sun., 1:30 p.m.-4:30 p.m., Gatlin E4

**Board of Directors,**

Sun., 1:30 p.m.-5:30 p.m., Sebastian K (1)

**IAQ 2010 Steering Committee,**

Sun., 6:30 p.m.-8:30 p.m., St. John's 24 (2)

**Standards Code Interaction,**

Sun., 7:00 p.m.-10:00 p.m., St. John's 27 (2)

**Monday, January 25****RAC Research Subcommittee Chairs,**

Mon., 6:30 a.m.-9:00 a.m., Conway (1)

**Environmental Health Executive,**

Mon., 7:00 a.m.-8:00 a.m., Wekiwa 3 (2)

**Technology Council Document Review Committee,**

Mon., 7:00 a.m.-9:00 a.m., Boardroom (1)

**YEA ,**

Mon., 7:00 a.m.- Noon, St. John 25 (2)

**ASHRAE Foundation,**

Mon., 8:00 -10:00 a.m., St. John 26 (2)

**Environmental Health Education/Research,**

Mon., 8:00 a.m.-10:00 a.m., Wekiwa 3 (2)



## Society Committee Meetings

### Professional Development,

Mon., 8:00 a.m.- Noon, St. John 27 (2)

### Members Council,

Mon., 8:00 a.m. – Noon, Wekiwa 5 (2)

#### Technology Council Operations,

Mon., 8:00 a.m.-Noon, St. John's 33 (2)

#### Technology Council Special Projects,

Mon., 8:00 a.m.-Noon, St. John's 31 (2)

#### Technology Council Planning,

Mon., 8:00 a.m.-Noon, St. John's 32 (2)

#### Environmental Health Handbook/Program,

Mon., 10:00 a.m.-Noon, Wekiwa 3 (2)

### Student Congress,

Mon., 10:00 a.m.-Noon, Suwannee 17 (2)

#### Publishing and Education Council Research Journal,

Mon., 11:00 a.m.- Noon, Suwannee 20 (2)

### Solar Decathlon Ad Hoc,

Mon., 2:00 p.m.-3:00 p.m., Sebastian I3 (1)

#### Publishing and Education Council Fiscal,

Mon., 2:00 p.m. -3:30 p.m., Boardroom (1)

### Region-at-Large Planning,

Mon., 2:15 p.m.-4:15 p.m., St. John 24 (2)

#### Technology Council AEDG Steering Committee,

Mon., 2:15 p.m.-5:00 p.m., St. John 23 (2)

### Honors & Awards,

Mon., 2:15 p.m.- 5:30 p.m., St. John 28 (2)

### Environmental Health,

Mon., 2:15 p.m. -6:15 p.m., Wekiwa 3 (2)

#### Members Council PAOE,

Mon., 2:30 p.m.-4:00 p.m., St. John's 32 (2)

#### Publishing and Education Council Functional,

Mon., 3:30 p.m.- 5:00 p.m., Boardroom (1)

### Associate Society Alliance,

Mon., 4:15-6:00 p.m., Sebastian I3 (1)

#### Student Activities EWEEK,

Mon., 4:15 p.m.-6:15 p.m., Sebastian L3 (1)

### Research Advisory Panel,

Mon., 6:00 p.m.-8:00 p.m., Sebastian L4 (1)

## Tuesday, January 26

### Life Members' Executive Board,

Tues., 8:00 a.m.-11:30 a.m., St. John's 23 (2)

### Members Council,

Tues., 8:00 a.m. – Noon, Wekiwa 5 (2)

### Publishing and Education Council,

Tues., 8:00a- Noon, Wekiwa 6 (2)

### Scholarship Trustees,

Tues., 8:00 a.m.- Noon, St. John's 32 (2)

### Technology Council,

Tues., 8:00 a.m.-Noon, Sebastian L1 (1)

#### Standards PPIS,

Tues, 11:00 a.m.-1:00 p.m., St. John's 34 (2)

### PEAC,

Tues., Noon-2:00 p.m., St. John's 25 (2)

#### Standards SPLS,

Tues., 2:00 p.m.-3:00 p.m., St. John's 34 (2)

### Society Rules,

Tues., 2:00 p.m.-5:00 p.m., St. John's 22 (2)

### Standards Advisory Committee,

Tues., 2:00 -6:00 p.m., Suwannee 15 (2)

#### Standards TCLS,

Tues., 5:00 p.m.-5:30 p.m., St. John's 34 (2)

#### Standards SRS,

Tues., 5:00 p.m.-6:00 p.m., St. John's 32 (2)

## Wednesday, January 27

### Technical Activities,

Wed., 7:00 a.m.-10:00 a.m., Suwannee 14 (2)

### Research Administration,

Wed., 7:00 a.m.-11:00 a.m., Suwannee 13 (2)

### Executive,

Wed., 7:30 a.m.-9:00 a.m., Suwannee 18 (2)

### CIBSE/ASHRAE Liaison,

Wed., 9:30 a.m.-Noon, Suwannee 18 (2)

### Standards,

Wed., 8:00 -10:00 a.m., Sebastian K (1)

### Technology Council,

Wed., 10:00a.m.-1:00 p.m., Suwannee 15 (2)

### Board of Directors,

Wed., 2:00 -6:00 p.m., Sebastian K (1)

## Thursday, January 28

### Executive,

Thurs., 7:30 a.m.-11:00 a.m., Suwannee 19 (2)

## TC/TG/SPC MEETINGS

The ASHRAE Technical 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.

### Policy for Scheduling TC/TG/SPC Meetings

TC and TG meetings will be automatically scheduled on the same day and time based upon the previous meeting schedule. Any changes to the time slot must be made in writing. All TC/TG subcommittees must be scheduled for each meeting. All SPC meetings must be confirmed prior to scheduling. Some of the meetings listed for Chicago have not been confirmed but are on this schedule.

Audiovisual equipment must be ordered for each meeting and only advance orders will be guaranteed. LCD projectors are not available.

NOTE: The parenthesis beside each committee represent the number of people expected to attend the meeting and any audiovisual equipment ordered. We encourage you to order audiovisual equipment in advance, as we are unable to guarantee that equipment will be available on-site. Every effort is made to accommodate room size versus number of committee members. If you have not supplied the Conferences Department with the number of members on your committee or subcommittee, we have no basis for room assignments.

### Finding the Assigned Meeting Room

All meetings are scheduled in Rosen Shingle Creek. The number in parenthesis following the room name indicates the level location within the hotel. Please refer to the diagrams of the meeting rooms in this program for assistance in finding your room.

### Description of Abbreviations

GPC = Guideline Project Committee  
 RP = Research Project  
 SPC = Standard Project Committee  
 SSPC = Standing Standard Project Committee  
 TC = Technical Committee  
 TG = Task Group  
 TRG = Technical Resource Group

### Format of Listings

#### Committee Number and Title

**Day**            **Time**            **Location**

*Session(s) the committee is sponsoring*

## TCs

### TC/TG Chair's Breakfast

<b>Sunday</b>	<b>6:30-8:00 a.m.</b>	
Section 1 (29)		Wekiwa 1
Section 2 (21)		St. John's 32
Section 3 (15)		St. John's 33
Section 4 (17)		St. John's 34
Section 5 (29)		St. John's 31
Section 6 (25)		St. John's 27
Section 7 (23)		Wekiwa 2
Section 8 (23)		St. John's 23
Section 9 (25)		Wekiwa 3
Section 10 (25)		Wekiwa 10

### TC/TG Chair's Training Workshop

**Sunday 9:45-10:45a Panzacola F2 (1)**

### Research Subcommittee Breakfast

**Monday 6:30-8:00a Conway (1)**

### TC 1.1 Thermodynamics & Psychrometrics (15)

**Monday 2:15-4:15p Panzacola F3 (1)**

### TC 1.2 Instruments & Measurements (15)

**Tuesday 1:00-3:30p Suwannee 12 (2)**

TC 1.2 Standards/Handbook (5)

**Monday 4:15-6:30p Wekiwa 1 (2)**

### TC 1.3 Heat Transfer & Fluid Flow (25)

**Tuesday 1:00-3:30p Suwannee 20 (2)**

*Sponsoring: Forum 10: Micro and Nano Systems and their Future Potential in HVAC and Energy Systems*

TC 1.3 Handbook

**Sunday 1:00-3:00p St. John's 30 (2)**

TC 8.5/1.3 Research (20/15)(screen)

**Sunday 3:00-7:00p Panzacola G1 (1)**

### TC 1.4 Control Theory & Application (40) (Screen)

**Tuesday 1:00-3:30p Gatlin A4 (1)**

*Sponsoring: Seminar 41: Measuring Humidity: Does Accuracy Matter?*

TC 1.4 Control Components and Applications /Green Buildings

**Sunday 3:00-3:45p Wekiwa 4 (2)**

TC 1.4 Program (30) (screen)

**Sunday 4:45-5:30p Wekiwa 4**

TC 1.4 Reference Applications (10)

**Sunday 5:30-6:30p Wekiwa 4**

TC 1.4 Research (20)(Screen)

**Monday 2:15-4:15p Suwannee 18 (2)**

TC 1.4 Handbook (15)

**Monday 4:15-5:15p Suwannee 18**

TC 1.4 Executive (15)

**Tuesday 7:00-8:00a St. John's 34 (2)**

**TC 1.5 Computer Applications (25/25)(Screen)**

**Monday 6:30-9:00p Gatlin E2 (1)**

*Sponsoring: Seminar 13: Using the Web to Improve Learning and Working for Building Professionals; Seminar 24: BIM to SIM: Technology Update; Seminar 36: Which BIM Interoperability Schemas Are Most Appropriate for Different Types of Building Energy Design*

TC 1.5 Emerging Applications (6/10)

**Sunday 5:00-6:00p Panzacola G2 (1)**

TC 1.5 Research (15)

**Sunday 6:00-7:00p Panzacola G2**

TC 1.5 Program (15)

**Sunday 7:00-8:00p Panzacola G2**

TC 1.5 Handbook (15)

**Monday 6:00-6:30p Gatlin E2 (1)**

**TC 1.6 Terminology (8/6) (Screen/E)**

**Monday 4:15-6:30p Wekiwa 10 (2)**

**TC 1.7 Business, Management & General Legal Education (20/5)**

**Monday 10:15a-Noon Gatlin A1 (1)**

*Sponsoring: Seminar 20: Selling Yourself In Interviews and Presentations; Seminar 26: Increase the Impact of Your ASHRAE Presentation; Seminar 46: ASHRAE Member's Survival Guide: Billing and Collection Practices to Insure You Get What You Deserve: Part 2; Seminar 7: Don't Let your BIM Go BOOM: Dealing with the Liability Issues of BIM*

**TC 1.8 Mechanical Systems Insulation (20)**

**Monday 4:15-6:30p Suwannee 17 (2)**

TC 1.8 RP-1356 PMS (8)

**Sunday 8:00-9:00a St. John's 29 (2)**

TC 1.8 Research (10)

**Sunday 9:00-10:00a St. John's 29**

TC 1.8 Handbook (10)

**Sunday 10:00-11:00a St. John's 29**

**TC 1.9 Electrical Systems (20)**

**Tuesday 3:30-6:00p Suwannee 19 (2)**

*Sponsoring: Forum 9: Will Equipment Protection Requirements for Large Buildings Change as NZEB with PV Increase?; Seminar 15: What Does A Large Building Operator Need to Know about the SmartGrid while the Grid Is Still in School?*

**TC 1.10 Cogeneration Systems (20/10)**

**Tuesday 3:00-4:30p Suwannee 17 (2)**

*Sponsoring: Seminar 48: Economics, Energy and CO2 Savings of CHP Systems and the Future of Opportunity Fuels as an Energy Source*

TC 1.10 Program/Research/Membership (15/10)

**Tuesday 1:00-3:00p Suwannee 17**

TC 1.10 CTIC/Handbook (8/4)(Screen)

**Monday 4:15-7:30p Gatlin E4 (1)**

**TC 1.11 Electric Motors and Motor Control (20)**

**Tuesday 1:00-3:30p Suwannee 19 (2)**

TC 1.11 Handbook/Research (5)

**Sunday 10a-Noon Suwannee 20 (2)**

**TC 1.12 Moisture Management in Buildings (15/25) (screen)**

**Saturday 1:00-3:00p Wekiwa 3 (2)**

*Sponsoring: Forum 6: Solving Moisture Problems Created By Energy Retrofits; Seminar 72: Lessons from the School of Hard Knocks: The Revised ASHRAE Guide for Buildings in Hot & Humid Climates*

TC 1.12 Programs/Handbook/Research (10)

**Saturday 10:00-Noon Wekiwa 3**

**TC 2.1 Physiology & Human Environment (12/15)**

**Tuesday 1:00-3:30p Suwannee 14 (2)**

TC 2.1 Research (13/10)

**Sunday 3:00-5:00p Suwannee 21 (2)**

TC 2.1 Programs/Handbook (10/5)

**Sunday 5:00-7:00p Suwannee 21**

**TC 2.2 Plant and Animal Environment (10/5)**

**Monday 4:15-6:30p St. John's 24 (2)**

**TC 2.3 Gaseous Air Contaminants /Removal Equip. (18/30)**

**Tuesday 1:00-3:30p Gatlin E5 (1)**

*Sponsoring: Forum 8: Should Gas-Phase Filtration be a Typical Application in Standard 62?*

TC 2.3 Research (15/15)

**Sunday 5:00-7:00p Wekiwa 6 (2)**

TC 2.3 Publications (10/10)

**Monday 3:00-4:00p Suwannee 19 (2)**

TC 2.3 Handbook (5/5)

**Monday 4:15-6:00p Suwannee 20 (2)**

TC 2.3 Standards (20/10)

**Monday 6:00-8:00p Suwannee 19**

TC 2.3 Planning (15)

**Tuesday 6:30-8:00a Wekiwa 2 (2)**

TC 2.3 Program (10/10)

**Tuesday 11:30a-1:00p Gatlin E5 (1)**

**TC 2.4 Particulate Air Contaminants /Removal Equip. (18/30)**

**Tuesday 3:30-6:00p Gatlin E5 (1)**

TC 2.4 Handbook (10/10)

**Saturday 1:00-3:00p Wekiwa 9 (2)**

TC 2.4 PMS 1360-RP (10)

**Sunday 10:00-11:00a Wekiwa 10 (2)**

TC 2.4 PMS 1287-RP (10)

**Sunday 11:00-Noon Wekiwa 10**

TC 2.4 Research (20/50) (screen)  
**Sunday 3:00-5:00p Wekiwa 6 (2)**

TC 2.4 Publications (10/10) (Flipchart)  
**Monday 3:00-4:00p Suwannee 19**

TC 2.4 Standards (20/10) (Screen)  
**Monday 4:15-6:00p Suwannee 19**

TC 2.4 Program (20/40) (Flip)  
**Tuesday 11:30a-1:00p Gatlin E5 (1)**

### TC 2.5 Global Climate Change (20/10)

**Tuesday 1:00-3:30p St. John's 24 (2)**

TC 2.5 Programs/Research (6/6)  
**Sunday 1:00-2:00p Boardroom (1)**

### TC 2.6 Sound & Vibration Control (18/12)

**Monday 2:15-4:15p Wekiwa 4 (2)**

*Sponsoring: Seminar 1: Acoustics in High Performance Buildings;  
 Seminar 10: Noise and the Mechanical System Design Process*

TC 2.6 RP 3122  
**Sunday 9:45-10:45a St. John's 23 (2)**

TC 2.6 Hot Topic – Using dBA/dBC Noise Criteria (20)  
**Sunday 1:30-2:00p St. John's 23**

TC 2.6 Criteria  
**Sunday 2:00-2:30p St. John's 23**

TC 2.6 Hot Topic – Aerodynamic Noise  
**Sunday 2:30-2:45p St. John's 23**

TC 2.6 Hot Topic – Lined Duct End Reflection  
**Sunday 2:45-3:00p St. John's 23**

TC 2.6 Programs (25)  
**Sunday 3:00-4:00p St. John's 23**

TC 2.6 RP 1408 PMS (Lined Duct)  
**Sunday 4:00-5:00p St. John's 23**

TC 2.6 Hot Topic-Terminal Unit Testing and ASHRAE 130  
**Sunday 5:00-5:30p St. John's 23**

TC 2.6 Excom (10)  
**Sunday 5:30-6:30p St. John's 23**

TC 2.6 Publications  
**Monday 8:00-9:00a Wekiwa 4 (2)**

TC 2.6 Acoustical CD  
**Monday 9:00-9:30p Wekiwa 4**

TC 2.6 Vibration Isolation  
**Monday 9:30-10:00a Wekiwa 4**

TC 2.6 Research (25)  
**Monday 10:00-11:00a Wekiwa 4**

### TC 2.7 Seismic and Wind Restraint Design (24/6)

**Tuesday 3:30-6:00p St. John's 33 (2)**

*Sponsoring: Seminar 31: Sustaining the Building Envelope During High Wind Event*

TC 2.7 Handbook (10/5)  
**Tuesday 8a-Noon St. John's 33**

TC 2.7 Seismic & Wind Restraint Design (20)  
**Tuesday 1:00-3:30p St. John's 33**

### TC 2.8 Building Environmental Impacts and Sustainability (75)

**Sunday 5:00-7:00p Panzacola H3&4 (1)**

*Sponsoring: Seminar 22: Standard 189.1P Overview: Part 1;  
 Seminar 30: Standard 189.1P Overview: Part 2; Seminar 47:  
 High Performance HVAC System in LEED Platinum Projects: A  
 Selected Showcase*

TC 2.8 International (25)  
**Sunday 12:00-12:30p Suwannee 14 (2)**

TC 2.8 Green Guide (25)  
**Sunday 12:30-1:45p Suwannee 14**

TC 2.8 Handbook (25)  
**Sunday 3:30-4:15p Suwannee 14**

TC 2.8 Program (25)  
**Sunday 4:15-4:50p Suwannee 14**

### TC 2.9 Ultraviolet Air and Surface Treatment (30)

**Monday 10:00a-Noon Wekiwa 10 (2)**

TC 2.9 Research  
**Sunday 8:00-10:00a Boardroom (1)**

TC 2.9 Project 1509  
**Sunday 10:00a-Noon Boardroom**

TC 2.9 Program, Handbook, Standards  
**Monday 8:00-10:00a Wekiwa 10**

### TC 3.1 Refrigerants & Secondary Coolants (20/10) (Screen)

**Monday 4:15-6:30p Wekiwa 6 (2)**

*Sponsoring: Forum 5: Refrigerant Safety Classification 2L: What Do We Do with It? ; Seminar 60: Advances in Refrigerants and Secondary Coolants*

TC 3.1 Research (5/5)  
**Monday 11:00a-Noon Wekiwa 6**

TC 3.1 Program and Handbook (6/4)  
**Monday 2:15-3:45p Wekiwa 6**

### TC 3.2 Refrigerant System Chemistry (12/40) (Screen/E)

**Monday 2:15-4:15p Panzacola G2 (1)**

TC 3.2 Research (10/8)  
**Sunday 4:00-5:00p Suwannee 12 (2)**

### TC 3.3 Refrigerant Contaminant Control (50)

**Tuesday 3:30-6:00p Panzacola G1 (1)**

TC 3.3 Research (10/8)  
**Sunday 5:00-5:30p Suwannee 12 (2)**

TC 3.3 Handbook  
**Sunday 6:00-7:00p Suwannee 12**



## TC/TG/SPC Meetings

### TC 3.4 Lubrication (60)

**Tuesday 1:30-3:30p Panzacola G1 (1)**

TC 3.4 Research (10/8)

**Sunday 5:30-6:00 Suwannee 12 (2)**

### TC 3.6 Water Treatment (18/10) (screen)

**Tuesday 1:00-3:30p St. John's 26 (2)**

TC 3.6 Handbook/Program/Research (12/4) (Screen)

**Sunday 3:00-5:00p Gatlin E3 (1)**

TC 3.6 RP 1361 (Screen)

**Sunday 10:00a-Noon St. John's 34 (2)**

### TC 3.8 Refrigerant Containment (9/5)

**Monday 4:15-6:30p Suwannee 16 (2)**

### TC 4.1 Load Calculation Data and Procedures (20/10)

**Monday 2:15-4:15p Suwannee 13 (2)**

*Sponsoring: Seminar 11: Background on Load Calculations Methodologies (Past and Present); Current ASHRAE Information (Handbook and Publications); Seminar 33: Recent ASHRAE Research on Load Calculations: Cooling Load Methodologies for Under Floor Air Distribution Equipment; Seminar 67: Load Calculations Methodologies for Unique Construction Types*

TC 4.1 Handbook

**Sunday 3:00-4:00p Panzacola H 1&2 (1)**

TC 4.1 Research (10/5)

**Sunday 4:00-5:00p Panzacola H 1&2**

TC 4.1 Programs & Standards (10/5)

**Sunday 5:00-6:00p Panzacola H 1&2**

### TC 4.2 Climatic Information (20) (Screen/Flip)

**Tuesday 1:00-3:30p St. John's 32 (2)**

TC 4.2 PMS 1477-RP (6/8) (screen/flip)

**Sunday 1:00-2:00p Suwannee 12 (2)**

TC 4.2 Program (6/8) (Flip)

**Sunday 2:00-2:30p Suwannee 12**

TC 4.2 Handbook (6/8)

**Sunday 2:30-4:00p Suwannee 12**

SSPC 169 (10/8) (screen/flip)

**Monday 10a-Noon Suwannee 13**

TC 4.2 Research (10/6)(Screen/flip)

**Monday 4:15-6:00p Gatlin E5 (1)**

### TC 4.3 Ventilation Requirements & Infiltration (14/20)

**Monday 4:15-6:30p St. John's 31 (2)**

*Sponsoring: Seminar 50: Humidity Control Issues and Solutions for High Performing Buildings*

TC 4.3 Program (5/5)

**Sunday 5:00-6:00p Wekiwa 1 (2)**

TC 4.3 Handbook (5/5)

**Sunday 6:00-7:00p Wekiwa 1**

TC 4.3 Research (8/8)

**Monday 2:15-4:15p St. John's 31**

TC 4.3 PMS for RP-1478

**Tuesday 8:00-9:00a Suwannee 18 (2)**

### TC 4.4 Bldg. Materials and Bldg. Envelope Performance (20/20)

**Monday 2:15-4:15p Gatlin E2 (1)**

*Sponsoring: Seminar 58: Crawlspace Humidity and Moisture Performance in Hot-Humid and Mixed Climates*

TC 4.4 RP 1365 (20)(screen)

**Sunday 11a-12:00p Sebastian L2 (1)**

TC 4.4 Research (40)

**Sunday 1:00-3:00p Sebastian L2**

TC 4.4 Handbook (30)

**Sunday 3:00-4:30p Sebastian L2**

TC 4.4 Program (25)

**Sunday 4:30-5:00p Sebastian L2**

TC 4.4 Standards (30)

**Sunday 5:00-5:30p Sebastian L2**

### TC 4.5 Fenestration (15/5)

**Monday 2:15-4:15p Gatlin E4 (1)**

TC 4.5 Research & Long Range Planning (15/5)

**Sunday 3:15-4:00p Suwannee 15 (2)**

TC 4.5 Program (15/5)

**Sunday 4:00-5:00p Suwannee 15**

TC 4.5 Handbook (15/5)

**Sunday 5:00-6:00p Suwannee 15**

### TC 4.7 Energy Calculations (75)

**Tuesday 6:00-8:30p Panzacola G1 (1)**

*Sponsoring: Seminar 37: Web-based Programs for Calculating Energy Code Compliance; Seminar 43: How to Assess the Performance of Sustainable Buildings*

TC 4.7 Research, Planning, Program (20/20)

**Monday 6:30-7:00p Suwannee 16 (2)**

TC 4.7 Research (20/20)

**Monday 7:00-9:00p Suwannee 16**

TC 4.7 Research Coordination, Handbook (40)

**Tuesday 3:30-5:00p Wekiwa 5 (2)**

TC 4.7 PMSC 1456 (5/5) (Screen)

**Sunday 8:00-10:00a Suwannee 20 (2)**

TC 4.7 PMSC 1404(5/5) (Screen)

**Sunday 1:00-3:00p Wekiwa 4 (2)**

TC 4.7 1416 (5/5) (Screen)

**Monday 8:00-10:00a St. John's 24 (2)**

### TC 4.10 Indoor Environmental Modeling (40)

**Monday 2:15-4:15p Suwannee 16 (2)**

*Sponsoring: Seminar 38: Modeling of Particle Transport in Indoor Environment for Air Quality Analyses*

TC 4.10 RP 1418 PMS (15) (Screen)  
**Sunday 12:30-1:30p Gatlin A3 (1)**

TC 4.10 RP 1487 PMS  
**Sunday 1:30-2:30p Gatlin A3**

TC 4.10 RP 1512 PMS  
**Sunday 2:30-3:30p Gatlin A3**

TC 4.10 Program  
**Sunday 3:30-4:30p Gatlin A3**

TC 4.10 Handbook  
**Sunday 4:30-5:00p Gatlin A3**

TC 4.10 Research (30)  
**Sunday 5:00-6:30p Gatlin A3**

#### **TC 5.1 Fans (25) (Screen)**

**Monday 4:15-6:15p Wekiwa 7 (2)**

*Sponsoring: Forum 7: Multiple Plenum Fans in an Array: What Are the Advantages and Disadvantages?; Seminar 74: Selection and Operation of Fan for Different Building Systems in Relation to Its Efficiency and ASHRAE 90.1 and Other Standards*

TC 5.1 Handbook (10/10) (screen)  
**Sunday 2:00-3:00p Suwannee 11 (2)**

TC 5.1 Research, Program (10/10)  
**Sunday 3:00-5:00p Suwannee 11**

TC 5.1 PES 1420 (8/12) (Screen)  
**Sunday 5:00-6:00p Suwannee 11**

TC 5.1 PMS 1272 (8/12)  
**Monday 10:00-11:00a Wekiwa 9 (2)**

TC 5.1 PMS 1216 (8/12) (Screen)  
**Monday 11:00-Noon Wekiwa 9**

#### **TC 5.2 Duct Design (12/20)**

**Tuesday 3:30-6:00p Gatlin E2 (1)**

TC 5.2 TRP 1333  
**Sunday 11:00-Noon St. John's 28 (2)**

TC 5.2 WS 1369, Snow removal louvers  
**Sunday 12:00-1:30p St. John's 28**

TC 5.2 RP 1488, Flat Oval Junction Test  
**Sunday 1:30-2:30p St. John's 28**

TC 5.2 CFD Shoot Out  
**Sunday 2:30-3:30p St. John's 28**

TC 5.2 Handbook (8)  
**Sunday 3:40-4:30p St. John's 28**

TC 5.2 Duct Fitting Database Maintenance  
**Sunday 4:30-8:00p St. John's 28**

TC 5.2 1180 Design Guide for Duct Design (10)  
**Monday 8:00a-Noon St. John's 28**

#### **TC 5.3 Room Air Distribution (25/15)**

**Tuesday 1:00-3:30p Gatlin E2 (1)**

TC 5.3 Handbook (20)(screen/E)  
**Friday 9:00-4:00p Suwannee 19 (2)**

TC 5.3 Handbook (20) (screen/E)  
**Saturday 9:00-3:00p St. John's 25 (2)**

TC 5.3 PMS RP-1335 (15)(screen)  
**Sunday 9:00-10:00a Gatlin E3 (1)**

TC 5.3 PMS RP-1522 (15)  
**Sunday 10:00-11:00a Gatlin E3**

TC 5.3 Chilled Beams (30)  
**Sunday 11:00a-1:00p Gatlin E3**

TC 5.3 Research (40)  
**Sunday 1:00-2:00p Gatlin E3**

TC 5.3 Handbook/Programs (40)  
**Sunday 2:00-3:00p Gatlin E3**

#### **TC 5.4 Industrial Process Air Cleaning (30)**

**Monday 2:15-4:15p Panzacola F2 (1)**

TC 5.4 PMS-1284 (10)  
**Sunday 10:00-Noon Suwannee 16 (2)**

TC 5.4 Research  
**Sunday 11:00-Noon Suwannee 16**

#### **TC 5.5 Air-to-Air Energy Recovery (22/4)**

**Tuesday 3:30-6:00p St. John's 26 (2)**

*Sponsoring: Seminar 34: Enhanced Dehumidification Strategies with Energy Recovery in Hot Humid Climates*

TC 5.5 Handbook, Program, Research (11/9)  
**Monday 4:15-6:30p Panzacola F3 (1)**

#### **TC 5.6 Control of Fire & Smoke (23/35)**

**Monday 4:15-6:30p Suwannee 14 (2)**

TC 5.6 Program (30)  
**Sunday 3:00-4:00p St. John's 25 (2)**

TC 5.6 Research  
**Sunday 4:00-5:30p St. John's 25**

TC 5.6 Handbook  
**Sunday 5:30-6:00p St. John's 25**

TC 5.6 Guideline 5 Subcommittee  
**Sunday 6:00-7:30p St. John's 25**

TC 5.6 Guideline 5 Subcommittee  
**Monday 2:15-4:15p Suwannee 14 (2)**

#### **TC 5.7 Evaporative Cooling (30)**

**Monday 4:15-6:30p Suwannee 15 (2)**

*Sponsoring: Seminar 71: Evaporative Cooling Down South? You've Got To Be Kidding!*

TC 5.7 Research and Handbook (10/5)  
**Sunday 3:00-4:00p St. John's 33 (2)**

TC 5.7 Programs and Standards (10/5)  
**Sunday 4:00-5:00p St. John's 33**

## TC/TG/SPC Meetings

### TC 5.8 Industrial Ventilation Systems (20/5) (Screen)

**Monday 4:15-6:30p Wekiwa 8 (2)**

TC 5.8 Ventilation of Hazardous Spaces (5/5)  
(Screen)

**Sunday 7:30-9:30p St. John's 31 (2)**

### TC 5.9 Enclosed Vehicular Facilities (30/10)

**Tuesday 3:30-6:00p Wekiwa 8 (2)**

*Sponsoring: Transactions 1: Natural Ventilation Applications and Principles in Transit Systems*

TC 5.9 Proposal Evaluation (10)

**Sunday 3:00-5:00p Suwannee 18 (2)**

TC 5.9 Program, Handbook, Research (25)

**Tuesday 1:00-3:30p Wekiwa 8 (2)**

### TC 5.10 Kitchen Ventilation (20/10) (screen)

**Sunday 4:00-5:30p Gatlin A4 (1)**

*Sponsoring: Seminar 21: Sustainability Case Studies in Hospitality and Foodservice Facilities*

TC 5.10 PMS 1480 & 1376 (screen)

**Saturday 1:00-3:00p St. John's 34 (2)**

TC 5.10 Handbook

**Sunday 8:00-11:00a Gatlin A4**

TC 5.10 Program

**Sunday 11:00-Noon Gatlin A4**

TC 5.10 Research

**Sunday 1:00-3:00p Gatlin A4**

TC 5.10 LRP

**Sunday 3:00-4:00p Gatlin A4**

TC 5.10 PMS 1469

**Monday 10:30-Noon Gatlin E2**

### TC 5.11 Humidifying Equipment (10/3)

**Monday 2:15-4:15p Suwannee 20 (2)**

TC 5.11 Handbook /Program (8/2)

**Sunday 9:00-11:00a Suwannee 14 (2)**

### TC 6.1 Hydronic & Steam Htg. Equip & Sys (35/15)

**Tuesday 1:00-3:30p Suwannee 16 (2)**

*Sponsoring: Seminar 69: Chilled Water Plant Retrofits for Optimization and Reduction in Energy; Seminar 76: Coil Selection and Control for Hydronic Systems*

TC 6.1 Program

**Monday 2:15-4:15p Wekiwa 2 (2)**

TC 6.1 Research (10/10)

**Monday 4:15-6:15p Wekiwa 2**

TC 6.1 Handbook / Chilled Water Plant (10/10)

**Sunday 5:00-7:00p Sebastian L4**

### TC 6.2 District Energy (20/10)

**Sunday 3:00-5:00p Wekiwa 5 (2)**

TC 6.2 PMS 1267 RP (9/10)(screen)

**Sunday 12:15-2:00p Wekiwa 5**

TC 6.2 Programs, Research, Handbook, Planning, (14)

**Sunday 2:00-3:00p Wekiwa 5**

### TC 6.3 Central Forced Air Htg. & Cooling Sys (30)

**Tuesday 1:00-3:30p Suwannee 18 (2)**

TC 6.3 Research (10/12)

**Monday 2:15-4:15p St. John's 26 (2)**

TC 6.3 Program (10/10)

**Monday 4:15-6:30p St. John's 26**

TC 6.3 Handbook and Standards (8/8)

**Monday 6:30-9:00p St. John's 26**

### TC 6.5 Radiant Heating and Cooling (17/10)

**Monday 2:15-4:15p St. John's 33 (2)**

*Sponsoring: Seminar 2: Radiant Cooling Projects for 30% Better than ASHRAE Standard 90.1-2004 Energy Use*

TC 6.5 Research, Spec Pubs, Journal, Program (6/8)

**Sunday 3:00-4:00p Boardroom (1)**

TC 6.5 Handbook, Snowmelt (6/8)

**Sunday 4:00-6:00p Boardroom**

TC 6.5 1383-RP

**Monday 8:00-10:00a Wekiwa 1 (2)**

### TC 6.6 Service Water Heating Systems (18/40)

**Monday 4:15-6:30p Panzicola G2 (1)**

*Sponsoring: Seminar 62: New Information on Service Hot Water Systems: Not Your Grandfather's Way Anymore!*

TC 6.6 Research/Handbook/Program (18/10)

**Monday 2:15-4:15p Sebastian L1 (1)**

### TC 6.7 Solar Energy Utilization (20/10)

**Tuesday 1:00-3:30p Wekiwa 6 (2)**

TC 6.7 Research/Program (8/5)

**Monday 4:15-6:30p Suwannee 11 (2)**

TC 6.7 Handbook/SPC 93 (6/10)

**Monday 6:30-8:30p Suwannee 11**

### TC 6.8 Geothermal Energy Utilization (16/25)

**Tuesday 3:30-6:00p Suwannee 16 (2)**

*Sponsoring: Seminar 77: Impact of Ventilation Air Strategies on Ground Source Heat Pump Systems*

TC 6.8 Research, Program, Handbook (15/15)

**Sunday 5:00-7:00p Wekiwa 10 (2)**

### TC 6.9 Thermal Storage (20/40)

**Monday 2:15-4:15p Panzicola G1 (1)**

*Sponsoring: Seminar 29: Effective Design and Operation of Thermal Energy Storage Systems in Hot and Humid Climates; Transactions 6: Recent Advances in Thermal Storage*

TC 6.9 Standards (15)

**Sunday 1:00-1:30p St. John's 29 (2)**

TC 6.9 Program  
**Sunday 1:30-2:30p St. John's 29**

TC 6.9 Research  
**Sunday 2:30-3:30p St. John's 29**

TC 6.9 Handbook,  
**Sunday 3:30-4:00p St. John's 29**

TC 6.9 LRP  
**Sunday 4:00-5:00p St. John's 29**

TC 6.9 Research RP 1387 PMS (10)  
**Monday 7:00-8:00a Suwannee 20 (2)**

**TC 6.10 Fuels & Combustion (30)**  
**Tuesday 3:30-6:00p Suwannee 18 (2)**

TC 6.10 Handbook (4/4)  
**Monday 2:15-4:15p St. John's 25 (2)**

**TC 7.1 Integrated Building Design (25/10)**  
**Monday 8:15-10:30a Wekiwa 6 (2)**  
*Sponsoring: Seminar 73: BIM Beyond Design and Construction*

TC 7.1 Subcommittees (15)  
**Sunday 6:00-8:00p Wekiwa 9 (2)**

**TC 7.3 Operations & Maintenance Management (25/7)**  
**Tuesday 1:00-3:30p Wekiwa 9 (2)**

TC 7.3 Standards/Program (7/3)  
**Monday 2:15-4:15p Panzacola F1 (1)**

TC 7.3 Research/Handbook (7/3)  
**Monday 4:15-6:30p Panzacola F1**

**TC 7.4 Building Operations Dynamics**  
*TC 7.4 has merged with TC 7.5 and is now a subcommittee under TC 7.5 – see meeting schedule below.*

**TC 7.5 Smart Building Systems (16/24)**  
**Tuesday 3:30-6:00p St. John's 28 (2)**  
*Sponsoring: Seminar 16: Implementing and Assessing Your Wireless Sensing and Control Network; Seminar 57: Smart Systems for Sustainable Buildings, Part 1; Seminar 64: Smart Systems for Sustainable Buildings, Part 2; Transactions 3: Simulation Tools for Evaluating Control Algorithms and Diagnostic Methods for Air-handling Units*

TC 7.5 Fault Detection&Diagnosis (40)  
**Sunday 3:00-4:00p Gatlin A2 (1)**

TC 7.5 Wireless Applications (40)  
**Sunday 4:00-5:00p Gatlin A2**

TC 7.5 Building/Utility Interface  
**Sunday 5:00-6:00p Gatlin A2**

TC 7.5 Handbook  
**Sunday 6:00-6:45p Gatlin A2**

TC 7.5 1390-RP  
**Monday 3:00-4:00p Gatlin E3 (1)**

TC 7.5 Buildings Operations Dynamics  
**Monday 4:00-5:30p Gatlin E3**

TC 7.5 Research  
**Monday 5:30-6:30p Gatlin E3**

TC 7.5 1312-RP PMS  
**Tuesday 8:00-9:30a**

**TC 7.6 Systems Energy Utilization (30)**  
**Tuesday 1:00-3:30p St. John's 30 (2)**  
*Sponsoring: Seminar 3: Commercial Benchmark Buildings for Research and Standards Development*

TC 7.6 Research (12)  
**Sunday 12:00-2:00p Wekiwa 1 (2)**

TC 7.6 Handbook (12)  
**Sunday 3:00-4:00p Wekiwa 1**

TC 7.6 Monitoring & Energy Performance  
**Monday 2:15-4:15p Wekiwa 9 (2)**

TC 7.6 Energy Management (12)  
**Monday 4:15-5:15p Wekiwa 9**

TC 7.6 Standards (12)  
**Monday 5:15-6:30p Wekiwa 9**

TC 7.6 Executive (12)  
**Monday 6:30-7:00p Wekiwa 9**

**TC 7.7 Testing & Balancing (20/30)**  
**Monday 2:15-4:15p Suwannee 15 (2)**

TC 7.7 Program/Handbook (5/5)(screen)  
**Saturday 8:00-10:30a Suwannee 18 (2)**

**TC 7.8 Owning & Operating Costs (25)**  
**Monday 2:15-4:15p Gatlin E5 (1)**  
*Sponsoring: Seminar 28: Operating Cost Implications In Humid Environments*

TC 7.8 Research, Handbook, Programs (10/5)  
**Sunday 3:15-5:15p St. John's 30 (2)**

**TC 7.9 Building Commissioning (25)**  
**Sunday 3:00-5:00p St. John's 32 (2)**  
*Sponsoring: Forum 4: Systems Manuals: What should be included in ASHRAE Guideline 1.4 on Developing Systems Manuals for the Commissioning Process; Seminar 12: Writing and Executing Functional Performance Tests; Seminar 66: LEED Pre-requisite vs. LEED Enhanced: Is it Really Enough?*

TC 7.9 Handbook (6/2)  
**Saturday 8:00-9:15a St. John's 24 (2)**

TC 7.9 Research (6/4)  
**Saturday 9:15-10:30a St. John's 24**

TC 7.9 Programs (5)  
**Saturday 1:00-2:00p St. John's 24**

TC 7.9 Long Range Planning  
**Saturday 2:00-3:00p St. John's 24**



## TC/TG/SPC Meetings

### TC 8.1 Positive Displacement Compressors (12/14)

**Tuesday 3:30-6:00p St. John's 25 (2)**

TC 8.1 Handbook (10/5)

**Monday 2:15-4:15p Wekiwa 8 (2)**

### TC 8.2 Centrifugal Machines (20/8)

**Monday 2:15-4:15p Suwannee 17 (2)**

*Sponsoring: Seminar 8: Centrifugal Chiller Maintenance for Sustainability*

TC 8.2 Research

**Sunday 5:00-6:00p St. John's 33 (2)**

TC 8.2 Handbook

**Sunday 6:00-7:00p St. John's 33**

TC 8.2 Program (15)

**Sunday 7:00-8:00p St. John's 33**

### TC 8.3 Absorption and Heat Operated Machines (30)

**Monday 3:30-6:00p Sebastian L2 (1)**

TC 8.3 Research/Handbook (8/4)

**Monday 2:00-3:30p Sebastian L2 (1)**

### TC 8.4 Air-to-Refrigerant Heat Transfer Equip (20/10)

**Tuesday 3:30-6:00p St. John's 30 (2)**

TC 8.4 Research (10/10)

**Monday 6:30-9:00p St. John's 27 (2)**

### TC 8.5 Liquid to Refrigerant Heat Transfer (25)

**Monday 4:15-6:30p St. John's 25 (2)**

*Sponsoring: Seminar 75: Recent Advances in Heat Transfer and Fluid Flow*

TC 8.5/1.3 Research (20/15) (screen)

**Sunday 3:00-7:00p Panzacola G1 (1)**

### TC 8.6 Cooling Towers and Evaporative Condensers (25)

**Monday 2:15-4:15p St. John's 22 (2)**

*Sponsoring: Seminar 25: Energy, Water and Sound: Improvements in Cooling Tower Design to Optimize Equipment Efficiencies*

TC 8.6 Handbook/Program/Research (8/6)

**Monday 9:00-11:00a Suwannee 19 (2)**

### TC 8.8 Refrigerant System Controls & Accessories (10/8)

**Tuesday 1:00-5:00p Suwannee 13 (2)**

TC 8.8 Program, Research, Handbook (12)

**Monday 2:15-4:15p Panzacola F4 (1)**

### TC 8.9 Residential Refrigerators and Food Freezers (12/10)

**Monday 2:15-4:15p St. John's 27 (2)**

TC 8.9 Research (6)

**Sunday 3:00-5:00p St. John's 24 (2)**

### TC 8.10 Mechanical Dehumidifiers & Heat Pipes (12/4)

**Tuesday 3:30-6:00p St. John's 27 (2)**

TC 8.10 Handbook/Program /Standards (9/10) (screen)

**Tuesday 2:00-3:30p St. John's 27**

*Sponsoring: Seminar 23: Humidity Control using Heat Pipes for Commercial Applications*

### TC 8.11 Unitary and Room Air Conditioners & Heat Pumps (20/30)

**Monday 4:15-6:30p Panzacola G1 (1)**

*Sponsoring: Seminar 6: Energy Conservation Impact of Common Maintenance Strategies for Packaged Rooftop Units*

TC 8.11 Handbook (5/5)

**Sunday 2:00-3:00p St. John's 34 (2)**

TC 8.11.Program (5/5)

**Sunday 3:00-4:00p St. John's 34**

TC 8.11 Research (5/5)

**Sunday 4:00-5:00p St. John's 34**

### TC 8.12 Desiccant Dehumidification Equipment and Components (30)

**Monday 2:15-4:15p Wekiwa 10 (2)**

TC 8.12 Program (10)

**Sunday 5:15-7:15p Wekiwa 2 (2)**

### TC 9.1 Large Building Air-Conditioning Systems (18/15)

**Tuesday 1:00-3:30p Gatlin E3 (2)**

TC 9.1 Standards Issues (5/5)

**Monday 4:15-6:30p St. John's 22 (2)**

TC 9.1 Research (5/5)

**Tuesday 12:00-1:00p Gatlin E2 (1)**

TC 9.1 Program (5/5)

**Tuesday 12:00-1:00p Gatlin E3 (1)**

TC 9.1 Handbook (10/5)

**Tuesday 12:00-1:00p Boardroom (1)**

### TC 9.2 Industrial Air Conditioning (40)

**Tuesday 1:00-3:30p Wekiwa 5 (2)**

TC 9.2 Handbook (8/2)

**Sunday 2:00-4:00p St. John's 27 (2)**

TC 9.2 Research (8/2)

**Sunday 4:00-5:00p St. John's 27**

TC 9.2 Program (8/1)

**Sunday 5:00-6:00p St. John's 27**

TC 9.2 Nuclear (9/8)

**Monday 2:15-4:15p Suwannee 11 (2)**

### TC 9.3 Transportation Air Conditioning (25/20)

**Monday 3:30-6:00p Gatlin A1 (1)**

TC 9.3 Handbook (4/4)

**Sunday 9:00-10:00a Wekiwa 1 (2)**

TC 9.3 Aviation (20/10) (screen)

**Sunday 10:00-Noon Wekiwa 1**

TC 9.3 Automotive (6/10)

**Sunday 5:00-7:00p Suwannee 14 (2)**

TC 9.3 Research (20/15) (Screen)

**Monday 2:15-3:30p Gatlin A1 (1)**

### TC 9.4 Applied Heat Pump/Heat Recovery Systems (13/25)

**Tuesday 1:00-3:30p St. John's 28 (2)**

*Sponsoring: Seminar 9: Energy and Environmental Implications of Water to Water Heat Pumps in Commercial and Industrial Applications, Part 2*

TC 9.4 Research/Program/Handbook (10)

**Monday 4:15-6:30p Suwannee 13 (2)**

### TC 9.5 Residential and Small Bldg. Applications (20/10)

**Tuesday 3:30-6:00p Suwannee 20 (2)**

TC 9.5 Programs & Research (6/2)

**Monday 6:30-9:00p St. John's 34 (2)**

### TC 9.6 Health Care Facilities (30/30)

**Sunday 5:00-7:00p Sebastian L3 (1)**

*Sponsoring: Seminar 27: Advance Energy Design Guide: Small Hospitals and Health Care Facilities*

TC 9.6 Infectious Diseases (10)

**Sunday 12:30-1:30p Sebastian L3 (1)**

TC 9.6 Research

**Sunday 1:30-2:30p Sebastian L3**

TC 9.6 Program

**Sunday 2:30-3:30p Sebastian L3**

TC 9.6 Energy

**Sunday 1:00-2:00p Suwannee 21 (2)**

TC 9.6 Handbook

**Sunday 2:00-3:00p Suwannee 21**

### TC 9.7 Educational Facilities (13/10)

**Sunday 1:00-3:00p Suwannee 15 (2)**

### TC 9.8 Large Building Air-Conditioning Applications (30)

**Monday 3:00-5:30p St. John's 29 (2)**

*Sponsoring: Seminar 59: Humidity and Air Quality in Specialist Museums and Galleries; Transactions 8: Achieving Required Humidity for Preservation Environments*

TC 9.8 Museums (12/5)

**Monday 8:00-Noon St. John's 29**

TC 9.8 Research, Program, Handbook (10/2)

**Monday 2:15-3:00p St. John's 29**

### TC 9.9 Mission Critical Facilities (25/50)(screen)

**Monday 2:15-9:30p Panzacola H 3&4 (1)**

*Sponsoring: Seminar 56: Integration of Server and Facilities Controls in Data Centers for Lower Costs and Higher Efficiency; Transactions 2: High Density Cooling Issues Update; Transactions 5: Climate Impact on Data Center Efficiency; Transactions 9: Contamination Issues in Datacom Environments*

TC 9.9 Program/ Handbook/ Research (30/10) (screen)

**Sunday 5:00-7:00p Gatlin A1 (1)**

TC 9.9 Long-Term Planning Workshop (10/25) (screen)

**Tuesday 1:00-5:00p Gatlin A1 (1)**

### TC 9.10 Laboratory Systems (75)(Screen)

**Tuesday 3:30-6:00p Panzacola G2 (1)**

*Sponsoring: Seminar 17: Case Studies of Florida Labs: Designing and Building in a Humid Environment*

TC 9.10 Standards, Research (10/20)(screen)

**Sunday 3:00-5:00p St. John's 31 (2)**

TC 9.10 Program, Lab Classifications (10/20)

**Sunday 5:00-7:00p St. John's 31**

TC 9.10 Issues with Lab Ventilation Standard (5/5) (screen)

**Monday 6:30-9:30p St. John's 30 (2)**

TC 9.10 Handbook, Design Guide (10/20)(screen)

**Tuesday 1:00-3:30p Panzacola G2**

### TC 9.11 Clean Spaces (30/45)(Screen/E)

**Monday 2:15-4:00p Panzacola H 1&2 (1)**

*Sponsoring: Transactions 4: Cleanroom Airflow Rate Modeling, Humidity an Airborne Contamination Controls*

TC 9.11 RP-1431 PMS (10) (Screen/E)

**Sunday 3:30-4:15p Sebastian L3 (1)**

TC 9.11 RP-1344 PMS (10) (Screen/E)

**Sunday 4:15-5:00p Sebastian L3**

TC 9.11 Handbook (10)

**Monday 4:00-4:30p Panzacola H 1/2**

TC 9.11 Design Guide(20)

**Monday 4:30-5:30p Panzacola H 1/2**

TC 9.11 Short Course (10)

**Monday 5:30-6:00p Panzacola H 1/2**

### TC 9.12 Tall Buildings (12/5)

**Tuesday 3:30-6:00p Wekiwa 3 (2)**

### TC 10.1 Custom Engineered Refrig Systems (30)

**Monday 2:15-4:15p Wekiwa 1 (2)**

*Sponsoring: Seminar 44: Commissioning for Refrigeration Systems: The Possibilities*

TC 10.1 Research/Handbook, (8/4)

**Sunday 5:00-7:00p Suwannee 13 (2)**

## TC/TG/SPC Meetings

TC 10.1 Standards/ Program (8/4)

**Sunday 5:00-7:00p Suwannee 18 (2)**

**TC 10.2 Automatic Ice Making Plants/Skating Rinks (15)**

**Monday 4:15-6:30p Wekiwa 4 (2)**

TC 10.2 Handbook (4/2)

**Monday 10:00-Noon**

**TC 10.3 Refrigerant Piping, Controls and Accessories (30)**

**Tuesday 1:00-3:30p St. John's 23 (2)**

TC 10.3 RP 1327 PMS (10)

**Monday 8:00-10:00a St. John's 34 (2)**

**TC 10.4 Ultra-Low Temp Refrigeration & Cryogenics (15)**

**Monday 4:15-6:30p St. John's 32 (2)**

TC 10.4 Research (15/4)

**Monday 6:30-8:00p St. John's 32**

**TC 10.5 Refrigeration Distrib and Storage Facilities (13/10)**

**Tuesday 3:30-6:00p Suwannee 12 (2)**

**TC 10.6 Transport Refrigeration (20)**

**Monday 4:15-6:30p Suwannee 12 (2)**

*Sponsoring: Seminar 51: Modeling and Characterization of Transport Refrigeration Unit*

TC 10.6 Handbook

**Monday 2:15-4:15p Suwannee 12 (2)**

**TC 10.7 Commercial Food. Beverage Display & Storage (25/25)**

**Monday 2:15-4:15p Gatlin A2 (1)**

*Sponsoring: Forum 3: The Path to Zero-Net Energy Supermarkets; Seminar 5:Sustainability Enhancements for Commercial Refrigeration Equipment*

TC 10.7 Research/Handbook (30)

**Sunday 6:00-7:00p St. John's 26 (2)**

**TC 10.8 Refrigeration Load Calculations (10/10)**

**Sunday 3:00-5:00p Gatlin A1 (1)**

*Sponsoring: Seminar 19: Following Latent Loads through the Cold Chain; Seminar 39: Comparing Refrigeration Loads: Peak Calculations, Hourly Simulation and Actual Operation*

**TC 10.9 Refrigeration Applications for Foods & Beverages (15/10)**

**Tuesday 9:00-11:00a Suwannee 19 (2)**

TC 10.9 Handbook (10/5)

**Tuesday 8:00-9:00a Suwannee 19**

**TC 10.10 Management of Lubricant in Circulation (20)**

**Sunday 1:00-3:00p St. John's 25 (2)**

## TGs/TRGs

**TG1.Exergy Analysis for Sustainable Buildings (14/8)**

**Sunday 8:00-10:00a Wekiwa 4 (2)**

*Sponsoring: Forum 1: What Does Exergy Mean to You in Hot and Humid Climates?*

**TG1.Optimatization (15)**

**Sunday 1:00-3:00p St. John's 31 (2)**

**TG2.HVAC Security (20/6)**

**Tuesday 9:00-12N Wekiwa 3 (2)**

**TG3.GVAC HVAC Contractors and Design Build Firms (10)**

**Sunday 10:30-12N Wekiwa 4 (2)**

*Sponsoring: Construction Management; Cost/Benefit Analysis Methodology and Tools Needed by Owners (sessions located at the Orange County Convention Center)*

**TRG4 Sustainable Building Guidance & Metrics (17/10)**

**Saturday 1:00-300p St. John's 33 (2)**

**TRG7 Tools for Sustainable Building Operations, Maintenance And Cost Analysis (15)**

**Sunday 1:00-3:00p St. John's 24 (2)**

*Sponsoring: Seminar 49: On the Front-line of Comfort: Working with Building Operators for Sustainable Comfort*

**TRG7-Under Floor Air Distribution (Screen) (40)**

**Wednesday 8:00-Noon Suwannee 17 (2)**

*Sponsoring: Seminar 4: Ensuring the Performance of Your UFAD System: TAB, Return Air and Humidity Control Best Practices*

**TG8.VRF Variable Refrigerant Flow(10/10)**

**Tuesday 3:30-6:00p St. John's 31 (2)**

**TG9.JF Justice Facilities (20/5)**

**Sunday 3:00-5:00p Suwannee 13 (2)**

TG9.JF Subcommittee

**Sunday 1:00-3:00p Suwannee 13**

## STANDARDS—GPCs/SPCs

**SPC Chair Training Breakfast**

**Sunday 7:00-9:00a Sebastian L1 (1)**

**SSPC 15 Safety Code Mech. Refrig. (22/18) (screen)**

**Sunday 1:00-5:00p Gatlin E5 (1)**

SSPC 15 ISO 5149 Ad Hoc (12)

**Sunday Noon-1:00p Gatlin E5**

**SPC 16/58 MOT/Rating Room Air Conditioners and PTAC/PTHP (5/10)**

**Tuesday 8:00-Noon Wekiwa 1 (2)**

**SPC 32.1 MOT for Beverage Vending Machines (10/10)**

**Sunday 10:30a-1:00p Suwannee 11 (2)**

**SSPC 34 Designation & Safety Class. of Refrig. (25/25)  
(Screen/E)****Monday 6:30-10:00p Wekiwa 6 (2)**

SSPC 34 Designation Nomenclature (10/10) (screen)

**Saturday 7:00-10:30a Suwannee 11 (2)**

SSPC 34 Flammability (15/20)(screen)

**Saturday 10:30-3:00p Suwannee 11**

SSPC 34 Toxicity (10/20) (screen)

**Sunday 6:30-10:00p St. John's 29 (2)****SSPC 41 Standard Methods for Measurement  
(10/10)****Sunday 1:00-4:00p Wekiwa 3 (2)**

SPC 41 RP-1460

**Sunday 11:15a-12:15p St. John's 33 (2)**

41.1 Temperature- Standard Method for Temperature Measurement (5/5)

**Monday 8:00-10:00a Suwannee 11 (2)**

41.2 Laboratory Airflow-Standard Method for Laboratory Airflow Measurement (5/5)

**Monday 10a-Noon Suwannee 11**

41.3 Pressure-Standard Method for Pressure Measurement (6/4)

**Sunday 4:00-6:00p Wekiwa 3**

41.4 Lubricant Content-Standard Method for Measurement of Proportion of Lubricant in Liquid Refrigerant (6/4)

**Monday 10:00-Noon Suwannee 12 (2)**

41.6 Humidity-Standard Methods for Measurement of Moist Air Properties (9/3)

**Sunday 6:00-8:00p Wekiwa 3**

41.7 Standard Methods for Gas Flow Measurement (4/4)

**Tuesday 8:00 – 10:00a Suwannee 21 (2)**

41.8 Standard Methods for Liquid Flow Measurement (4/4)

**Tuesday 10:00-Noon Suwannee 21 (2)**

41.9 Calorimeter Test Methods for Mass Flow Measurements of Volatile Refrigerants (5/5)

**Monday 2:15-4:15 Sebastian L3 (1)**

41.11 Power-Standard Methods for Power Measurement (6/4)

**Monday 8:00a-10:00a Suwannee 12 (2)****SSPC 52.2P MOT/Part Size Eff. Proc. for Testing Air  
Cleaning Devices (13/40) (E)****Saturday 8:00-Noon Suwannee 15 (2)****SSPC 55 Thermal Env Cond. for Human Occupancy  
(12/20)(screen)****Saturday 8:00a-3:00p Wekiwa 10 (2)****SSPC 55 Thermal Env. Cond. for Human Occupancy  
(12/12)(screen)****Sunday 9:00a-12p Wekiwa 3 (2)****SSPC 62.1 Ventilation and Acceptable IAQ in Commercial,  
Institutional and High-Rise Residential Buildings (30/30)  
(E/Screen)****Saturday 8:00a-1:00p Suwannee 16 (2)****Sunday 1:00-7:00p Sebastian I 3/4 (1)**

SSPC 62.1 Education (20/20) (screen)

**Friday 9:00a-5:00p Wekiwa 7 (2)**

SSPC 62.1 Administration (15/25)(screen)

**Friday 9:00a-5:00p Wekiwa 8 (2)****SSPC 62.2 Ventilation and Acceptable IAQ in Low-Rise  
Residential Buildings (28/13)(Screen/Electric)****Friday 8:00-Noon Wekiwa 6 (2)****Friday 1:00-2:30p Wekiwa 6 (2)****Saturday 8:30-3:00p Suwannee 17 (2)**

SSPC 62.2 Technical Subcommittee (12)

**Friday 2:30-5:00p Wekiwa 9 (2)**

SSPC 62.2 IAQ Subcommittee (12)

**Friday 2:30-5:00p Wekiwa 10 (2)**

SSPC 62.2 System Subcommittee (12)

**Friday 2:30-5:00p Suwannee 20 (2)**

SSPC 62.2 Envelope Subcommittee (20)

**Friday 2:30-5:00p Wekiwa 6 (2)****SPC 64 Methods of Laboratory Testing Remote  
Mechanical Draft Evaporate Refrigerant Condensation  
(8/6)****Monday 4:15-6:15p St. John's 33 (2)****SPC 72 MOT/Commercial Refrigerators and Freezers  
(8/15)****Sunday 1:00-5:00p St. John's 26 (2)****SSPC 90.1 Energy Eff. Design of New Bldg. (Screen/E)  
(50/60)****Saturday 8:00a-12p Sebastian I 3/4 (1)****Sunday 9:00a-12p Sebastian I 3/4 (1)****Monday 8:00a-12p Sebastian I 3/4 (1)***Sponsoring: Transactions 7: ASHRAE Standard 90.1 Metal Building  
U-factors*

Format &amp; Compliance Subcommittee (4/6)(E)

**Friday 5:00-10:00p Suwannee 20 (2)****Saturday 1:00-5:00p Suwannee 13 (2)****Sunday 4:00-7:00p Suwannee 20 (2)**

Mechanical Subcommittee (15/25)(screen/E)

**Friday 9:00a-10p Suwannee 15 (2)****Saturday 1:00-7:00p Sebastian I3/4 (1)****Sunday 1:00-8:00p Suwannee 17 (2)**



**TC/TG/SPC Meetings**

Lighting Subcommittee (12/10)(screen/E)

**Friday 9:00a-10p Suwannee 12 (2)**  
**Saturday 1:00-7:00p Suwannee 20 (2)**  
**Sunday 1:00-8:00p Suwannee 19 (2)**

ECB Subcommittee (7/10) (Screen/E)

**Friday 5:00-10:00p Suwannee 11 (2)**  
**Saturday 1:00-5:00p Suwannee 18 (2)**  
**Sunday 1:00-4:00p Suwannee 20 (2)**

Envelope Subcommittee (screen/E)(15/30)

**Friday 9:00a-10:00p Suwannee 16 (2)**  
**Saturday 1:00-7:00p Suwannee 15 (2)**  
**Sunday 1:00-7:00p Suwannee 16 (2)**

**SSPC 90.2 Energy Eff. Design of New Low Rise Res. Bldg. (20/10)(screen, electric)**

**Monday 2:15-6:15p Wekiwa 5 (2)**

SSPC 90.2 HVAC (10)

**Monday 6:30-9:15p Wekiwa 7 (2)**

SSPC 90.2 Envelope (10/10)(screen, electric)

**Monday 6:15-9:15p Wekiwa 5**

**SSPC Standard 100 Revision (20)**

**Tuesday 8-12:30p St. John's 22 (2)**

Section 4 Working Group (10)

**Monday 2:15-4:15p St. John's 34 (2)**

Section 5 Working Group (15)

**Monday 2:15-4:15p St. John's 34**

Section 6 Working Group (10)

**Sunday 8:00-10:00a St. John's 28 (2)**

Section 7 Working Group (15)

**Monday 4:15-6:15p St. John's 34**

Section 8 Working Group (10)

**Monday 9:00-11:00a Wekiwa 2 (2)**

**SPC 110 Fume Hood Testing (15) (screen)**

**Saturday 8:00-10:30a St. John's 32 (2)**

**SPC 118.1 MOT/for Commercial Water Heaters (6/6)**

**Sunday 9:00-11:00a Suwannee 18 (2)**

**SPC 118.2R MOT/for Rating Residential Water Heaters (20/10)**

**Tuesday 1:00-4:00p Wekiwa 1 (2)**

**SPC 119 Air Leakage Performance for Detached Single-Family Residential Buildings (7/7)**

**Sunday 6:00-8:00p St. John's 34 (2)**

**SPC 127 Standard MOT for Rating Computer and Data Processing Room Unitary Air-Conditioners (10)**

**Tuesday 1:00-4:00p Suwannee 21 (2)**

SPC 127 Subcommittee

**Tuesday 12:00-2:00p St. John's 31 (2)**

**SPC 128 MOT Spot Air Conditioners (6/4)**

**Monday 2:15-4:15p Sebastian L4 (1)**

**SPC 129 Measuring Air Change Effectiveness (6/6) (Screen)**

**Sunday 5:00-7:00p Gatlin E5 (1)**

**SSPC 134 Graphic Symbols (6/6)**

**Sunday 1:00-2:00p St. John's 32 (2)**

**SSPC 135 BACnet (45/15)**

**Saturday 8:00-3:00p Wekiwa 5 (2)**

**SSPC 135 BACnet (45/15)**

**Monday 8:00a-Noon Suwannee 15 (2)**

SSPC 135 (25)

**Thursday (6/18) 8:00a-5:00p Wekiwa 4 (2)**

SSPC 135 (25)

**Thursday (6/18) 8:00a-5:00p Wekiwa 3 (2)**

SSPC 135 Working Group (25)

**Friday 8:00a-5:00p Wekiwa 1 (2)**

SSPC 135 Working Group (25)

**Friday 8:00a-5:00p Suwannee 11 (2)**

SSPC 135 BACnet Working Group (25)

**Sunday 8:30a-5:00p Wekiwa 2 (2)**

SSPC 135 BACnet (25)

**Sunday 8:00a-5:00p Wekiwa 7 (2)**

**SSPC 140 Standard MOT for Evaluation of Bldg. Energy Analysis Computer Program (14/8) (screen)**

**Monday 2:15-4:15p Suwannee 21 (2)**

SSPC 140 Data Format Subcommittee (10) (screen)

**Sunday 7:30-9:30p Suwannee 14 (2)**

**SPC 145P Test Methods for Assessing Performance of Gas Phase Air Clean. Equip. (15/15)(Screen/ E)**

**Sunday 8:00-5:00p Sebastian L4 (1)**

**SPC 147 Minimizing the Release of Refrigerants (15/5) (screen/flip)**

**Sunday 6:00-10:00p Suwannee 12 (2)**

**SPC 147 Working Session (15) (flip)**

**Saturday 9:00a-3:00p Wekiwa 2 (2)**

**SPC 150 MOT Performance of Cool Storage Systems**

**Sunday 6:00-10:00p St. John's 32 (2)**

**SPC 151 MOT for Shipboard Balancing (6/4)**

**Saturday 1:00-3:00p St. John's 28 (2)**

**SPC 152R MOT/for Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution Systems (9/4)**

**Sunday 8:30-Noon St. John's 32 (2)**

**SPC 154 Ventilation for Commercial Cooking Operations (6/30) (Screen)**

**Monday 2:00-6:00p Gatlin E1 (1)**

**SPC 155P MOT/Rating Commercial Space Heating Boiler Systems (12/5)**

**Sunday 12:30-2:30p Suwannee 18 (2)**

**SSPC 160 Criteria for Moisture Control Design Analysis (13/10)**

**Tuesday 8:00a-Noon St. John's 28 (2)**

**SPC 161P Air Quality Within Commercial Aircraft (25/15)(Screen)**

**Sunday 1:00-6:00p Gatlin E2 (1)**

**Monday 8:00a-Noon Gatlin E5 (1)**

**SPC 164.2 MOT/Capacity and Power Input of Self-Contained Humidifiers for Residential Applications (10/3) (screen)**

**Monday 8:15-10:00a Wekiwa 8 (2)**

**SPC 164.3 MOT/Capacity and Power Input of Commercial and Industrial Humidifiers (8/4)**

**Monday 10:00-11:30a Wekiwa 8 (2)**

**SPC 166P Heating, Vent, A/C and Refrig Terminology (6/4)**

**Monday 8:00a-Noon Suwannee 18 (2)**

**SSPC 169 (10/8) Weather Data for Building Design Standards (screen/flipchart)**

**Monday 10a-Noon Suwannee 13 (2)**

**SSPC 170 Ventilation of Healthcare Facilities (20/10) (screen)**

**Sunday 8:00-Noon Wekiwa 6 (2)**

**SPC 172P MOT/Insoluble Materials in Synthetic Lubricants And HFC Refrigerant Systems (8/2)**

**Monday 8:00-Noon St. John's 23 (2)**

**SPC 173 MOT to Determine the Performance of Halocarbon Refrigerant Leak Detectors (9/4)**

**Monday 6:30-9:30p Suwannee 12 (2)**

**SPC 174 MOT for Rating Packaged, Desiccant Based Dehumidifier Sys.(10)**

**Monday 10a-Noon St. John's 34**

**SPC 175 Metal Pressure Vessel Testing (5/5)**

**Monday 4:15-6:30p Panzacola F4 (1)**

**SPC 177P MOT Fractionation Measurement of Refrigerant Blends (6/20)**

**Monday 8:00- 10:30a Gatlin E1 (1)**

**SPC 179P MOT Life Testing Positive Displaced Compressors (6/10)**

**Sunday 1:00-5:00p Wekiwa 9 (2)**

**SSPC 180P Standard Practice for Inspection & Maintenance of HVAC Systems (24/6) (Screen)**

**Friday 1:00-5:00p Wekiwa 3 (2)**

**SPC 184 MOT/ for Field Test of Liquid Package Chillers (17/6) (screen)**

**Tuesday 8:00-Noon Gatlin A4 (1)**

**SPC 185 MOT/UVC Lights for Use in Air Handling Units or Air Ducts to Inactivate Airborne Microorganisms (15/10) (screen)**

**Saturday 8:00a-3:00p Suwannee 19 (2)**

**SPC 186P MOT/for Rating Positive Displacement Compressors that Operate at Supercritical Temperatures of the Refrigerant (7/6)**

**Monday 10:00a-Noon Boardroom (1)**

**SPC 188 Minimizing the Risk of Legionellosis Associated with Building Water Systems (32/10) (screen)**

**Tuesday 3:30-6:00p Gatlin A4 (1)**

**SPC 189.1 ASHRAE/USGBC/IESNA Standard for the Design of High-Performance Green Buildings except Low-Rise Residential Buildings (40/50) (screen)**

**Tuesday 8:00a-5:00p Sebastian L3 (1), L4 (1)**

**Wednesday 8a-Noon Sebastian I 3&4 (1)**

**SPC 189.2 Design, Construction and Operation of High-Performance Green Healthcare Facilities (20/10) (screen)**

**Monday 8a-Noon St. John's 30 (2)**

**Monday 2:15-6:15p St. John's 30**

**SPC 190 MOT/for Rating Indoor Pool Dehumidifiers for Moisture Removal Capacity and Moisture Removal Efficiency (6/6)**

**Tuesday 1:00-2:00p St. John's 27 (2)**

**SPC 191 Water Conservation (15/10)(screen)**

**Sunday 8:00-Noon Suwannee 17 (2)**

*Sponsoring: Seminar 70: How to Achieve the Optimum Balance Between Water and Energy Savings and Minimize the Effect on the Carbon Footprint*

**SPC 193 Method of Testing for Determining the Air-Leakage Rate of HVAC Equipment (Screen) (25)**

**Sunday 3:00-5:00p Panzacola G2 (1)**

**SPC 195P MOT for Rating Air Terminal Unit Controls (6/5)(screen)**

**Tuesday 8:00-Noon St. John's 26 (2)**

**SPC 197 MOT for Attenuation Characteristics of Vibration Isolators (8/4) (screen)**

**Tuesday 8:00-Noon St. John's 24 (2)**

**SPC 198 MOT for Rating DX Dedicated Outdoor-Air Systems (6/6)**

**Tuesday Noon-1:00 p St. John's 27 (2)**

**SPC 199 MOT for Rating the Performance of Industrial Pulse Cleaned Dust Collectors (6/2)**

**Tuesday 1:00-3:00p Wekiwa 3 (2)**

**SPC 200 MOT for Chilled Beams (20/10)(screen)**

**Monday 8:00-Noon St. John's 22 (2)**

**SGPC 0-General Commissioning Process (11/10) (E/Screen)**

**Saturday 8:00-Noon St. John's 33 (2)**

**TC/TG/SPC Meetings**

**GPC 1.2 Commissioning Process for Existing HVAC&R Systems (26/10) (E/Screen)**

**Friday 8:00a-5:00p Wekiwa 4 (2)**  
**Saturday 8:00a-3:00p St. John's 30 (2)**

**GPC 1.5 Commissioning Smoke Control Systems (11/10) (screen/E)**

**Sunday 6:00-7:30p St. John's 25 (2)**  
**Monday 2:15-4:15 Suwannee 14 (2)**

**GPC 1.3 Building Operation and Maintenance Training for the HVAC&R Commissioning Process (18)**

**Tuesday 1:00-5:00p Wekiwa 2 (2)**

**GPC-10P Achieving Acceptable Indoor Environment (10/10)(E)**

**Sunday 8:00a-10:00a Gatlin A3 (1)**

**SGPC 13 Guideline for Specifying Direct Digital Control (15) (screen)**

**Saturday 8:00-Noon St. John's 28 (2)**

**GPC 14 Measurement of Energy Demand Savings (10/10) (Screen)**

**Sunday 6:00-10:00p Suwannee 11 (2)**

**GPC 20 XML Definitions for HVAC&R (12/12) (Screen)**

**Monday 10:15a-12:15p St. John's 24 (2)**

**GPC 23 Guideline for the Design/Application of HVAC Equip. for Rail Passenger Vehicles (15/10) (screen)**

**Monday 8:00-Noon Suwannee 14 (2)**  
**Tuesday 8:00-Noon Suwannee 11 (2)**  
**Tuesday 1:00-5:00p Suwannee 11**

**GPC 25 MOM/Solar-Optical Properties of Materials (5/5)**

**Sunday 8:00-9:00p Suwannee 15 (2)**

**GPC 26 Guideline for Field Testing of General Ventilation Filtration Devices and Systems for Removal Efficiency In Situ By Particle Size and Resistance to Airflow (20)**

**Monday 10:00a-11:00a Wekiwa 1 (2)**

**GPC 27P Procedures for Measurement of Gases in Indoor Environments (6/6)**

**Sunday 3:00-5:00p Panzacola F1 (1)**

**GPC 32 Sustainable, High Performance Operations & Maintenance**

**Sunday 1:00-3:00p St. John's 24 (2)**

**OTHER**

**Thermal Performance of the Exterior Envelopes of Whole Buildings XI**

**Monday 9:00a-Noon Gatlin E4 (1)**

**USNC/IIR (20/30)**

**Tuesday 2:00-4:00p Sebastian L1 (1)**

**USNT/IEA (20/30)**

**Tuesday 4:00-6:00p Sebastian L1**

**ISO/TC 86/SC 6/WG 1 (15) (Screen)**

**Tuesday 9:00a-5:00p Wekiwa 1 (2)**  
**Wednesday 9:00a-5p Wekiwa 1**  
**Thursday 9:00a-5p Wekiwa 1**

**ISO/TC 86/SC 6 (25)**

**Friday 9:00a-Noon Wekiwa 5 (2)**

**US TAG to ISO/TC 142 (30/10) (Screen)**

**Saturday 2:00-3:30p Suwannee 16 (2)**

**US TAG ISO/TC 205 (20) (Screen)**

**Tuesday 8:00-10:00a Boardroom (1)**

**ISO/TC 86/SC 1/WG 1 (15) (screen)**

**Wednesday 9:00-5:00p Suwannee 21 (2)**  
**Thursday 9:00-5:00p Wekiwa 1 (2)**

**ISO/TC 142/WG 3, General ventilation filters (25) (screen)**

**Friday 8:00-3:00p St. John 27 (2)**

**ISO/TC 142/WG 8, Gas-phase air cleaning (15) (screen)**

**Monday 8:00-Noon Suwannee 21 (2)**

**ISO/TC 142/WG 2, UV-C Technology (15) (screen)**

**Wednesday 1:00-5:00p Suwannee 18 (2)**

## ASHRAE STAFF

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 Marie Ingram, Supervisor  
 Phil Mendoza  
 Wayne Madkins  
 Lily Cheng

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 Lois Benedict  
 Gloria Cofer, Assistant to BOD  
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Doug Read, Program Director  
 Ryan Colker  
 Pat Ryan

### Handbook

Mark Owen, Editor  
 Heather Kennedy  
 Nancy Thysell

### Human Resources

Sharon Priebe, Manager  
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### Information Technology

Dana Suffes, Manager  
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### Journal

Fred Turner, Editor  
 Sarah Foster  
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 Jeri Eader  
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### Member Services

Carolyn Kettering, Director  
 Kim Fulcher

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Ericka Reid, Manager  
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Julie Harr  
Brian Haynes  
Jim Colton

### Publishing Services

David Soltis, Manager  
Tracy Becker  
Jayne Jackson  
Kimberly Gates  
Kristina Rayford  
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### Region Activities

Vickie Grant, Manager  
Jeanie Kirksey

### Research and Technical Services

Michael Vaughn, Manager  
Steve Hammerling  
Tara Thomas  
Donna Daniel

### Special Publications

Cindy Michaels  
Michshell Phillips  
Matt Walker  
Amelia Sanders  
Elisabeth Parrish

### Standards

Stephanie Reiniche, Manager  
Steve Ferguson, Assistant Manager—Codes  
Doug Tucker, Assistant Manager—International  
Mark Weber, Assistant Manager—U.S.  
Tom Embry  
Gwen Johnson  
Beverly Fulks  
Angela McFarlin  
Tanisha Meyers-Lisle  
Susan LeBlanc

### Student Activities and YEA

Tarra Holman, Assistant Manager

### Technology

Claire Ramspeck, Director  
Cassandra Craig  
Bruce Hunn, Director Strategic Programs  
Lilas Pratt, Assistant Manager

Winter	Date	Annual
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### FUTURE ASHRAE CONFERENCES

	2010	Albuquerque June 26–30
Las Vegas	2011	Montreal June 25–29
January 20–February 2		
Chicago	2012	San Antonio June 23–28
January 21–January 25		

### PAST ASHRAE CONFERENCES

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	

## SPEAKER LIST

## A

Abdelaziz, Omar., *Seminar 75*  
 Ali, Ahmed Hamza H. *Poster Session*  
 Allard, Francis. *Seminars 32 and 35*  
 Alvarez, Rolando. *Seminar 10*  
 Anders, Jude. *Seminar 61*  
 Andrepont, John. *Seminar 29*  
 Athienitis, Andreas K. *Poster Session*  
 Austin, Jr., George W. *AHR Expo Sessions, 1/25, 1/26*

## B

Balaras, Constantinos A. *Poster Session*  
 Barnaby, Charles. *Seminar 11*  
 Bauman, Fred. *Seminar 33*  
 Berana, Menadro. *Seminar 40*  
 Bixby, David C. *Seminar 68*  
 Bobker, Michael. *Seminars 49 and 57*  
 Bochat, Jim. *Seminar 44*  
 Brambley, Michael R. *Seminars 57 and 64*  
 Brendel, Michael . *Seminar 74*  
 Brooke, Tom. *Seminar 23*  
 Brown, Carl. *Seminar 71*  
 Burroughs, Barney. *Seminar 61*

## C

Candanedo, José A. *Poster Session*  
 Cavallini, Alberto. *Seminar 75*  
 Chen, Qingyan. *Seminar 38*  
 Choudhary, Manoj K. *Transactions 7*  
 Christianson, Leslie. *Transactions 7*  
 Claridge, David E. *Seminar 43 and Poster Session*  
 Cleland, Don. *Seminar 19*  
 Colker, Ryan M. *Seminar 52*  
 Conklin, Rick. *Seminar 17*  
 Conlan, Wade. *Seminar 17*  
 Connor, Kevin. *Seminar 60*  
 Conrad, Ernest. *Transactions 8*  
 Cousins, Fiona. *Seminar 63*  
 Coward, Jr., Charles W. *Seminar 74*  
 Cowen, David. *Seminar 5*  
 Crawley, Drury., *Seminars 3 and 30*

## D

Dale-Derks, Chuck. *Seminar 28*  
 Davis, Brad. *Seminar 21*  
 Degelman, Larry. *Seminar 37*  
 del Percio, Stephen. *Seminar 7*  
 Derome, Dominique. *Poster Session*  
 Deru, Michael. *Seminars 3 and 42*  
 Des Champs, Nicholas. *Seminar 71*  
 Dettmers, Daniel. *Seminars 19, 39 and 44*  
 Dieckmann, John. *Seminar 34*  
 Dietrich, William. *Seminar 18*  
 Dillard, Michael. *Seminar 28*  
 Ding, Gou-liang. *Seminar 45*  
 Dobbs, Gregory. *Seminar 34*

Doniger, David. *Seminar 52*  
 Dwyer, Tim. *Seminar 13*

## E

Eardley, Mike. *Seminar 12*  
 Earley, Jim. *Seminar 28*  
 Eastman, Charles. *Seminar 36*  
 Eichelberger, Curt , *Seminar 1*  
 Elsberger, Martin. *Seminar 32*  
 Enck, Harry J., *Seminar 66*  
 English, Ecton. *Transactions 2*

## F

Fannin, Daniel. *Transactions 9*  
 Faramarzi, Ramin. *Seminars 5 and 6*  
 Faulkner, Steven. *Seminar 15*  
 Feng, Jingjuan. *Poster Session*  
 Fenton, Donald. *Seminar 39*  
 Finck, Mark. *Seminar 21*  
 Floyd, Anthony. *Seminar 22*  
 Frankenfield, Guy. *Seminar 29*  
 Fricke, Brian. *Seminars 5 and 19*  
 Friedman, Glenn. *Seminars 11, 33 and 67*  
 Fullerton, Brent A. *Seminar 74*

## G

Gaffney, Harry. *Seminar 71*  
 Galler, Mike. *Transactions 3 and Seminar 24*  
 Ganesh, Rad. *Forum 7*  
 Gill, John W. *Seminar 27*  
 Glass, Samuel V. *Seminar 58*  
 Goldstein, Kate. *Seminar 67*  
 Gowri, Krishnan. *Seminars 24 and 37*  
 Grobler, Francois., *Seminar 36*  
 Grosse-Kracht, Rainer. *Seminar 14*  
 Grzywacz, Cecily M. *Transactions 8*  
 Gupta, V. P. *Seminar 8*

## H

Haberl, Jeff. *Seminar 37 and Poster Session*  
 Hales, David. *Poster Session*  
 Hammack, Katherine. *Seminars 22 and 30*  
 Hanninen, Reijo. *Seminar 73*  
 Harada, Atsushi. *Seminar 40*  
 Harder, Patrick. *Seminar 16*  
 Harriman, Lew. *Seminars 28 and 72*  
 Hart, Reid. *Seminar 6*  
 Hartke, Jason., *Seminar 52*  
 Hathaway, Alden. *Seminar 9*  
 Hayter, Richard. *Seminar 13*  
 Healy, William. *Seminars 16 and 57*  
 Hedman, Bruce., *Seminar 48*  
 Hegberg, Mark. *Seminar 76*  
 Hellmer, Bruce. *Transactions 5*  
 Hentschel, Greg. *Seminar 25*  
 Herrlin, Magnus. *Transactions 2*  
 Herrmann, Sebastian. *Seminar 45*  
 Hiller, Carl C. *Seminar 62*  
 Hinge, Adam. *Seminar 49*

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Hodgson, Murray R. *Poster Session*  
Hoest, Ryan. *Seminar 39*  
Hoffman, Bill., *Seminar 70*  
Hogeling, Jaap. *Seminar 35*  
Horn, Donald. *Seminar 22*  
Horton, Douglas J. *Seminar 21*  
Hosni, Mohammad. *Seminar 11*  
House, John. *Transactions 3 and Seminar 57*  
Hovorka, Frank. *Seminar 55*  
Hu, Shih-Cheng. *Poster Session*  
Hutto, Scott. *Seminar 9*  
Hutzel, William. *Seminar 13*  
Hwang, Yunho. *Seminar 14*  
Hydeman, Mark. *Seminar 70*

### J

Jain, Neera. *Seminar 51*  
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Jekel, Todd. *Seminar 19*

### K

Karagiozis, Achilles. *Seminar 58*  
Karney, Richard. *Seminar 62*  
Kasprzak, Chris. *Transactions 7*  
Katipamula, Srinivas. *Seminar 64*  
Kavanaugh, Steve. *Seminar 77*  
Kazachki, Georgi S. *Seminar 14*  
Keke, Zheng. *Poster Session*  
Kelly, Daniel S. *Seminar 25*  
Kennedy, Stephen D. *Seminar 30*  
Kennedy, John. *Seminar 36*  
Kettler, Gerald J. *Forum 4*  
Khalifa, Ezzat H. *Seminar 38*  
Khalil, Essam. *Seminar 59*  
Khan, Mohd. Kaleem. *Poster Session*  
Khosravi, Salman. *Poster Session*  
Kilkis, Birol. *Forum 1 and Seminar 54*  
Klaassen, Curtis J. *Seminar 41*  
Klein, Gary. *Seminar 70*  
Kline, Stephen G. *Seminar 25*  
Knight, Dennis. *Seminar 73*  
Koeller, John. *Seminar 22*  
Koran, William E. *Seminar 43*  
Kozubal, Eric. *Seminar 6*  
Krarti, Moncef. *Transactions 6, Seminar 43 and Poster Session*  
Kubes,, Kristine A. *Seminar 7*  
Kuempel, John. *Seminar 69*

### L

Leslie, Neil P. *Poster Session and Seminar 72*  
Levin, Hal. *Technical Plenary and Seminars 42 and 61*  
Lewis, Angela. *Seminar 73*  
Li, Yuguo. *Technical Plenary*  
Li, Bin. *Seminar 51*  
Li, Siwei. *Poster Session*  
Li, Haorong. *Seminar 64*  
Lilkendey, Robert. *Seminar 10*

Lilly, Jerry. *Seminar 1*  
Liu, Bing. *Seminar 3*  
Liu, Tang-Jen. *Poster Session*  
Liu, Xiaobing. *Seminar 77*  
Lizardos, Evans. *Seminars 69 and 76*  
Lomel, Brian. *Seminar 50*  
Long, Nicholas., *Seminar 18*  
Lstiburek, Joe. *Seminar 72*  
Lu, Frank. *Poster Session*  
Lui, Yury. *Transactions 5*  
Lull, William P. *Forum 8*  
Lutz, James. *Seminar 62*

### M

Maekawa, Shin. *Transactions 8*  
Markel, Lawrence. *Seminar 15*  
Marsielle, Tom. *Seminar 22*  
Maston, Sarah E. *Seminar 66*  
Mauceri, Maria. *Seminar 58*  
Mayes, Scott. *Seminar 70*  
McBride, Merle F. *Transactions 7*  
McGinn, Tim. *Seminar 2*  
McGowan, Alex. *Forum 6*  
McGuire, Bill. *Seminar 17*  
McGuire, Molly. *Seminar 30*  
McLaughlin, Mike. *AHR Expo Session, 1/25*  
McQueeny, Michael. *Seminar 4*  
Megerson, Jim. *Seminar 4*  
Menchhofer, Doug. *Seminar 47*  
Mescher, Kirk. *Seminar 77*  
Meteyer, Michael. *Seminar 27*  
Meyer, Josua. *Seminar 75*  
Michalski, Stefan. *Seminar 79*  
Milliken, Harry. *Seminar 23*  
Mills, Frank A. *Seminar 59*  
Modera, Mark. *Seminar 6*  
Moffitt, Ronnie. *Seminar 34*  
Mohs, Bill. *Seminar 51*  
Moiseev, Neil. *Seminars 1 and 10*  
Mullen, Matthew. *Seminar 49*  
Muller, Christopher O. *Transactions 9*  
Müller, Norbert. *Seminar 14*  
Murphy, John A. *Seminar 74*

### N

NNarayanamurthy, Ram. *Seminar 6*  
Nasont, Dennis A. *Seminar 56*  
Nemati, Omid. *Poster Session*  
Nigusse, Bereket. *Poster Session*  
Nix, John. *Transactions 6 and Forum 9*  
Novoselac, Atila. *Seminars 38 and 67*

### O

O'Brien, Paul. *Seminar 47*  
O'Dwyer, Tom. *Transactions 1*  
Ohadi, Michael M. *Forum 10*  
Olesen, Bjarne. *Seminar 35*  
O'Rourke, Michael P. *Seminar 2*

## P

Papar, Riyaz. *Seminar 48*  
 Patenaude, Ray. *Seminar 72*  
 Patterson, Michael K. *Seminar 56*  
 Pedersen, Curtis O. *Seminar 33*  
 Perencevic, Stanislav. *Seminar 75*  
 Persily, Andrew. *Seminar 61*  
 Peterman, Karl. *Seminar 1*  
 Peterson, Janice. *Seminar 49*  
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 Pierskalla, Brad. *Seminar 51*  
 Pless, Shanti. *Seminar 27*  
 Post, Doug. *Seminar 68*  
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 Pucciano, Frank., *Seminars 9 and 15*

## R

Rabah, A. A. *Poster Session*  
 Radermacher, Reinhard. *Seminars 40 and 45*  
 Rakheja, Ashish. *Seminar 55*  
 Rau, Daniel. *Seminar 31*  
 Rauss, Devin. *Seminar 5 and Forum 3*  
 Raychaudhuri, Aresh. *Seminar 74*  
 Reindl, Douglas. *Seminars 42 and 44*  
 Reinhold, Tim , *Seminar 31*  
 Richardson, Gaylon. *Seminar 4*  
 Richman, Eric. *Seminar 37*  
 Roberts, Ken. *Seminar 20*  
 Rodgers, Terry. *Transactions 5*  
 Roland, Joseph. *Seminar 60*  
 Rosenstock, Steve. *Seminar 15*  
 Roth, Stephen. *Seminar 36*  
 Roy, Kenneth P. *Seminar 1*  
 Rumsey, Peter H. *Seminar 2*

## S

Sagi, Hemi. *Poster Session*  
 Saldutti, Robert. *Seminars 46 and 53*  
 Salim, Munther. *Transactions 5*  
 Sami, Samuel. *Seminars 23 and 60*  
 Sanchez, J. Greg. *Transactions 1*  
 Sarkar, J. *Poster Session*  
 Schiavon, Stefano. *Seminar 40*  
 Schroeder, David J. *Poster Session*  
 Schuyler, Glenn. *Seminar 50*  
 Scott, Doug. *Seminar 39*  
 Secor, Pete. *Seminar 16*  
 Seidl, Reinhard. *Seminar 12*  
 Sekiguchi, Keisuke. *Poster Session*  
 Selkowitz, Steve. *Seminar 55*  
 Seppanen, Olli A. *Seminar 32*  
 Setty, Raj. *Seminars 24 and 66*  
 Shahriari, Paul. *AHR Expo Session, 1/26*  
 Shapiro, Leon E. *Seminars 25, 46 and 53*  
 Shapiro, Ian. *Seminar 65*  
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 Sherren, Richard. *Seminar 31*  
 Shih-Cheng , Hu. *Transactions 4*

Shipp, Paul. *Seminar 58*  
 Shrestha, Som S. *Poster Session*  
 Siegel, Jeffrey A. *Seminar 38*  
 Simmonds, Peter. *Seminar 2*  
 Sinclair, Ray. *Seminar 50*  
 Skelton, Benjamin. *Seminar 13*  
 Sleti, Ahmad. *Seminar 40*  
 Smith, Saunders. *Seminar 8*  
 Smith, Jeff. *Seminar 9*  
 Smith, Donald C. *Seminar 77*  
 Songkakul, Pornsak. *Seminar 16*  
 Sorell, Vali. *Seminar 56*  
 Spata, Anthony J. *Seminar 21*  
 Spitler, Jeffrey D. *Seminar 11 and Forum 2*  
 Spletzer, Stephen. *Seminar 60*  
 Springer, David. *Seminar 62*  
 Stahl, Lennart. *Transactions 2*  
 Stanke, Dennis. *Seminar 61*  
 Stein, Jeff. *Seminar 41*  
 Stephens, Brent. *Poster Session*  
 Straube, John. *Seminar 50*  
 Sun, Wei. *Transactions 4*  
 Swann, E. Mitchell. *Seminars 7 and 53*  
 Sweetser, Richard. *Seminar 48*

## T

Tabarra, Mohammad. *Transactions 1*  
 Tanner, Robert D. *Seminar 5*  
 Taylor, Steven T. *Seminar 41*  
 Thevenard, Didier. *Poster Session*  
 Thibodeau, David. *Seminar 47*  
 Thomas, Martin. *Seminar 62*  
 Thome, John. *Seminar 75*  
 Tian, Lin. *Poster Session*  
 Todorovic, Branko. *Seminar 54*  
 Todorovic, Marija. *Seminar 54 and Poster Session*  
 Treado, Stephen. *Poster Session*  
 Tredinnick, Steve M. *Seminar 69*  
 Trent, Richard. *Seminar 23*  
 Troutman, Monte. *Seminar 18*  
 Tseng, Paul. *Seminar 47*  
 Tzempelikos, Athanassios. *Poster Session*

## U

Underwood, David. *AHR Expo Session, 1/25*

## V

Vallort, Jim. *Seminar 4*  
 Varshney, Kapil. *Seminar 65*  
 Veeck, Alan. *Seminars 20 and 26*  
 Villa, Herb. *Transactions 2*  
 Virta, Maria. *Seminar 54*  
 Visser, Klaas. *Seminar 14*  
 Vucci, John. *Seminar 8*

## W

Wagner, Timothy. *Seminar 48*  
 Waite, Michael. *Transactions 7*  
 Walter, William. *Forum 5*



## Speaker List

Wang, Fu-Jen. *Transactions 4*  
Waring, Michael. *Poster Session*  
Webber, Michail. *Seminar 70*  
Wegmann, Robert. *Seminar 29*  
Welle, Benjamin. *Seminar 24*  
Wen, Jin. *Transactions 3*  
Werkema, Tom. *Seminar 52*  
Wessel, Dennis J. *Seminar 27*  
Wilkins, Christopher. *Seminar 73*  
Willis, Robert. *Transactions 6*  
Wingfield, Gary. *Seminar 33*  
Wise, Steve. *Seminar 10*  
Witte, Michael J. *Poster Session*

**X**  
Xu, Peng. *Seminar 64*

**Y**  
Yamazaki, Takanori. *Poster Session*  
Yang, Chin-Ting. *Poster Session*  
Yavuzturk, Cenk C. *Poster Session*  
Ye, Xiaojiang. *Poster Session*  
Yount, Forrest S. *Seminar 8*

**Z**  
Zhou, Xiaohui. *Seminar 41*  
Zuo, Wangda. *Seminar 38*



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